

Worcestershire Sub–Regional Green Infrastructure
Partnership

Socio-economic benefits of Green Infrastructure

Framework Document 4

Version 4; draft for comments

November 2013

Chapter 1: Introduction

Preparation of this Green Infrastructure Framework Document 4: Socio-economic benefits of Green Infrastructure has been led by the County Council's Strategic Planning and Environmental Policy team. The framework has been endorsed by the Worcestershire Green Infrastructure Partnership.

Partnership members include the Worcestershire Wildlife Trust, Natural England, Environment Agency, Forestry Commission, English Heritage, the County and District Councils and the Voluntary Sector.

Background to the study

The Worcestershire Green Infrastructure Partnership is producing a series of "framework documents" which provide the evidence base for the development of the GI Strategy.

- **GI Framework Document 1** provided an introduction to the concept of green infrastructure (GI) and also identified the need for the strategic planning of GI and the policy drivers that support the planning of GI at differing spatial scales.
- **GI Framework Document 2** provided an introduction to the natural environment data sets of landscape, biodiversity and historic environment and developed the concept of GI Environmental Character Areas based on the quality and quantity of these natural environment assets.
- **GI Framework Document 3** identified the functionality, and supply of strategic recreational assets in Worcestershire. It also explores the potential need for new recreational assets and identified areas of search and potential funding mechanism for new facilities.
- **GI Framework Document 4** (current) explores the relationship between health, climate change, economy and green infrastructure.

The 4 frameworks documents will form the detailed evidence base for the Worcestershire Green Infrastructure Strategy, which sets out the vision and opportunities for multi-functional green infrastructure in the county.

Note:

Green Infrastructure framework documents have benefited from scrutiny and input from stakeholders. The framework documents and the Strategy are non-statutory and hold the status of guidance to provide a framework for the planning of a comprehensive multifunctional green infrastructure throughout Worcestershire.

Purpose of the study

GI presents a co-ordinated interdisciplinary approach to environmental planning that is proactive, multi-scale and multi-functional. GI can deliver benefits not only to the environment but can also contribute to the development of better places in which to live, work and invest.

This paper is the fourth in a series of papers towards the development of a Worcestershire GI Strategy that will enable the strategic planning, co-ordination, delivery and management of existing and future green spaces.

Framework Document 4 aims to explore how multifunctional green infrastructure solutions can provide economic and health benefits as well as contribute to climate change mitigation and adaptation.

The Audience

This paper provides the audience with the evidence required to support Local Planning Authorities (LPA) and other organisations involved in the development of GI strategies and as such the primary audience are the LPA's within Worcestershire. This paper will also be of interest to the development industry, utility companies, the Local Strategic Partnership members and anybody with an interest in how to plan for GI in Worcestershire.

The paper intends to be a useful tool to policy makers but does not diminish the need for the reader to be alert to both existing and emerging evidence and policy with regard to planning for GI.

Scope and Structure of the study

The GI Framework 4 consists of three sections:

- Economic benefits of green infrastructure
- Health & wellbeing benefits of green infrastructure
- Climate change benefits of green infrastructure

It focuses on the socio-economic context of GI and investigates synergies between green infrastructure and socio-economic issues facing Worcestershire. It explores how

multifunctional green infrastructure solutions can provide economic, health and climate change benefits.

The chapters portray the current Worcestershire's status in relation to each of the socio-economic themes with the use of statistical information, maps and local studies. This includes findings of the mapping and data analysis which was undertaken to inform the setting of the strategic priorities identified in the Worcestershire Green Infrastructure Strategy 2013-2018.

Additionally, chapters provide a narrative and examples of various ways in which GI contributes to the well functioning economy, prosperous and healthy communities and county's climate change mitigation and adaptation. They identify how the appropriate application of the GI solutions can maximise benefits and minimise risks to the Worcestershire's economy, natural environment and residents.

Information Sources

Framework Document 4 uses local/county level information wherever possible. Where local level information was not available the relevant national or regional data and research was used to supplement the local evidence base.

This document has been inspired by and benefits from two pieces of work in particular. The basis for the socio-economic context came from the groundbreaking Natural Economy Northwest programme which was produced by the Northwest Regional Development Agency and Natural England in 2009. Furthermore, the Natural England's Microeconomic Evidence for the Benefits of Investment in the Environment – review, 2012 proved to be an invaluable source of the evidence on economic benefits of GI. The full list of sources can be found in the Appendix B.

Context

GI is often described as 'multifunctional', providing a range of environmental and social and economic services or "ecosystem services". GI overarches almost all aspect of our lives through directly benefiting the economy or improving the quality of life. More information on context for the multifunctionality of green infrastructure can be found in Appendix A

Chapter 2: Economic Benefits of Green Infrastructure

Introduction

The economic benefits of GI are widely recognised by policy makers at different levels. Sustainability West Midlands recognises that well-connected, accessible green infrastructure can greatly improve ‘quality of place’ through improving appearance and providing a range of other benefits. These can substantially boost inward investment, attract companies and in turn employees, customers and services¹.

This chapter focuses on the benefits that green infrastructure can bring to the local economy. It explains how a quality natural environment can contribute to increased property and rental values, attract more inward investment and visitors to the area or be a cost saving solution through flood risk mitigation or resident health improvement.

The study quantifies the financial costs and savings where possible; however where there was a lack of relevant information, the paper recognised the potential contribution from green infrastructure in the qualitative terms such increased visitor numbers or customer satisfaction.

This chapter explores links between GI and the following areas:

- Property prices and quality of place
- Economic growth and investment
- Tourism
- Agriculture and Land Management

There are also significant economic benefits that green infrastructure provide to health & wellbeing sector which are described in Chapter 3 of this paper. Similarly Chapter 4 explores how green infrastructure can be a financially viable solution to climate change adaptation and mitigation.

¹ West Midlands Regional Observatory (nd) WEST MIDLANDS: FIT FOR THE FUTURE? Preparing the region for economic recovery. Continuing a State of the Region dialogue. Green Infrastructure

ECONOMIC BENEFITS



Property and quality of life

A property located within 450 metres from a park can be up to 19% higher in value than houses without such a premium

Economic Growth and Inward Investment

Larger investment in green infrastructure, including of the Riverside Park Industrial Estate in Middlesbrough, which included planting of over 1800 new trees created a setting for stimulation business growth. As a result it attracted new high profile occupants and saw occupancy grow by 38%. It leveraged over £1m of private investment, 28 new businesses started up and 60 new jobs were created

Tourism

In 2008, visitors to English countryside spent £11.5 billion and generated 340,000 jobs.

Agriculture & Land Management

Sustainable Catchment Management Programme (SCaMP) in the Peak District provided £2.7 million of grants towards the cost of the work to farmers and allowed them to access additional agri-environment income for ten years. Reduction in chemical inputs to drinking water as a result of the programme provided financial savings to United Utilities.

Climate Change

The wider risks and cost of climate change to the national economy are estimated to be equivalent of losing up to 20% of GDP or more. Green infrastructure can reduce these costs through contributing to climate change mitigation and adaptation.

Flood Risk

The Association of British Insurers predicts that a 2°C temperature rise will increase annual insured losses in Great Britain from inland flooding by 8% or by £47 million to £600 million. Well executed green infrastructure can reduce flood risk costs through both flood alleviation solutions and mitigation of climate change contributors such CO² partially responsible for the extreme weather events.

Health & Wellbeing

.Increased physical activity through access to high quality green spaces has potential to save the NHS £2.1 billion a year.

Economic Context

There is a link between overall prosperity of the place and quality of the surrounding natural environment. This chapter aims to capture this prosperity in Worcestershire by investigating unemployment, household income and employment deprivation patterns.

Employment deprivation patterns are represented by the Indices of Multiple Deprivation (IMD) cover a range of socio-economic measures². Access to quality green infrastructure will primarily contribute to addressing the health but indirectly also links to economic and some social factors such as crime within the indices. The recent evidence proves that GI can add to creation of more attractive and healthier places for people to live which may attract the more affluent residents into these areas. On the other hand, accessible and quality green spaces encourage physical activity and facilitate social interaction which can help in building self-esteem and contributing to social mobility of disadvantaged people.

This information has been spatially represented on the context maps and amalgamated together on the combined economic map. The following datasets have been used to map the green infrastructure related economic patterns in Worcestershire:

Economic indicator	Datasets	Map
Unemployment	This indicator represents the claimant count and claimant count rate for Jobseekers Allowance (JSA)	Figure 2
Household income	Household income indicator is using Paycheck which accounts an income from employment (earnings) as well as that from other sources, for example investments and savings (CACI Ltd, 2010)	Figure 3
Employment Deprivation	This indicator uses the Employment domain of the English Indices of Deprivation 2010 at Lower layer Super Output Area (LSOA) level.	Figure 4

Note: It is important to note that most of the areas indicated as poor on the maps below perform relatively well on a national scale. The comparisons are therefore only relevant when used to identify patterns at a county-scale.

Overall economic performance

The economic performance of Worcestershire is generally good. Notwithstanding this, some areas of particularly good or poor performance can be identified.

High performing areas are scattered and to the north of Worcester, continuing past Droitwich and to the east along A44. There is also an area of good performance in the north-east of the county. The Birmingham and Black County conurbation, with good transport links encouraging commuting, is likely to be a factor here, influencing the higher employment levels and younger age profile of the area.

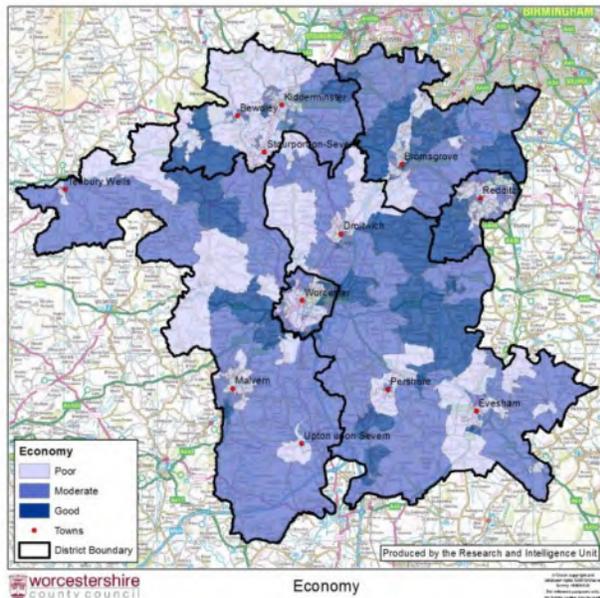
² Socio-economic measures of IMD include:

1. Economic factors including household income, employment rates
2. Health factors including life expectancy, disability and morbidity, mental health issues and risk of premature death
3. Education, skills and training including attainment at levels 2, 3 and 4 and higher education
4. Housing including homelessness and overcrowding
5. Crime including violent crime, burglary, theft and criminal damage
6. Housing environment including poor quality housing, air quality, and road traffic accidents.

Similarly, the positive socio-economic pattern of the south east corner of the county is likely to be influenced by the proximity to Stratford-upon-Avon and good transport links. The more prosperous areas are also be found around Malvern, Bredon Hill. The rural and picturesque character of these parts of Worcestershire could be considered as one of the factors attracting high-income earners and wealthy retirees to settle.

However there may be some issues of hidden rural deprivation in Worcestershire which is generally hard to measure due to being more dispersed than in urban areas.

Figure 1: GI related economic indicators: Combined map

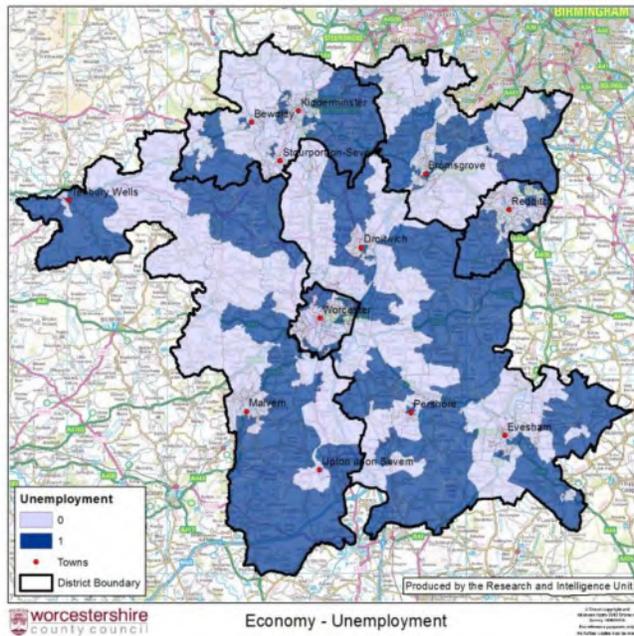


Unemployment numbers

In Worcestershire, in September 2012 there were around 10,500 people claiming Jobseekers Allowance (JSA), representing 3.0% of the population aged 16-64; this is a lower percentage than for the West Midlands and England. Across Worcestershire Redditch, Worcester and Wyre Forest have the highest claimant count rate at 3.7%, higher than the England average, and Malvern Hills has the lowest at 2.2%.

Generally, concentrations of unemployment are found in the more built up areas of the county in particular Kidderminster, Redditch and Worcester. The lowest job seeker allowance counts can be found in rural areas of the county with the exception of vale of Evesham along A46 and Southern Teme Valley.

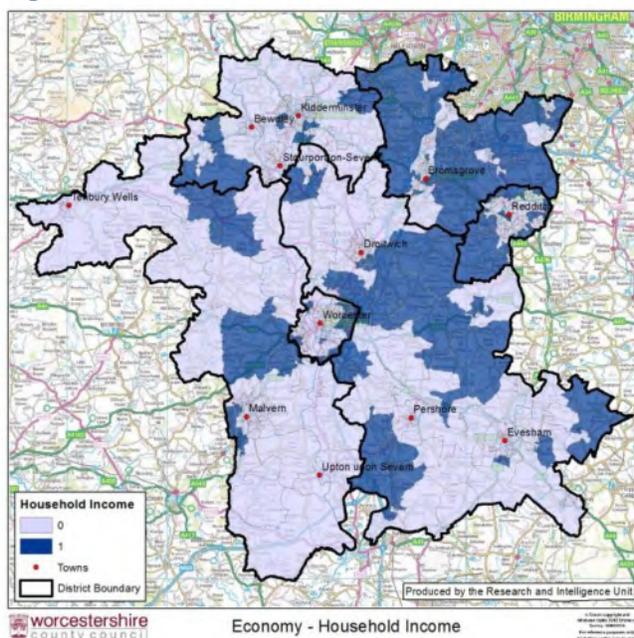
Figure 2: GI related economic indicators: Unemployment



Household Income

The median household income in Worcestershire is £30,000. This is higher than elsewhere in the West Midlands and England. Household incomes are highest in the North East of the County, particularly in Bromsgrove district. This is may be enhanced by the links that this area have with the Birmingham and Black Country conurbations. The high income areas stretch further down to cover the eastern villages of the county. There are also smaller but still significant pockets of wealth at the edge of Cotswolds, to the West from Worcester and in Wyre Forest – Abberley Hills area.

Figure 3 - GI related economic indicators: Household income

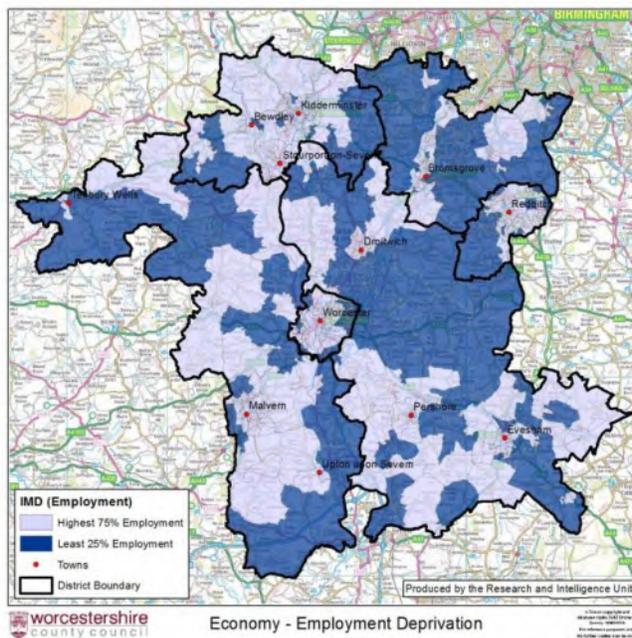


Employment Deprivation

Twelve Lower Super Output Areas (LSOAs) in Worcestershire are in the top 10% of employment-deprived areas in England. This represents 3.3% of the LSOAs in the county, with 64 LSOAs (17.7%) in the top 30% of employment-deprived areas³.

Rural fringes of the main urban settlements are generally performing well in terms of economic deprivation. The least deprived areas are those within picturesque countryside such as around the Abberley Hills, Bredon Hill, the sedge of the Cotswolds and villages in the east of the county.

Figure 4: GI related economic indicators: Employment Deprivation.



3 Department for Communities and Local Government (March 2011) English Indices of Deprivation 2010 at Lower layer Super Output Area (LSOA) level

Property prices and quality of place

Introduction

There is a wide spread literature which has established a link between environmental improvements in the form of green infrastructure investments and an increase in housing and land values. Proximity to high quality and accessible greenspace directly can impact upon house prices and greener places can increase visitors and improve rental values.

Current Situation

Quality of place

Worcestershire is considered as a good place to live by its residents based on the quality of natural environment⁴. More specifically, in a recent poll Worcester was voted one of the happiest places to live in the UK and the happiest place to live in the West Midlands, with the quality of parks, the outdoor environment and local character being key factors⁵.

GI can boost Property Prices through:

- Provision of the high quality green spaces in the proximity to properties
- Creation of leisure walks and attractions
- Flood risk prevention
- Provision of gardens, orchards and allotments
- Contribution to the visual attractiveness of place
- Providing for the community wellbeing

House Prices

The house prices in Worcestershire were gradually increasing during late 1990s and early 2000s following the national trend, resulting in the median house price in 2007 (£179,000) being nearly three times the 1996 figure (£60,000). The credit crunch and collapse of the housing market saw prices to drop in 2007 to recover in 2011 on the £172,000 level (just 1% under 2007 value). The highest median property prices can be found in rural areas of Malvern Hills and Wychavon as well as Bromsgrove which is popular location for people working in the Black County and Birmingham conurbation⁶.

Opportunities

There is a close link between environmental improvements and the regeneration of deprived areas. Investment in landscaping, parks and allotments can change negative perceptions of neighbourhoods and consequently reduce housing abandonment rates and increase the property prices in the area.

9 out of 10 adults in in the UK identify parks, playgrounds and green spaces as important in making their neighbourhood a good place to live or work⁷. Microeconomic Evidence for the Benefits of Investment in the Environment – review (MEBIE) proves that proximity to and

⁴ Worcestershire County Council (2012) Worcestershire Viewpoint Survey November 2011

⁵ Rightmove.co.uk survey reported in Guardian March 2013.

⁶ Department for Communities and Local Government (2013) Live tables on housing market and house prices: Table 586: Median house prices based on Land Registry data, by district, from 1996

⁷ Ipsos Mori survey <http://www.groundwork.org.uk/news--events/news/2012/90-of-adults-say-green-spaces.aspx>

views of greenspace can increase the house prices. The study claims that properties located 450 metres of a park can be worth up to 19% more than houses not in such a location. A view of forest and water can benefit in increase of house value by 7% and 5% respectively⁸.

Note:

This information need to be looked at as anecdotal. There are numerous contextual factors such as the social make-up of the area, size and quality of the green space etc which impact also property prices.

Case Study: South Worcester Concept Statement - EDP Perspective

Since early 2010, EDP has undertaken a wide range of baseline environmental studies to inform potential development options for an urban extension to the South of Worcester; including ecology, landscape, public open space, rights of way and archaeological/ heritage studies. As a multidisciplinary environmental consultancy, the EDP team has naturally progressed project assessment and design under the ethos of Green Infrastructure (GI).

Following completion of initial baseline studies at South Worcester, EDP engaged representatives from the local authorities, national agencies and community groups under the umbrella of a 'GI Group'; including representatives from Forestry Commission, Natural England, Environment Agency, Worcester County Council and the Wildlife Trust. The group (as a whole or in sub-groups to focus on specific aspects) has met a total of nine times in the past 12 months.

Reflecting on the value of joint working one year on, EDP Partner (and landscape architect) Ben Rosdale observed: *"From the outset, the GI Group provided a very effective forum for discussions between the developer's consultant team and the key consultees. In contrast to the normal development of site options, having the right people in the same room at the same time enabled very rapid resolution of site specific issues. We were also able to jointly produce a GI Concept Plan containing agreed objectives for the delivery and monitoring of GI on site. By agreeing the priorities at an early stage, the developer team have been able to progress landscape design options and consideration of viability issues with increased confidence – which we believe will deliver time, risk and cost efficiencies in the development of mitigation strategies."* EDP has now developed a GI Strategy for South Worcester which has been submitted alongside a site-wide planning application in 2013.

Source: Ben Rosdale, EDP, internal communication

⁸ Natural England (2012) Microeconomic Evidence for the Benefits of Investment in the Environment - review

Economic growth and investment

Introduction:

Green Infrastructure can boost economic growth and job creation. Natural environment provides a range of products and services which contribute to expansion of various economic sectors which is particularly prevalent in the predominately rural area of Worcestershire.

It can attract inward investment and support job creation in the area. Various factors such as visual attractiveness and quality of place can play important part in companies' decisions about siting their premises. There is also an awareness of the promotional effect that business incorporating the environmentally friendly solutions can have on companies' customers, partners and employees.

Current situation:

Economic performance

Total GVA in Worcestershire in 2011 was £9,159 million, which equates to 9.6% of the West Midlands total. Although GVA in the county has increased steadily since the late 1990's there was a notable fall in output in 2009 during the recession; it has since begun to increase again⁹.

There is a positive trend in terms of number of new businesses established in the county. There were 2,325 new businesses established in Worcestershire in 2011, a 6.9% increase compared with 2010. The West Midlands and England both saw rises over the same period (9.8% and 12.0% respectively)¹⁰.

Economic priorities for Worcestershire

The Worcestershire Local Enterprise Partnership¹¹ aims to attract significant private sector investment into the county through implementing their Growth Plan. They see that local landscapes, cultural heritage and quality natural environment make Worcestershire a magnificent business location¹².

GI contributes to Economic Growth and Inward Investment through:

- Natural heritage and attractive landscapes
- Creating green and visually attractive business premises
- Providing a healthy environment
- Increase in labour productivity
- Supporting health of employees and reducing their sickness levels
- Costs reductions through providing natural solutions to flooding

⁹ Worcestershire County Council (2013) Local Economic Assessment

¹⁰ As above

¹¹ Local Enterprise Partnership - partnerships between local authorities and businesses setting the economic priorities for the area

¹² Worcestershire Local Enterprise Partnership (2012) Business Plan

Opportunities:

Natural environment products and services

The natural environment provides an enormous range of products such as water or soils and services such as production of food worth £15 billion to the national economy¹³ and supporting a wide range of economic sectors including food production, agriculture and horticulture. Protecting natural areas can deliver economic returns that are 100 times greater than the cost of their protection and maintenance¹⁴. In 2009 approximately 122,000 people in the UK were employed in the green space sector, including public parks departments, nature reserves and landscape services¹⁵.

Inward investment and business growth

The interdependent nature of sectors in the rural economy and the interdependencies between rural and urban areas is well documented in Worcestershire. The quality of the natural environment forms a key part of the Worcestershire 'offer' for businesses seeking to locate in the County with many indigenous business citing the quality of life offering as being a key factor in their choice of business location. Business leaders in Worcestershire see the environment as one of a series of factors taken into consideration alongside other more business focused issues as part of any options appraisal for locating a business¹⁶.

There are some outstanding examples which are to support the theory of green infrastructure providing widespread benefits to businesses. For example, a large investment in the green infrastructure of the Riverside Park Industrial Estate in Middlesbrough, which included planting of over 1800 new trees created a setting for stimulation business growth. As a result it attracted new high profile occupants and saw occupancy grow by 38%. It leveraged over £1m of private investment, 28 new businesses started up and 60 new jobs were created¹⁷. Furthermore, study of commercial space in London shows that companies are prepared to pay a premium to be close to high quality open space¹⁸.

Case Study: Natural Benefits for Business project in Cumbria

The Natural Benefits for Business project in Cumbria indicated that actions to protect and enhance biodiversity taken by the companies provided economic gains:

- a greater customer satisfaction and increased return on sales
- boosted staff morale leading to better staff retention
- a "light touch" maintenance of the grounds – reduced management costs
- planting traditional hedgerows deterred vandals and thieves and reduced security costs.

Source: *Natural England (nd) Natural Benefits for Business*

¹³ TEEB Report

¹⁴ Economic of Ecosystems and Biodiversity Study quoted in Natural Environment White Paper (p10)

¹⁵ CABE, Green space skills 2009: National employer survey findings

¹⁶ Internal discussions with the Economic Development team at Worcestershire County Council

¹⁷ Urban Regeneration & Greenspace Partnership (2010) Benefits of Green Infrastructure: Report to Defra and CLG

¹⁸ Gensler & Urban Land Institute (2011) Open Space: an asset without a champion?

Labour productivity

Access to greenspace can increase the labour productivity and reduce costs caused by sickness absence. MEBIE says that there is a connection between an attractive green environment and increased health of the employees as this encourages exercise in the form of walking and cycling¹⁹. Other research indicates that looking at nature through a window can lead to reduced stress and improved work performance in the office²⁰.

Case Study: Europe's largest green roof at Kanes Foods

Kanes Foods, a leading UK supplier of fresh chilled vegetables based in the Vale of Evesham constructed a new sustainable salad factory covered with the largest Europe's green roof. The curved roof is covered in grass which incorporates a range of indigenous wild flowers. The roof maximises the thermal efficiency of the building whilst providing a new wildlife habitat which blends into the contours of the surrounding Cotswold Hills.

The roof provides multifunctional benefits to the company, employees, natural environment and local economy. The Kanes' green roof:

- Improves health and wellbeing of the company's employees through exposing them to the surrounding nature and improved air quality
- Contributes to the company's productivity and profits by reducing a number of employees taking time off sick.
- Protects largely valued by locals and visitors Worcestershire's landscapes from detrimental visual impact
- Supports local economy by creating a landmark feature, which is unique for this type of industry. This attracts attention and potentially inward investment from outside of the county
- Reduces energy costs to the company through better thermal insulation of the building.
- Significantly reduces the surface water runoff volumes and rates of rainfall leaving roofs.
- Enhances biodiversity through the wildflower meadow attracting butterflies and other types of birds. It is also anticipated that the roof hosts some skylark nestings.

Source: *Kanes Foods website*

¹⁹ MEBIE

²⁰ World Health Organisation Commission for Social Determinants. Strategic Review of Health Inequalities in England post-2010 Task Group 4: The Built Environment and Health Inequalities Final Report 12 June 2009, the Marmot Review.

Tourism

Introduction:

Accessible and quality green spaces are a major part of the Worcestershire's tourist offer. They support needs of the local residents but can also be a potential attractor for visitors contributing to the tourism sector.

Current situation:

Sector performance

Tourism is one of the largest industries in Worcestershire worth approximately £539million in 2008²¹. It is estimated that in 2010 it employed over 11,000 people. This sector attracts 10 million visitors to Worcestershire each year.

Tourism offer

Many of Worcestershire's high quality green spaces attract visitors from within and outside the county. Green infrastructure assets such as the Lickey and Clent Hills are predominantly attracting "*day visitors*" travelling from Worcestershire or surrounding areas including the Birmingham and Black Country conurbation.

Some of Worcestershire's assets such as the Malvern Hills, Cotswolds and Wyre Forest are nationally recognised. The Guardian recently identified The British Camp in the Malvern Hills as one of the best views in England²². These assets attract so called "*staying visitors*" which usually come from further afield and tend to prefer longer visits.

Visitor preferences

Tourists visit Worcestershire for many purposes including enjoyment of the county's countryside, scenery and wildlife, visiting attractions & events, using waterways, exploring the local heritage as well as taking part in various activities. In 2005, at least 12% of all visitors to Worcestershire came for walking and hiking²³.

GI contributes to tourism through:

- Natural heritage and attractive landscapes
- Healthy environment
- Encouraging healthy behaviours of local residents and visitors
- Provision of setting for the visitor's spend
- Specialist tourism such as food and drink festivals

²¹ The Sub-Regional Value of Tourism in the UK in 2008 published by the Tourism Intelligence within the Office of National Statistics

²² Guardian (2010) Britain's best views: The British Camp, Malvern Hills
<http://www.guardian.co.uk/travel/2010/may/06/britains-best-views-worcester-malvern>

²³ The Worcestershire Visitor Survey 2005

Opportunities:

Visitor economy

Traditionally, business and visitor economy have been treated as separated economic sectors. In Worcestershire there is an interest in providing more integrated approach which builds on the natural environment offer to create a coordinated business tourism package for the county. This initiative seeks to encourage increased longer term visits by people whose primary purpose in visiting Worcestershire is business related²⁴.

A number of visitors will have a direct impact on the on the local economy through visitors spending money on accommodation, food & drink or fees for cultural and outdoor activities. There are no local estimations on how much people have spent by visiting GI related attractions but the national estimations prove that there is a clear link between green infrastructure and tourism. In 2008, visitors to English countryside spent £11.5 billion and generated 340,000 jobs. Forest related tourism expenditure on day visit to forests exceed £2 billion per year. Similarly, the South West landscapes brought enough visitors to support over 70 000 jobs²⁵.

The many natural products grown in Worcestershire generate financial benefits to retail sector but they also contribute to other sectors such as distribution or tourism. The local produce of Worcestershire is behind the many of events and festivals taking place in Worcestershire such as Apple Fest in Tenbury or Vale of Evesham British Asparagus Festival. These events are known to attract many visitors and generate return on investment. For example, it is estimated that the Pershore Plum festival attracted 17,000 visitors (2007 figures)²⁶.

Health links

The attractive and accessible GI assets contribute to health and wellbeing of both local residents and tourists from outside of the county through supporting health lifestyles, promoting physical activity and providing healthy environment. This will have a long term saving benefits to the local and national budgets spent on the healthcare. The economic benefits of this health and GI interrelation are explored in more detail in Chapter 3: Health Benefits of Green Infrastructure.

²⁴ Internal discussions with the Economic Development team at Worcestershire County Council

²⁵ MEBIE

²⁶ Wychavon District Council (2011) Shaping the future together, August 2011

Case Study: Droitwich Canals

The Droitwich Canals were reopened in 2011 more than 70 years since being officially abandoned. The £12.7m restoration of Droitwich Canals project undertaken by a wide range of public, private and voluntary sector partners created the Mid Worcestershire ring, the only short break cruising ring in England.

The ring allows boats, cyclists and walkers to make a 21-mile circular journey through some of the Britain's most beautiful and historic countryside. As part of the canal restoration project, a linear park has been created providing picnic sites, fishing pegs, and new stop off points for boaters, walkers and cyclists. The area is also rich in wildlife so everyone can enjoy the sights and sounds of nature up close such as Coney Meadow Reedbed, a 5.5 hectare wildlife habitat, near Salwarpe.

It has been estimated that the network extension to Droitwich Canal will generate a significant economic gain for the area, including:

- £2.75m additional visitor spend
- 196 FTE jobs
- £3,088,800 uplift values for adj. Houses
- 322,000 additional visitor days plus
- 10 to 15 new businesses established
- 330,00 additional visitor days
- 3,300 boat movements on the Droitwich Canals
- 12,000 p.a. cycling visits
- 2,000 p.a. canoe visits
- 3,500 angling visits
- £144,000 annual health benefits

Source: Economic Development Team, WCC and British Waterways Droitwich Barge Canal.

Agriculture and Land Management

Introduction:

One of the major continuing challenges is to increase food production while improving environmental outcomes. This challenge is particularly relevant to Worcestershire where the economic success is largely reliant on agricultural land uses and food production. Green infrastructure can be a multifunctional solution which addresses these issues.

Current situation:

Worcestershire farmed area in 2010 was 117,165 ha which is approximately 67% of the total land. Worcestershire's financial output from horticulture accounts for 20% (70 million) of the overall output in West Midlands²⁷. The Vale of Evesham plays an important role in horticulture concentrating a large number of businesses which specialise in that sector.

It is estimated that in 2012, 55% of Worcestershire residents grew fruit and/or vegetables for their own consumption, mainly in their garden or in tubs, a similar result to that found in the 2009 survey. There are differences across districts with those in Malvern Hills being most likely to grow their own food.²⁸

Opportunities:

Multifunctional benefits

Green infrastructure can provide benefits to agriculture, horticulture and wider food production sectors whilst protecting and enhancing natural environment. In the wider sense, GI supports well-functioning ecosystem services (the benefits that a healthy environment provides for people) which are essential to growing foods and breeding healthy animals such as clean water and soils²⁹. For example, planting trees on the edge of the field can prevent pollutant run-off to the watercourses and ensure a long-term clean water provision. GI solutions are multifunctional therefore; the same trees could be a natural flood management structure to slow water flow from the land. This in itself will provide large savings to the farming sector through a reduction in need for water purification and the effect of flooding on future crops.

GI supports Agriculture & Land Management through:

- Clean water and soils
- Water supply
- Flood risk prevention
- Protecting important species such as bumblebees
- Provision of gardens, orchards and allotments
- Agricultural diversification
- RDPE funding

²⁷ European Food and Farming Partnerships (2011) Getting to the hearth of horticulture

²⁸ Worcestershire County Council (2012) Worcestershire Viewpoint Survey May 2012

²⁹ More detail about ecosystem services can be found in Appendix A

The opportunities for these sectors are connected to new and innovative ways of farming such as water storage facilities. Agricultural and horticultural businesses could face damaging water shortages in the coming decades as a result of predicted increase incidence of summer droughts. In many parts of Worcestershire, water resources are under severe pressure. The majority of catchments in which horticultural production is concentrated have been defined by the Environment Agency as being either over-licensed and/or over-abstracted. Well executed water storage facilities such as ponds can not only provide water supply for the business in the dry periods but a wide range of green infrastructure benefits such as biodiversity or landscape.

The key to successful application of GI solutions is a cross-boundary and cross-organisational approach to management and creative incentives for upstream land users to manage their land for nature's benefit. This is particularly important in relation to natural resources such as water. It is such a mobile resource which affects upstream land uses and downstream users of water and habitat.

Direct financial opportunities

This is linked to some direct financial opportunities which multifunctional GI offers to farmers and land owners. There are European initiatives managed by the Rural Development Programme for England (RDPE) having a £3.9 billion budget of which £3.3 billion is allocated to agri-environment and other land management between 2007-2013. Further £600 million has been allocated to make agriculture and forestry more competitive and sustainable³⁰.

The aim of this funding is to provide financial to farmers and land managers for initiatives that support the protection, preservation and improvement in the quality of water, air and soil, in the abundance of bio-diversity and in preservation and enrichment of landscapes.

There are two relevant schemes:

- Agri-Environment schemes to provide rewards to farmers for environmentally-sensitive land management
- The England Woodland Grant Scheme to provide funding for the planting and management of woodlands

Furthermore, there may be potential for the Payment for the Ecosystem Services (PES) which has been supported by the Natural Environment White Paper which states that land managers should be "*getting returns from a range of ecosystem services in addition to those they get from food production*"³¹. PES could be put in place in order to compensate the farmers and land managers for the loss of income from traditional activities and the change of land management practices undertaken to enhance level of ecosystem services eg. flooding of wetland or improved water quality³².

Agricultural diversification

³⁰ RDPE Network & National Care Farming Initiative Joint Project (2010) Support for Care Farming Through the Rural Development Programme for England. A review and look forward

³¹ HM Government (2011) Natural Environment White Paper, p.24

³² DEFRA (2010) Payment for Ecosystem Services

Green Infrastructure can provide new opportunities for agricultural diversification for food and non food crops. Rural areas and the agricultural industry undergoing structural change are provided with diversification opportunities to supply local markets for biofuels and biomass³³.

It has been identified that Worcestershire has potential for biomass electricity power production and heating. Farmers in Worcestershire are already growing energy crops including miscanthus (most popular), oil seed rape and willow coppice.

Woodland

Finally, green infrastructure can deliver economic benefits through creation and maintenance of existing woodland. New and existing woodland can support local economy through supply of timber, woodfuel market and biofuels.

For example, a single woodchip boiler installed in Worcestershire County Council is producing around 1 million kWh of renewable heat every year. This uses around 600 tonnes of woodfuel annually, sourced from local forestry operations. The fuel source would be wood chip, energy crops and multi-functional crops sourced within the area³⁴.

³³ MEBIE

³⁴ Worcestershire County Council (2013) Emerging Renewable Energy Strategy for Worcestershire

Case Study: Overbury Farms – Sustainable Food Production

Overbury Farms, on the slopes of Bredon Hill in Worcestershire, covers over 1500ha of land and is a mixed farming business combining arable and vegetable crops, together with a sheep enterprise of 1100 ewes. A proportion of the company's produce is sold direct through the internet to the public but majority of it goes to large retailers including lamb to Sainsbury's and barley sold to Carling¹.

Since 2003 Overbury has achieved the LEAF (Linking Environment and Farming) accreditation. LEAF is a charity which promotes integrated farm management, combining traditional methods and modern technology to produce nutritious food through sustainable practices. Overbury is one of only 1700 farms in the UK to receive this renewed annually accreditation.

Overbury Farms deserved their title through solutions such as integrating sheep into arable rotations, rainwater harvesting from lambing shed roofs and use of solar panels to reduce energy costs. The farm is also pioneer for so called "precision farming" which uses modern technology such as GPS to apply fertiliser depending on precise soil fertility to use resources more efficiently and to vary the seed rate across the field. Other benefits include establishing crops faster, cheaper and more efficient soil management and minimising release of nitrogen to the environment¹.

Jake Freestone, farm's manager, said that *"using variable rate fertiliser applications on one field alone have saved 4.8 tone of fertilizer and a reduction in cost of over £1,400, in 6 years"*. He recognised that being environmentally friendly and more efficient *"appeals to his customers, helps build trust and strategic business alliances. For example, being LEAF-Marqued has secured a premium for oilseed rape for the next 5 years"*¹.

In October 2012, Overbury Farm became a LEAF demonstration farm showcasing best sustainable practices to visiting community groups, conservation organisations, local schools and other farmers.

Source: Overury Farms website <http://www.overburyfarms.co.uk/>
The Newspaper of the Cotswolds AONB, Issue 28, Spring/Summer 2013, A New LEAF

Chapter 3: Health & wellbeing benefits of green infrastructure

Introduction

There is a strong link between the provision of accessible and good quality green spaces and improved health of residents.

This chapter identifies GI opportunities for increased physical activity, exposure to nature and climate change resilience and mitigation. It explores how GI can contribute towards reduction in occurrences of diseases such as diabetes, depression or respiratory conditions and how accessible green spaces can be a contributor to greater community cohesion through attracting and facilitating human interaction.

The major challenge lies in the deeper understanding of these linkages and opportunities and coordination of the strategies produced by variety of stakeholders. Linking work undertaken by the health and wellbeing sector with the partners responsible for the provision of green spaces in our towns and cities can ensure the supply of multifunctional infrastructure which caters well for health and wellbeing of residents.

This chapter covers GI contributing to:

- Financial benefits
- Health and wellbeing levels
- Social inclusion and community cohesion

GI BENEFITS TO HEALTH & WELLBEING ECONOMIC BENEFITS

Physical Activity

Increasing physical activity through access to high quality green space has the potential to save NHS £2.1 billion a year.

Physical Health: Obesity

The Forest Research (2010) proves that the under 25's are more likely to be obese if they do not have access to green space.

Physical Health: Heart Diseases

Proximity to greenspace is generally associated with increased levels of physical activity. The regular physical activity can reduce coronary heart disease by 10%,

Mental Health

The University of Essex proved that mental health can benefit from the engagement in physical activities whilst simultaneously being directly exposed to nature. 89% of the participants in their study have seen exercising in the natural environment as the most influential factor in improvement of their frame of mind.

Climate Change

Climate Change Related Conditions

Informed selection and strategic placement of trees and GI can reduce the urban heat island effect and cool the air, reducing health related premature human death during high-temperature events which account to even 1100 deaths per year.

Community Cohesion & Wellbeing

The study undertaken by Sullivan et al. (2004) found that 83% more individuals engaged in social activity in green spaces as opposed to sparsely vegetated/concreted ones.

Health Context

assessment of health conditions relating to green infrastructure including cardiovascular and respiratory diseases, obesity and mental wellbeing. Issues such as circulatory diseases and obesity are lifestyle related. To maintain the reductions in death rates Worcestershire will need to be tackled through a better diet and more physical activity³⁵.

Health deprivation patterns are represented in this paper by the Indices of Multiple Deprivation (IMD) cover a range of socio-economic measures³⁶. Access to quality green infrastructure will primarily contribute to addressing the health and wellbeing issues including social factors such as crime within the indices. The recent evidence proves that accessible and quality green spaces encourage physical activity which can help reducing health risk of obesity, cardiovascular problems, mental health etc. GI can facilitate social interaction which can help in building self-esteem and contributing to social mobility of disadvantaged people.

This information has been spatially represented on the context maps and amalgamated together on the combined health map. The maps and accompanying narrative are presented under subheadings below.

The following datasets have been used to map health patterns in Worcestershire:

Economic indicator	Datasets	Map
Obesity	CACI and Kantar Health ACORN data	Figure 6
Heart Disease	South East Public Health Observatory (SEPHO)	Figure 7
Respiratory Conditions	CACI and Kantar Health ACORN data	Figure 8
Mental Health	CACI and Kantar Health ACORN data	Figure 9
Health Deprivation	This indicator uses the Health domain of the English Indices of Deprivation 2010 at Lower layer Super Output Area (LSOA) level.	Figure 10

Note: It is important to note that most of the areas indicated as poor on the maps below perform relatively well on a national scale. The comparisons are therefore only relevant when used to identify patterns at a county-scale.

Health Combined

Worcestershire is a mixed bag in terms of ill health however it performs relatively well when compared to the national figures. The major issues recognised are around obesity which average percentage for the county (26%) is higher than national average (23%). Heart diseases are an issue to the most areas in Worcestershire despite of the numbers improving and remaining at the level lower than the UK average. There are also pockets of health related deprivation, mental health and respiratory diseases across the county.

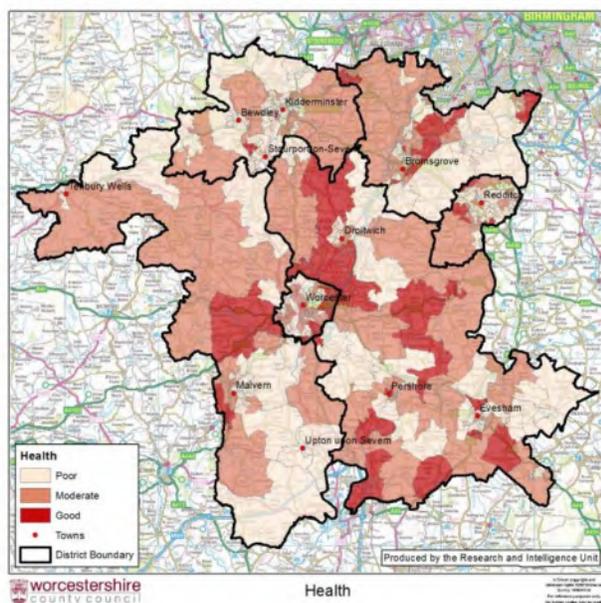
Health problems are a predominantly urban issue in Worcestershire. The rest of the county is performing well, however some pockets of poorer health can be found in the Vale of

³⁵ Worcestershire County Council (nd) Public Health Annual Report 2007-08

³⁶ See Chapter 2: Economic Benefits of Green Infrastructure for more detail on IMD

Evesham; the south-east of the county; the very north of Malvern district; a corridor between Droitwich, Bromsgrove and Redditch towns; and a Worcester-Pershore strip.

Figure 5: GI related health indicators – combined map



Obesity

26% (120,000) of all adults in Worcestershire are obese³⁷ which is 3% above the national average. Another 40% of adults are overweight³⁸. Childhood obesity, estimated 10% for 5 year olds and 18% year olds, is closely linked to the deprivation levels. Each year, Worcestershire experiences approximately 400 deaths due to obesity related ill-health such as diabetes, high blood pressure, heart attack, stroke and cancers³⁹.

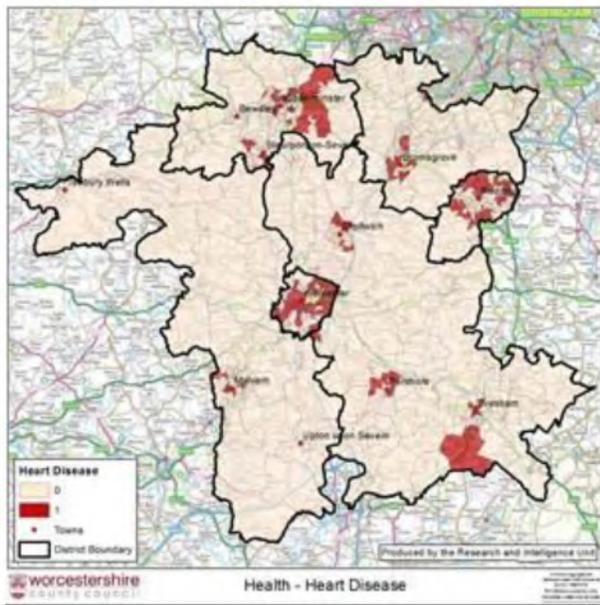
Geographically, obesity is an issue throughout the county. The least obese areas are the corridor to the West of Worcester, an area to the south of Malvern Hills; an area north from Bewdley and Kidderminster; the Worcester-Droitwich corridor; eastern villages; and areas in proximity to Bredon Hill.

³⁷ Obesity - determined by using weight and height of a person to calculate a number called the "body mass index" (BMI). An adult who has a BMI of 30 or higher is considered obese.

³⁸ Overweight - determined by using weight and height of a person to calculate a number called the "body mass index" (BMI). An adult who has a BMI between 25 and 29.9 is considered overweight.

³⁹ Worcestershire Health and Well-being Board (2012) Joint Strategic Needs Assessment

Figure 7: GI related health indicators: Heart Diseases



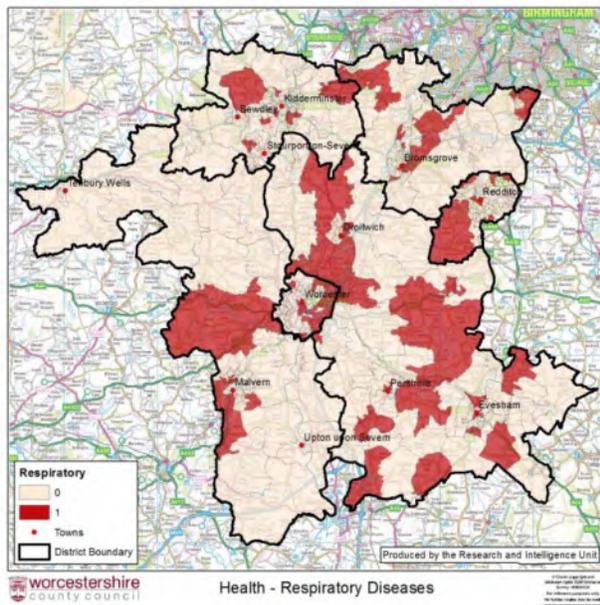
Respiratory diseases

Between 2008 and 2010, there was an annual average of 743 deaths from respiratory disease as the underlying cause. This represents 13.6% of deaths across the county and slightly lower than the England average of 13.8%. Across the same time period in Worcestershire, there were an average of 1,800 deaths per year where respiratory disease was listed as either the underlying cause of death or as a contributory cause of death, a total of 32.8% of all deaths compared to 34.2% in England⁴².

Respiratory related conditions are generally a problem for residents across the county. The exception from this are: a corridor to the West of Worcester, an area to the south of Malvern Hills; an area north from Bewdley and Kidderminster; the Worcester-Droitwich corridor; eastern villages; and areas in proximity to Bredon Hill.

⁴² CACI and Kantar Health, Health ACORN data

Figure 8: GI related health indicators: Respiratory Diseases



Mental Health

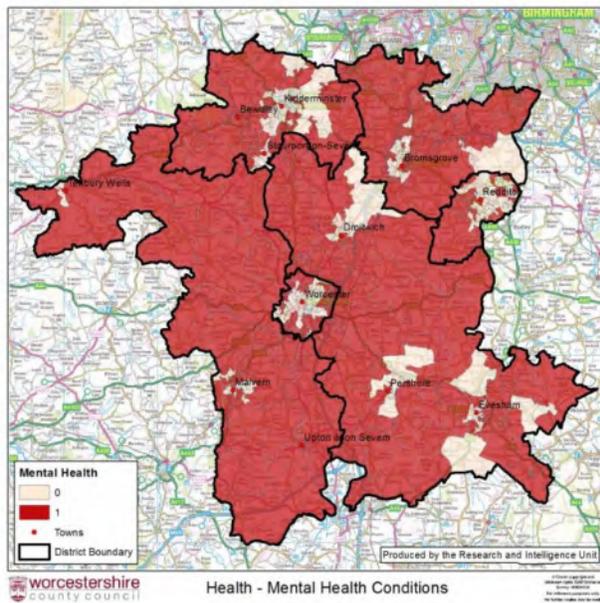
Nationally, at least one in six individuals suffers from a mental health related condition at any one time. More widely, it is predicted that depression may become second most common reason for disability in developed countries⁴³. Joint Strategic Needs Assessment (2012) estimates that one adult in eight in Worcestershire have some form of mental health problem with the most common being depression and anxiety. Additionally, approximately 10,000 children ages 5 to 16 have been recognised with a clinically significant mental health issues⁴⁴.

In spatial terms, mental health problems are found in and around major settlements. There are also some pockets in the Vale of Evesham and in the eastern part of Bromsgrove District adjacent to Redditch.

⁴³ Mental Health Organisation, website <http://www.mentalhealth.org.uk/help-information/mental-health-statistics/UK-worldwide/>

⁴⁴ Worcestershire Health and Well-being Board (2012) Joint Strategic Needs Assessment

Figure 9: GI related health indicators: Mental health conditions



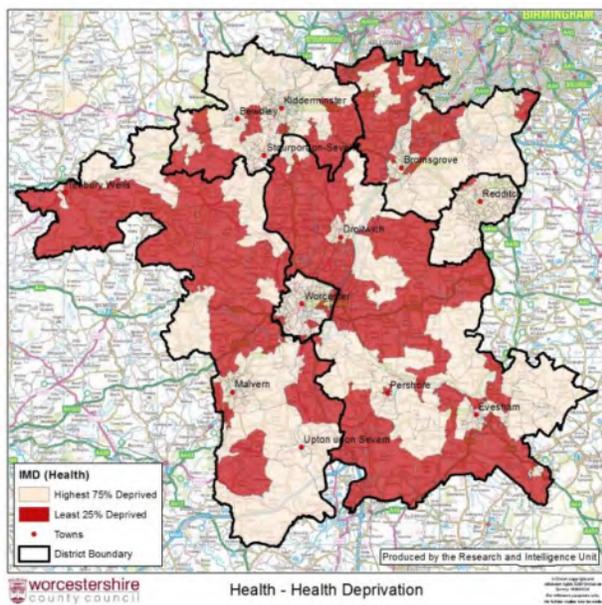
Health Deprivation

Worcester has 13 Lower Layer Super Output Areas (LSOAs) in the top 10% of areas for Health Deprivation, representing 3.6% of areas in the county and 65 LSOAs (18%) in the top 30% health deprived.

Redditch is the district which is the most health-deprived in the county. 7 LSOAs in Redditch (12.7%) are in the top 10% deprived, with 27 LSOAs, almost half of all areas in Redditch, in the top 30% for health deprivation. Worcester City and Wyre Forest are also relatively health deprived in comparison with the rest of the county, with each having around 20% of their LSOAs in the top 30% for health and disability deprivation⁴⁵.

⁴⁵ Department for Communities and Local Government (March 2011) English Indices of Deprivation 2010 at Lower Super Output Area (LSOA) level. This domain measures premature death and the impairment of quality of life by poor health. It considers both physical and mental health. The domain measures morbidity, disability and premature mortality but not aspects of behaviour or environment that may be predictive of future health deprivation.

Figure 10: GI related health indicators: Health deprivation



Financial Benefits

Introduction:

Healthy natural environment and access to natural green spaces can provide long term economic benefits and contribute to reduction the ill-health treatment costs.

Current situation:

Costs associated with physical inactivity.

The annual cost of physical inactivity in England is estimated at £8.2 billion⁴⁶. Lack of physical activity can be partly responsible for higher obesity and other physical health rates. It can also negatively influence people moods and motivation which can lead to reduced economic activity and increased depression and anxiety levels.

Costs associated with mental health

The total costs of mental illness in England can reach £77.4 billion with £754 million spent on drug prescriptions. This spend includes other factors such as losses in the economy due to peoples inability to work (£23.1 billion) and spent on NHS hospital and community health services (£4.9 billion)⁴⁷.

£106 million was spent by the NHS on treatment of mental health problems in adults and children in Worcestershire in 2010/11. £9.4million was spent by Worcestershire County Council on social care for adults with mental health problems.

Costs associated with obesity

It is estimated that the NHS costs of managing conditions associated with obesity nationally can get to level of £10 billion per year by 2050 while the wider costs to society and business are expected to reach even £49.9 billion per year⁴⁸. Locally based financial estimations indicate that NHS spends over £80 million treating obesity related ill-health and another £60 million treating the consequences of excess weight⁴⁹.

Opportunities:

The need for more preventive rather than reactive approaches to human health is increasingly being recognised amongst stakeholders at different tiers. At the national level, Annual Report of the Chief Medical Officer recognised *the benefits of regular physical activity to health, longevity, wellbeing and protection from serious illness have long been*

GI provides health & wellbeing benefits through:

- Contributing to prevention of health problems
- Reducing money spend on treating illness

⁴⁶ National Institute for Health and Clinical Excellence (2008) National costing report: Physical activity and the environment

⁴⁷ Peacock, J et al (2007) Got the Blues, then find some Greenspace. The mental Health Benefits of Green Exercise Activities and Green Care.

⁴⁸ Foresight Report: Tackling obesity. Future choices (Government Office for Science)

<http://www.foresight.gov.uk/OurWork/ActiveProjects/Obesity/KeyInfo/Index.asp>

⁴⁹ Worcestershire Health and Well-being Board (2012) Joint Strategic Needs Assessment

*established*⁵⁰. It reinforces the minimum recommendation of 30 minutes of physical activity five times a week for an adult. At the county level, Worcestershire Health and Wellbeing Board has recently published the Joint Health and Wellbeing Strategy 2013-2016 which encourages a greater emphasis on prevention, early intervention and early help as a means to achieve the quality and value for money health results.

Green infrastructure supports this new preventive approach to health. Natural green spaces by providing for outdoor physical activity, providing friendly environment for people and patients to relax and interact are reducing the occurrences of many physical and mental diseases whilst saving large amounts of money otherwise spent on treatments.

Regular participation in physical activities has been shown to improve physical and mental health. Increasing physical activity through access to high quality greenspace has the potential to save the NHS £2.1 billion a year⁵¹.

Case Study: The Walking For Health initiative

The Walking For Health initiative which is funded by Macmillan and hosted by The Ramblers (previously managed by Natural England) aims to promote walking as a healthy exercise. The programme runs approximately 600 schemes to offer short, free, local health walks in communities across England.

Initial evaluation of the programme indicated that every £1 invested in the programme delivered £7 in benefits to the NHS, through an increase in both mental and physical health and well-being.

Source: <http://www.walkingforhealth.org.uk/about-us>

⁵⁰ The Annual Report of the Chief Medical Officer 2009, p. 21

⁵¹ Benefits of Green Infrastructure: Report by Forest Research (October 2010)

Health and Wellbeing

Introduction:

Green infrastructure can reduce numbers of physical and mental health sufferers through facilitating physical activity and providing visually attractive and calming landscapes.

It also creates an opportunity for interaction of various population groups, increases community cohesion and reduces the levels of antisocial behaviour.

The successful delivery of these objectives is dependent on the levels of quality and accessibility of the natural assets.

GI supports health and wellbeing of Worcestershire's residents through:

- Provision of accessible and quality green spaces
- Supply of the healthy, locally grown food
- Visually attractive and relaxing landscapes
- Provision of the communal spaces for people to meet and undertake activities
- Ensuring the healthy environment i.e. fresh air and cooling effect.

Current situation

Physical activity

In England, only 28% of adult women and 40% of adult men are meeting the physical activity guidelines which recommend 150 minutes of moderate activity every week. Generally, participation in physical activity declines significantly for older population groups. The level of participation also varies between geographical areas and socio-economic position⁵².

The 2011 public survey estimated that the majority of Worcestershire residents (87%) felt that physical activity is important to them. 72% of residents spend at least 30 minutes on moderate physical activity at least three days each week and 18% of residents every day of the week⁵³.

Worcestershire natural assets

Worcestershire is rich in natural openspace with 6 watercourses and 7% of the total land cover being woodland. There are sub-regional assets such as Malvern Hills or a number of smaller local green assets including country paths and formal parks. These assets deliver a wide range of recreational opportunities. There is also potential for even greater expansion. For example, the Lickey Hills and the Clent Hills provide valuable open space for recreation, access to nature and offer panoramic views over Birmingham and surrounding countryside.

Accessibility to green space

⁵² Worcestershire County Council, Public Health webpages
<http://www.worcestershire.gov.uk/cms/public-health/staying-healthy-and-campaigns/physical-activity/benefits-of-exercise.aspx>

⁵³ Worcestershire County Council (2012) Worcestershire Viewpoint Survey November 2011

There are over 11,750 ha of accessible natural green spaces⁵⁴ in Worcestershire which are available for use by the general public for free-to-access recreation during daylight hours. This include strategic recreational provision and smaller natural green spaces at a neighbourhood or district scale, the public rights of way network, and sites which charge for access.

Overall 55.2% of Worcestershire residents are within 5km of sites that are 100ha or larger (county-scale sites) and 31.8% are within 10km of sites that are 500ha or larger (sub-regional scale sites). This falls short of the Natural England's Target Natural Green Space Target that all communities should be with 10/5km respectively of 100/500ha site.

The proportion of households within 5km of county-scale sites is higher in the north of the county due to a cluster of assets including the Wyre Forest, Lickey and Clent Hills, and other facilities in neighbouring counties. Access to county-scale sites is also good in Malvern Hills district due to proximity of the access land to Malvern Hills AONB.

The proportion of households with access to sub-regional provision is also high in the Malvern Hills and Wyre Forest districts. Many of the county-scale recreational assets in these areas are, however, near to or over capacity and face significant visitor pressure from within the sub-region⁵⁵.

Wychavon is a rural district, but access to recreational assets is low and the network of rights of way is less dense than in the rest of the county. Access to county-scale and sub-regional assets is also poor in Worcester city, although access to neighbourhood-scale assets is good.

The majority of the existing facilities are currently experiencing high level of demand and are unlikely to be able to absorb an increase in visitor numbers without having a detrimental impact on the habitats, visitor experience or the quality of the site. To overcome this, a new country park or similar facility will be required in the county, to accommodate the informal recreational needs arising from predicted population growth⁵⁶.

Opportunities

Mental health and wellbeing

Contact with nature can have therapeutic effects on individuals and communities through relaxation and calming opportunities it provides. There is an extensive literature to prove a correlation between the proximity and quantity of green

⁵⁴ The Accessible Natural Greenspace Standard (ANGSt) Model identifies the maximum distance that any resident should have to travel from their home to reach natural or semi-natural green space which is freely accessible. It is divided into four tiers:

- Sites and habitats over 500ha should be within 10 km
- Sites and habitats over 100ha should be within 5km
- Sites and habitats over 20ha should be within 2km
- Sites and habitats over 2ha should be within 300m

⁵⁵ Worcestershire County Council (2013) Worcestershire Green Infrastructure Framework Document 3

⁵⁶ ANGSt is the Accessible Natural Greenspace Standard, developed by Natural England in the early 1990s

spaces and issues such as the longevity and risk of mental illness, level of stress and reduction in symptoms of Attention Deficit Disorder amongst children⁵⁷. The green landscapes, walks, parks and landscaping features such as trees in the surrounding environment play a curative role. The provision of adequate amount of accessible green spaces when planning for new developments and retrofitting green infrastructure features into existing development contributes to the quality of place and mental wellbeing of the residents.

Case Study: Therapeutic Farming at Top Barn

The Top Barn special needs training centre is located on a 300ha mixed farm five miles north of Worcester on the banks of the River Severn. The client list at Top Barn includes people with severe learning disabilities, physical disabilities and brain injuries, as well as mental health patients and disengaged young people. However there is also a wide range of courses for the local community and anyone interested in rural skills and a sustainable lifestyle.

A staff member, Roger Bates, adds his own perspective. *“Coming to the farm provides people with an opportunity to achieve something. They can make a connection from making the seed beds, planting things and looking after them. They can see they are not isolated tasks.”*

The main aim is to provide training, education and therapeutic opportunities with a rural theme. Activities include horticulture, farming, animal husbandry, woodland skills, alternative building and farmhouse style cookery using home-grown produce. Lessons take place both inside and outdoors.

Ian Iontton, visually impaired, visiting Top Barn for several months claims that *“Being with animals and out in the countryside is better than being in a classroom, all closed in. Here, I am thrown challenges that show me I can do things rather than getting stressed about things I can’t.”*

Source: Community Care, "The therapeutic value of care farms", 22nd March 2007 and Farmers Weekly "Care farming could put £149m/year into the rural economy", 4th April 2008.

Physical activity and access to green spaces

People with good access to green space are 24% more likely to be physically active⁵⁸ which is why green infrastructure provision can be crucial in addressing this issue. The report of Office for Deputy Prime Minister (2002) suggests that increasing the standard of public spaces in order to create sustainable and more inclusive leaving could create an "unintended outcome" of increased physical activity⁵⁹.

The most popular forms of physical activity to most of people are those that can be incorporated into everyday life such as walking to work.⁶⁰ Green infrastructure

⁵⁷ As above

⁵⁸ Natural England (2012) Microeconomic Evidence for the Benefits of Investment in the Environment

⁵⁹ Office for the Deputy Prime Minister (2002) Living spaces: cleaner, safer, greener

⁶⁰ National Institute for Health and Clinical Excellence (2008) National costing report: Physical activity and the environment

through creating attractive and safe open public spaces and travel routes such as cycle paths can encourage physical activity.

This is especially prevalent in combination with exercise which has beneficial effects on mental health in itself. Moderate regular exercise can enhance mood, self esteem and reduce stress – the elements that can increase risk of depression. The University of Essex proved that mental health can benefit from the engagement in physical activities whilst simultaneously being directly exposed to nature. 89% of the participants in their study have seen exercising in the natural environment as the most influential factor in improvement of their frame of mind⁶¹.

The Marmot Review commissioned by the Secretary of State for Health in 2010 reviewed the most effective evidence-based strategies for reducing health inequalities in England. The study highlighted the link between the physical environment and health and well-being of communities and saw active travel and improved access to open and green spaces as important as one of the priorities for action. According to the review, there should be a park or small play area within 4 minutes walk from each household⁶².

Case study: Diglis Bridge

In 2010, Sustrans in partnership with Worcestershire County Council and Worcester City Council completed the development of Diglis Bridge over the River Severn in Worcester. The project created a series of new and improved walking and cycling routes which lead to a new non-vehicular crossing over the River Severn and which link into national cycle networks. This created a high quality traffic-free riverside loop and improved access to riverside.

The riverside loop has transformed the way local residents incorporate exercise into their daily routine by running and walking for fitness, health reasons or the enjoyment of surrounding landscapes and wildlife.

Many walking and cycling groups have either set-up or moved to take advantage of the new routes. There are now five regular walks run under the national Walking for Health initiative and Worcester is in the first year of a five year Heart City programme run by the British Heart Foundation. It estimated that that there are approximately 1,000 cyclist and 4,000 pedestrian journeys using the bridge each month.

The improvement to Worcester waterfront also attracted new visitors providing benefits to local businesses including at least 20% increase in sales for Diglis House Hotel.

Source: Sustrans (nd) Health Benefits Getting people active in Worcester
Sustrans (nd) Case study: getting Worcester walking and cycling

Physical health

Physical activity is the key to prevention but also treatment of some of diseases and disorders. The Lancet magazine claims that inactivity increases the risk of

⁶¹ Peacock, J et al (2007) Got the Blues, then find some Greenspace. The mental Health Benefits of Green Exercise Activities and Green Care.

⁶² The Marmot Review (2010) Fair Society, Healthy Lives

many adverse health conditions such as coronary disease, diabetes and shortens life expectancy. Worldwide estimations prove that physical activity could prevent approximately 6% of coronary diseases, 7% of type two diabetes and 10% of breast and colon cancers. It also decreases the world's population life expectancy by 0.68 years⁶³.

Delivering GI priorities such as active travel and improved access to open and green spaces will contribute to physical health and mental wellbeing of local communities. The Natural England's research indicates that people with good access to green space are 24% more likely to be physically active⁶⁴. It is very important knowing that the regular physical activity can reduce coronary heart disease by 10%, risk of type two diabetes by 33-50% and hip fracture for elderly by 50%⁶⁵.

It is crucial that residential areas are supported with the accessible and good quality green spaces. They can be utilised for walking, cycling and variety of organised and non-organised sport activities. There are many good practice examples already in place in Worcestershire. Fore example: Worcester Cripplegate Park runs weekly outdoor military fitness sessions as classes as does Worcester Woods Country Park. Variety of parks across Worcestershire is used by running and cycling clubs.

Case study: Green Gym programme

In 1998 the Conservation Volunteers, an environmental charity started the Green Gym programme which aims to improve natural environment while provide volunteers with ways of enhancing their fitness. The programme started as a single pilot project grew to approximately 55 project by 2006 and received the financial support from central government. The Green Gym projects are run by experienced leaders which give the participants the opportunity to undertake conservation tasks. This improves their physical condition, gives opportunity to learn new skills and builds confidence whilst the local green spaces receive appropriate care and maintenance. The local Green Gyms are often run buy separate organisations under the licence of the Conservation Volunteers.

The successful example of this programme in West Midlands is Telford Green Gym. It targets some of the most vulnerable and deprived groups in the area, in relation to social exclusion, low income and health inequalities. The survey undertaken amongst the participants indicated that most of them felt more positive about the future and more confident, they have made friends through Green Gym as well as reported improvements in their physical health including weight loss, eating more healthy and cutting down on alcohol and cigarettes.

Source: *The Conservation Volunteers website <http://www.tcv.org.uk/greengym>
Telford and Wrekin Primary Care Trust (non-dated) Telford Green Gym leaflet*

⁶³ I-Min Lee et al (2012) Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy, *The Lancet*, vol 380, 21 July 2012, p.219-229.

⁶⁴ Natural England (2008) Microeconomic Evidence for the Benefits of Investment in the Environment – review, <http://publications.naturalengland.org.uk/publication/32031>

⁶⁵ The Annual Report of the Chief Medical Officer 2009

Social interaction and community cohesion

Local green spaces such as parks can facilitate the increased social interaction contributing towards community cohesion and development of the attachment with locality.

Where residents perceive the quality of green space to be good they are generally more satisfied with their neighbourhood and more prone to interaction. Study undertaken by Sullivan et al. (2004) found that significantly more individuals engaged in social activity in green spaces as opposed to concreted ones⁶⁶.

Community gardening schemes including allotments or orchards are a great opportunity to establish and maintain contact with community and with nature for a range of demographic groups. Involvement in development of community gardening spaces can enhance the physical health and emotional wellbeing of residents as well as motivate them for more community engagement⁶⁷.

Case Study: To follow

Social Inclusion

Certain population groups are particularly prone to social exclusion. This includes people with disabilities, ethnic minorities, elder people, urban deprived populations and people in lower socio-economic groups. Community cohesion encouraged by access to green spaces can have positive impact on creating social interaction between members of these groups.

Overall, more deprived communities tend to be in areas where there is less green infrastructure or where it is of poorer quality⁶⁸. The national research on patterns of use of green space revealed that members of these disadvantaged groups were less likely to visit the natural environment with key barriers for greater participation being a lack of time, issues of costs and transport. Despite that they were more likely to use close-to-home green spaces. This highlights the importance that the proximity and accessibility of green spaces have on increased social inclusion and positive mental attitude of residents leading to increased social mobility⁶⁹.

The quantity as well as quality of green spaces have significant influence over the level of its use. People generally are prepared to travel further to a higher-quality park. Study completed by CABE stated that only 1% of those living in social housing reported using their local green space due to concerns about safety, lack of access and poor quality environment⁷⁰.

Antisocial behaviour

⁶⁶ Forest Research (2010) Benefits of Green Infrastructure

⁶⁷ Ely, Pitman (2012) Green Infrastructure, Life support for human habitats. The compelling evidence for incorporating nature into urban environments

⁶⁸ CABE Space (2010) Community green: using local spaces to tackle inequality and improve health

⁶⁹ Natural England (2012) Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment Annual Report from the 2012-13 survey

⁷⁰ CABE Space (2010) Community green: using local spaces to tackle inequality and improve health

Furthermore, there is evidence to suggest that domestic violence levels can be lower in greener areas, and crime levels significantly lower in residencies near natural spaces. This may be caused by potential stronger community ties that residents of deprived neighbourhoods can develop in the greener surroundings⁷¹.

Green infrastructure can facilitate working with excluded populations groups including your people and offenders to help reduce antisocial behaviour. Generally, contact with nature can provide sense of calmness and therefore reduce the levels of anger and frustration which contribute to antisocial behaviour.

Various activities and teaching new skills concentrated around natural environment have been seen as beneficial to disadvantages and excluded societal groups, such as forest schools⁷².

Case Study: Sherwood Pines Forest Park

Forestry Commission is running sessions in bushcraft and traditional woodland skills at Sherwood Pines Forest Park. These activities benefited students from Oakdale Learning Centre which provides out of school support for young children who have struggled with mainstream schooling and had been excluded from their schools due to significant behavioural incidents.

Forestry Commission together with Oakdale staff developed a learning programme to meet the students' needs for kinaesthetic learning in varied surroundings. The programme consisted of a number of afternoon sessions built of activities including constructing fires, building shelters, felling small trees, carving green wood and undertaking the assault course.

As well as learning traditional woodland skills, the students also developed their team building and social skills which will help in reducing their antisocial behaviour and integration within the society and mainstream school system.

The project succeeded with students' good attendance and active participation in the activities throughout the autumn and winter seasons.

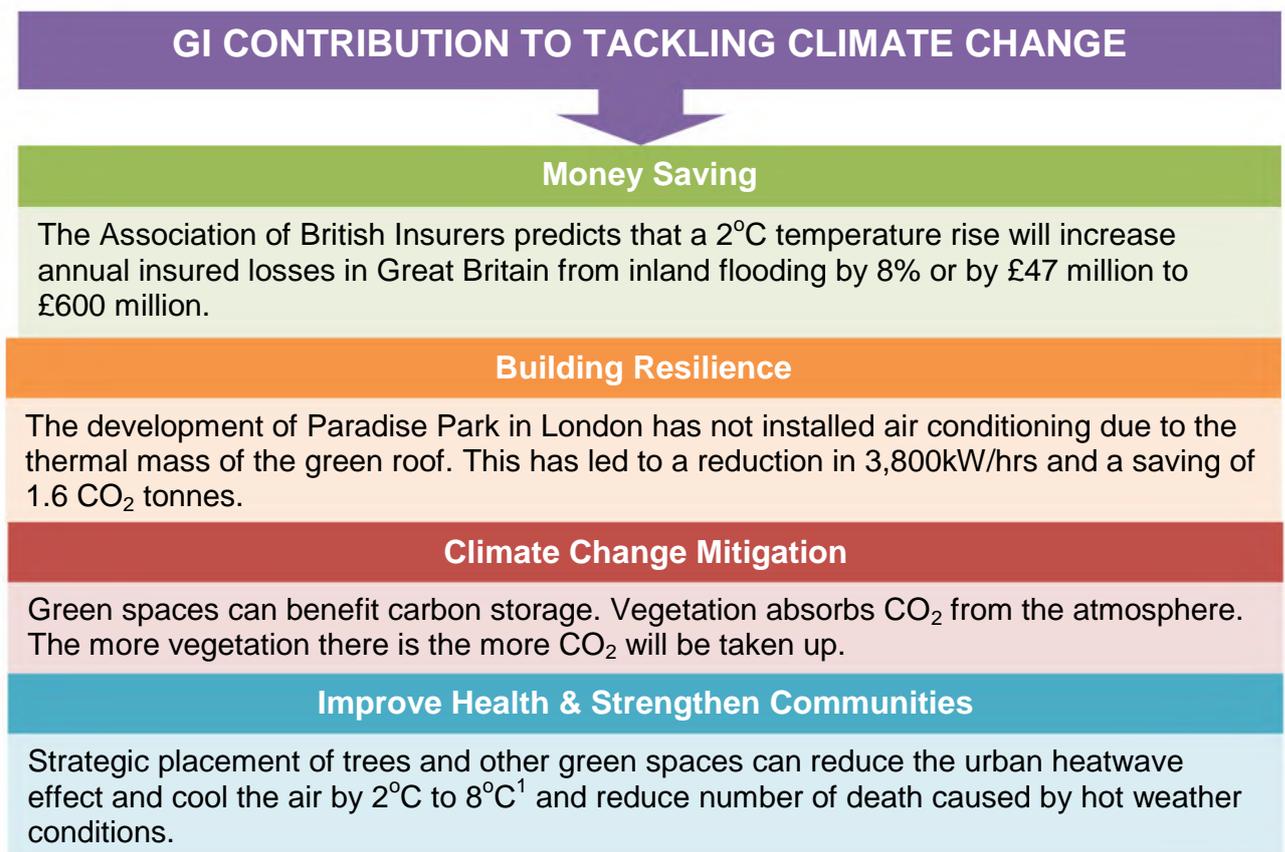
Source: Laura Freer, "Working with excluded young people to help reduce antisocial behaviour", *Countryside Recreation Network News*, Volume 22, Autumn 2013,

⁷¹ Forest Research (2010) Benefits of Green Infrastructure

Chapter 4: Climate Change Benefits of Green Infrastructure

Introduction

Green Infrastructure offers us a solution to delivering sustainable development that meets the needs of the local economy, local people and the natural environment. Effective maintenance and management of our natural environment can offer services to support our efforts to tackle climate change; not only through supporting emissions reduction but also lessening the impacts severe weather and gradual changes to climate may have on the local area. Green infrastructure has a key role to play in tackling climate change. This is a move away from relying on traditional techniques for responding to issues such as severe weather such as hard engineering responses to flooding or relying on high energy demanding solutions to dealing with hotter weather. Across the County we have already seen examples of where green infrastructure principles have been applied resulting in multiple benefits.



Climate change context

Weather

The latest climate projections for the UK (UKCP09) indicate towards the following key headline messages;

- milder but wetter winters,
- warmer but drier summers
- more frequent and intense extreme weather events.

The extent of the changes in climate will vary over time depending level of both human and natural influences. When considering a project it is important to determine its expected life span and the potential impacts the climate may have over the whole life of the project. For example, a new building may have an expected life span of 60 years. Considering the impact current weather and that conditions that are likely in the 2020s are likely to be insufficient for the whole life of the building which could potentially leave the site vulnerable.

The changes in climate that are predicated nationally are by 2020s;

- the temperature on the warmest day in summer could increase by as much as 5.5°C⁷³
- the temperature on the warmest night in summer could increase by as much as 3.6°C⁷⁴
- Summer precipitation could decrease by as much as 25%⁷⁵
- Winter precipitation on the wettest day could increase by as much as 20%⁷⁶
- The temperature on the coolest day in winter could increase by as much as 3.8°C⁷⁷

By the 2050s it is expected that the change in temperatures and extremes of rainfall will be greater

- the temperature on the warmest day in summer could increase by as much as 8°C⁷⁸
- the temperature on the warmest night in summer could increase by as much as 6.5°C⁷⁹
- Summer precipitation could decrease by as much as 36%⁸⁰
- Winter precipitation on the wettest day could increase by as much as 40%⁸¹

⁷³ Projection for medium emissions scenario for 2020s using 90% probability level

⁷⁴ Projection for medium emissions scenario for 2020s using 90% probability level

⁷⁵ Projection for medium emissions scenario for 2020s using 10% probability level

⁷⁶ Projection for medium emissions scenario for 2020s using 90% probability level

⁷⁷ Projection for medium emissions scenario for 2020s using 90% probability level

⁷⁸ Projection for medium emissions scenario for 2050s using 90% probability level

⁷⁹ Projection for medium emissions scenario for 2050s using 90% probability level

⁸⁰ Projection for medium emissions scenario for 2050s using 10% probability level

⁸¹ Projection for medium emissions scenario for 2050s using 90% probability level

- the temperature on the coolest day in winter could increase by as much as 4.6°C⁸²

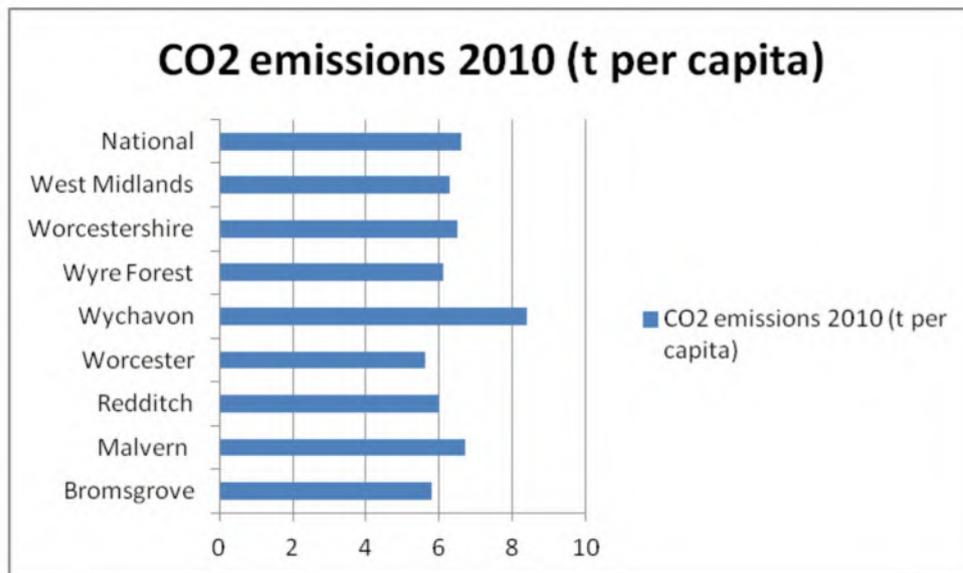
Worcestershire emissions

In Worcestershire, the latest data (2010) indicates that CO₂ emissions are 6.5t per capita following a reduction of 11% since 2005. This is below the national average of 6.6 t per capita but greater than the West Midlands average of 6.3 t per capita. Emissions per capita vary between districts in Worcestershire. The districts with the lowest emissions for 2010 were Worcester (5.6t per capita), Redditch (6t per capita) and Bromsgrove (5.8t per capita). The district with the highest emissions per capita is Wychavon (8.4t per capita)⁸³. This could be due to it being distinctly rural and the sparse nature of the settlement resulting in greater use of private cars for travel and (as much of the district is off the gas grid) the use of emissions-intensive forms of fuel such as oil to heat homes.

Notwithstanding the above, generally higher concentrations of total CO₂ emissions are found around urban centres and along major transport corridors and lower emissions usually come from the more rural areas of the county.

Figure 11 compares all districts and county figure with the regional and national emissions figure for the same year to show the area with the highest emissions.

Figure 11: Latest (2010) CO₂ emissions figures for Worcestershire, Districts, West Midlands and National



Air Quality

Air quality in Worcestershire is generally good. It is generally better in rural areas and worse around urban areas and major road infrastructure. National policy requires local authorities to declare Air Quality Management Areas (AQMAs) and to put reduction plans in place where concentration of nitrogen dioxide exceeds set limits. The AQMAs are hot-spots where there is traffic congestion, often in

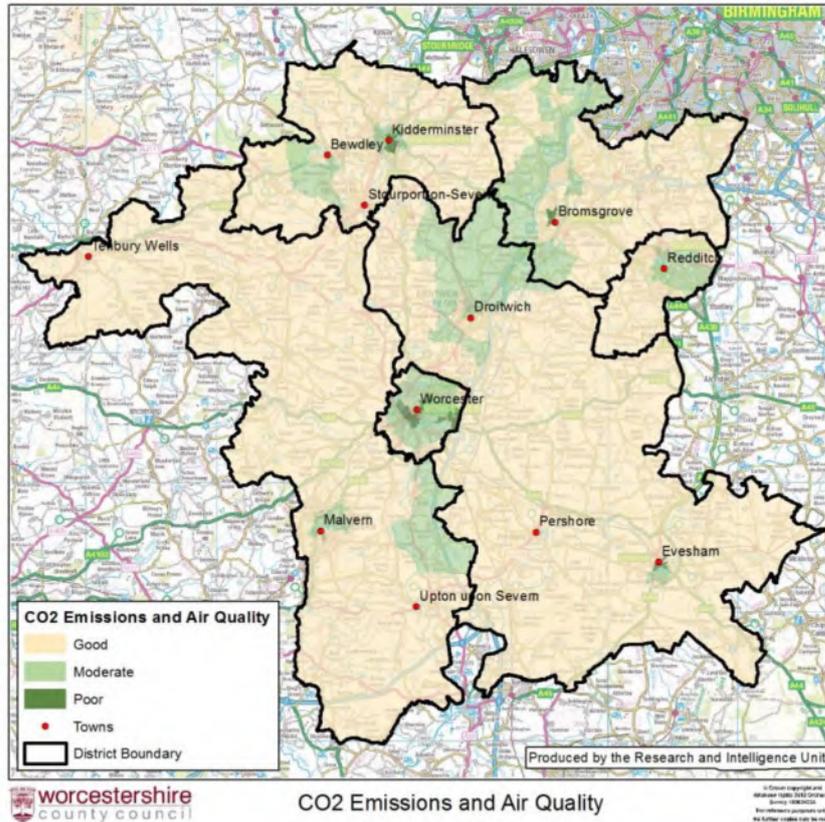
⁸² Projection for medium emissions scenario for 2050s using 90% probability level

⁸³ Department for Energy and Climate and Change (2013) Local and Regional CO₂ Emissions Estimates for 2005-2010', produced by AEA

narrow streets that have buildings close to the kerbside forming 'canyons', or roads with high traffic flows. There are a total of 10 designated AQMAs located in four Worcestershire districts: Bromsgrove (4), Worcester (3), Wychavon (1) and Wyre Forest (2)⁸⁴.

Figure 12 below illustrates the levels of CO₂ emissions and air quality in Worcestershire which are proxies for measuring the level of county's contribution to global climate change.

Figure 12: CO₂ emissions and air quality in Worcestershire



Source: Department for Energy and Climate Change (2013) *Local and Regional CO₂ Emissions Estimates for 2005-2010*, produced by AEA

⁸⁴ Worcestershire Partnership (2013) *State of the Environment Report: Air Quality*

Economic Benefits

Introduction

Green infrastructure can be cost effective solution in mitigation and adaptation of climate change. Tree planting and other green landscaping provide natural air conditioning and contribute towards greenhouse gas absorption. This can contribute to minimising the future climate change related events such as floods and droughts.

Current situation:

Climate change costs

Climate change is a serious global threat and failing to address it can lead to serious costs to the environment, people and economy. The Stern Review (2005) states that *"if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more"*⁸⁵.

Extreme weather impacts

Climate change may increase the costs of doing business, for example, the Association of British Insurers predicts that a 2°C temperature rise will increase annual insured losses in Great Britain from inland flooding by 8% or by £47 million to £600 million. Indeed, as a result of flooding in June and July 2007, there were an estimated 185,000 insurance claims in the UK of which 35,000 were commercial claims⁸⁶.

Across Worcestershire we have already felt the impacts of severe weather in previous years. The extensive flooding in 2007 had a significant impact on the economy of Worcestershire. The closure of the Severn Valley Railway not only meant loss of revenue for that business but all the other businesses such as hotels and cafes which rely on the tourism that the railway brings to the area. These flood events are thought to have cost Worcestershire £6.4 million per week⁸⁷. Furthermore, the collapse of a culvert under the road at Cropthorne B4084 due to supporting soil being washed away by floodwater. Repairs cost nearly £1million and took 6 months to complete.

GI is a cost-saving solution to climate change mitigation & adaptation and flood management through:

- Reduce cost of ill health associated with climate change
- Minimising costs being a result of flooding
- Reducing costs of droughts to the local economy
- Reducing energy costs

⁸⁵ HM Treasury (2005) The Stern Review: The Economics of Climate Change. p. vi

⁸⁶ WCC (2011) Worcestershire County Economic Assessment 2010-2011

⁸⁷ Worcestershire County Council (nd) Worcestershire Local Climate Impacts Profile

Opportunities:

Severe weather events

Severe weather such as flooding have a negative impact on the County roads which disrupts commuters and delivery traffic. Some businesses have been directly impacted by severe weather events which can result in costly repairs, loss of business. Limiting the disruption to the local economy by lessening the impact a single severe weather event has is an important factor. For example, opportunities for farmers to store water on their land during wetter weather which can then be used to water crops during drier periods could alleviate issues faced by water abstraction restrictions.

Flooding

Green Infrastructure features such as buffering of watercourses provide a way of minimising fluvial flooding. Carefully planned landscaping incorporating flood defences can provide long term benefits to developers through more efficient planning application granting process, costs reduction and increased property values. In 1999 Bryant Homes/Taylor Wimpey addressed the issue of flood risk at their Diglis Water development by designing a waterfront park which provided an attractive, multifunctional, focal point along the edge of the River Severn. The waterfront park was designed to be flooded and to hold water when the river reaches its capacity. As a result, the marketability factor of Diglis Water is extremely high with the site proving to be one of the most popular in the Midlands⁸⁸.

The investment in sustainable drainage schemes (SuDS) promoted as one of the GI solutions is a mechanism for managing both fluvial and pluvial flood risk. Related to these green roofs are one of a number of opportunities for channelling surface water but biodiversity enhancement or provision of spaces for access and recreation.

Energy use

Those businesses which are considered to be high emitters of CO₂ are also high energy users; this not only means high energy bills but potential reputational risk as many organisations look for fellow businesses with similar green credentials. Finding more natural methods including green infrastructure for reducing temperature in urban spaces could reduce the demand for cooling for some businesses. Green infrastructure methods could include strategic planting of urban trees to provide shading for people and buildings. An appropriate application of green roofs can provide cooling and insulation for buildings. Plants on rooftops absorb the heat which keeps the building warmer during winter months, while they help keep building cooler during summer months. For example, the Paradise Park in London development has not installed air conditioning due to the thermal mass of the green roof. This has led to a reduction in 3,800kW/hrs and a saving of 1.6 CO₂ tonnes⁸⁹.

⁸⁸ Landscape Institute (2011) Why Invest in Landscape?

⁸⁹ Environment Agency (website) <http://www.greenroofstoday.co.uk/>

Case Study: Red Hill School, Worcester

Red Hill School in Worcester opened in 2007. The school site had previously had problems with flooding. The development includes a swale system in one area of the grounds capable of storing excess water on the site. This not only alleviates flooding issues on site but holds water that would otherwise be flowing directly in to storm drains.

In 2010 Defra commissioned a study which compared the estimated costs of traditional drainage versus the SuDS solution for the school. It demonstrated the significantly reduced cost of implementing SuDS over traditional drainage at all rates examined. SuDS were considerably cheaper due the storage provided within landscape features, which reduces the need for expensive traditional water storage.

Source: *Defra's Water Availability and Quality Evidence Programme (2012) Comparative Costings for Conventional Drainage and SuDS.*

Social benefits

Introduction

Another health benefit of green infrastructure stems from the improvement of the local environment which than can indirectly improve health of communities. Increasing green cover can improve air quality and mitigate effects of climate change such as extreme weather conditions which can reduce air quality related mortality rates or heat-wave related health risks.

Climate change is expected to have varied impacts on different members of society from the impact of poor air quality on those with underlying respiratory illness to creating opportunities to strengthen community through shared interests.

Current situation

Air quality related health issues

Increased CO₂ levels can lead to reduction of air quality in the area which generally will increase percentage of people suffering from respiratory diseases.

The assessment of health indicators (2008) identified that Worcestershire residents suffer from respiratory diseases (cause for 13.6% of all deaths) however a number of death caused by these conditions are slightly lower than the England average (cause for 13.8% of all deaths). Please see the context section in Chapter 3 contains more detail on respiratory diseases.

Heatwave related health issues

There are approximately 1100 heatwave related premature deaths per year in the UK with these numbers increasing even higher during exceptionally hot years. Across the county we see a sharper increase in mortality when temperature rises to 26°C or higher. "*An estimated 8-11 extra deaths nationally occur each day for each degree increase in air temperature during the summer heatwaves*"⁹⁰.

Opportunities

Carbon storage and garden spaces

Green infrastructure can create widespread opportunities for reducing emissions in the local area and additional benefits for residents. Green spaces can benefit carbon storage. Vegetation absorbs CO₂ from the atmosphere. The more vegetation there is the more CO₂ will be taken up⁹¹.

The benefits of green space for carbon storage can not only be achieved through afforestation practices but also on a smaller scale through appropriate use of garden spaces. Garden spaces are an important component in a green infrastructure network. They can provide spaces for growing of local food and

⁹⁰ Doick, Hutchings (2013) *Air temperature regulation by urban trees and green infrastructure*, Forest Research, Research Note

⁹¹ Imperial College London (2012) *Plants may absorb more carbon dioxide than previously thought*, Article by Simon Levey

recreation in a predominantly urban area and be beneficial for mental wellbeing of residents.⁹²

Removal of air pollutants and health benefits

There has been increasing recognition of the importance of green space in the absorption of pollutants produced in the industrial sector and transport systems in urban environments⁹³. The removal of air pollutants such as ozone, CO₂ and particulates can be favourable for the health of local people. Ground level concentrations of ozone are a particular problem during hotter weather due to the action of sunlight on the pollution. Ozone concentrations are likely to be higher on hot, sunny days. This means that with more frequent hotter days expected as the climate changes, this issue of the impact of ozone on respiratory illness will become more prevalent.

Effects of extreme weather on health of residents

Warmer summers are expected to impact health, both negatively and positively. Urban areas tend to be warmer than more rural locations due to the heat absorption and slow release of heat from hard structures and the heat output from air conditioning units to keep the inside of the buildings cooler. By providing green space in urban areas, the natural environment can be used to provide cooling. Strategic placement of trees and other green spaces can reduce the urban heatwave effect and cool the air by 2°C to 8°C⁹⁴ and reduce the number of deaths caused by hot weather conditions.

Warmer weather also encourages the use of outdoor spaces. The opportunity to use green spaces for recreation is not only good for physical health and fitness but also improving the mood and mental wellbeing of local people. Appropriate natural shading offered by the tree canopy can help reduce exposure to the sun. Provision of green space could help to cool urban areas over night. During hotter weather, buildings have to cool over night by emitting heat into the surrounding area. Night time temperatures have to drop below 15°C to allow for sufficient cooling.

⁹² Guite et al (2006) *The impact of the physical and urban environment on mental well-being*, Journal of the Royal Institute of Public Health, Public Health 120, p. 1117-1126

⁹³ Forest Research (nd) Improving air quality, <http://www.forestry.gov.uk/fr/URGC-7EDHQH>

⁹⁴ Doick, Hutchings (2013) *Air temperature regulation by urban trees and green infrastructure*, Forest Research, Research Note

Case Study: Warndon Villages, Worcester - community led green spaces

Since summer 2011, Transition Worcester Orchard Workers have been working with Worcester City Council to revive an Orchard in the Warndon Villages areas of the City. Few local residents were aware of the Orchard after 20 years of neglect. A group of local residents, the City council and Transition Worcester orchard workers all began work to make the orchard a usable space where there is easy access to the fruit.

In the first year, over 40 volunteers were involved in rejuvenating this green space in to a useable community resource where residents can take pride in the fruits grown at the site and teach others how to make fruit juice. This project shows the power of the community in supporting green space development and the value this has to local residents.

Source: www.transitionworcester.org.uk

Environmental

Introduction

Changes in the climate are expected to result in a range of impacts globally, nationally and across the county⁹⁵. We are unable to stop weather events from happening but we can respond to them in a more effectively. How we respond to these impacts is crucial to future sustainability and an opportunity to build natural resilience to change through effective maintenance and management of the local environment.

Current situation

Habitats

Isolated habitats will find adapting to shifts in the climate more difficult as species movement becomes more difficult. Generally, species will move to the climate band most suitable for them. Isolated green spaces will limit this movement making it more difficult for species to adapt to change.

Water quantity

Rainfall variations are already resulting in periods of water shortage and excess. At the start of 2012, following previously drier than normal winters, a drought was announced by the Environment Agency. Ground water levels had declined resulting in water abstraction licence restrictions across Worcestershire. Changing the way we think about water use, can limit disruption from water shortage or excess water.

Water quality

Alongside the issue of excess or shortage of water comes the quality of the local water bodies. The majority of watercourses in Worcestershire are at a medium or high risk of not meeting the Water Framework Directive (WFD) objective. The WFD has set a target that all surface and ground waters should aim to reach 'good status' by 2015 and all water bodies must reach 'good' or 'high' status by 2027. Diffuse pollution from phosphates and nitrates are causing the most problems in Worcestershire's watercourses, with Worcestershire having the highest levels of these pollutants in the West Midlands. Issues of quality can be exacerbated by low water flows or by excess rainfall washing pollutants in to the water⁹⁶.

Flooding

The types of flooding that arise in Worcestershire include fluvial flooding (from water courses), rising groundwater and pluvial flooding (from surface water run-off). Pluvial flooding can occur anywhere in the county as it is the result of large amounts of rainfall being unable to drain away effectively.

Approximately 10% of the land area of Worcestershire is at risk of fluvial flooding (about 167km²). There are over 9,000 properties at risk of fluvial flooding,

⁹⁵ UK Climate Projections (UKCP09)

⁹⁶ Worcestershire County Council (2011) 'Planning for Water in Worcestershire' Technical Research Paper

approximately 4% of the total number of properties in the county. 38% of these properties are at significant risk; 30% are at moderate risk; 32% are at low risk⁹⁷.

Opportunities

The use of SuDs can hold water for when there are drier periods. SuDs aim to return the drainage of an area to a more natural system state rather than rainwater running straight in to the nearest water course or storm drain. Allowing the natural filtration of water back in to the environment helps to alleviate impacts of flooding. Across Worcestershire we have already seen the widespread impacts of flooding from fluvial and surface water.

The use of SuDs could regulate the water levels and help address water quality associated with flow. This method of water regulation will also support biodiversity as sustainable drainage system can also contribute to biodiversity enhancements in both rural and urban environments.

Case study: The Hive, Worcester

The Hive, Worcester's joint public and university library and history centre opened its doors to the public in July 2012. The iconic building is built to mitigate against or to be resilient to future climate and incidents of severe weather which are expected to increase. Two water meadows are situated along the western elevation of the building which can hold excess water following intense or prolonged periods of rainfall. These water storage basins have been planted with a range of native wildflower species, based on communities found locally in traditional lammas meadows. They are as used as a recreational area during drier periods.

⁹⁷ Worcestershire County Council (2011) Planning for Water in Worcestershire: Technical Research Paper

Appendix A: Multifunctional GI

What is GI?

Green infrastructure is the network of green spaces and natural elements that intersperse and connect our cities, towns and villages. Green infrastructure is contributed to by many different elements. These include biodiversity, the landscape, the historic environment, the water environment (also known as blue infrastructure), public access to green spaces and informal recreation sites.

Multifunctional GI

The coordinated approach to managing the GI components and assets can safeguard critical natural areas while providing climate change resilient infrastructure and supporting socio-economic wellbeing of the residents. At the centre of this approach lays “**multifunctionality**”, which in the GI context means the integration and interaction of different functions and activities in relation to the piece of land or wider area. For example, the urban GI of green roof reduces storm water runoff and water pollution while also decreasing the urban heath effect, improving the building's insulation and contributing to local biodiversity.

GI as opposite to "grey" infrastructure tend to be designed for performing more than one function. Figure 13 sets out the key priorities for each of the environmental aspects of green infrastructure are set out below

Figure 13: Green Infrastructure Components



In combination these interventions can deliver multiple socio-economic benefits. A single GI project can tackle or offer a partial solution to several problems and deliver multiple objectives. This makes GI a valuable, beneficial and cost-effective practical and policy tool in addressing various environmental and socio-economic demands and pressures. Figure 14 illustrates multifunctional benefits that GI can provide.

Figure 14: Benefits of multifunctional green infrastructure



Over the past few years, there has been a broadening discussion on the value of the "natural environment" and natural systems that support the people's existence. The living things including both fauna and flora are essential ingredients of the well-functioning ecosystem. For example, the food production requires good quality natural resources such as soils and water or attractive landscapes can help in making the most of the human interaction with nature. Nature can provide wide-ranging societal and economic benefits, which are an effect of the processes often described as **"ecosystem services"**. The multifunctional GI being at the core of ecosystem services is seen as the value for money way of linking nature with built environment.

Value of GI

The concept of multifunctionality in GI context means that a single solution can deliver multiple benefits or save money to local and wider economy. Its contribution across several functions can be measured by placing a monetary value on the functions performed. For example, estimates can be made on how much potential savings the GI flood management solutions can provide to the local economy through reducing a number of residential and business properties to be flooded, a number of local residents turning into public health with

physical and mental health related issues or reduction in costs to the post flooding road maintenance. However, there are still several values upon which it is difficult to place the financial figure, particularly around the cultural and aesthetic values. These are largely expressed in qualitative terms such as recreational opportunities. In that case some alternative ways of valuing can be used; for example, the proximity to green spaces can be measured by the proxy of people's willingness to buy a property in this particular area.

The difficulty in putting a financial value on GI has recently been addressed by the economic valuation of ecosystem services. In principle, GI protects and supports ecosystem functioning therefore understanding of the values and tools used in their identifying could contribute to the evaluation of GI⁹⁸. Currently, there is an intensive work undertaken at the national level to identify tools for the financial evaluation of ecosystem services and GI. Until then the monetary evaluation of GI solutions is a challenging task.

Ecosystem Services

The ecosystems approach is essentially about shifting the focus of policy-making and delivery away from looking at natural environment policies in separate 'silos' - e.g. air, water, soil, biodiversity - and towards a more holistic or integrated approach based on the whole ecosystems⁹⁹.

Ecosystem services are the benefits that a healthy environment provides for people, either directly or indirectly and four broad types of ecosystem service are usually recognised:

- **Provisioning services** - products obtained from ecosystems, including food, timber, woodfuel, fresh water, biodiversity, genetic resources, biochemical's, natural medicines and pharmaceuticals.
- **Regulating services** - benefits obtained from the regulation of natural processes, including: the regulation of air quality, climate, flooding and erosion; water purification; disease and pest control; pollination; and buffering pollution.
- **Cultural services** - the non-material benefits people obtain through spiritual enrichment, cognitive development, reflection, recreation and aesthetic enjoyment.
- **Supporting services** - the services that are necessary for the production of all other ecosystem services, including soil formation, photosynthesis, primary production, nutrient cycling and water cycling.

The ecosystem approach means recognising that regardless of its current main use, any area of land has the potential to deliver a very wide range of services (such as flood management, biodiversity, or recreation) and it is important that the diversity of these services is recognised in policy and decision making. There may however, be a limit of the extent to which multifunctionality can be pursued without impairing the delivery of one or

⁹⁸ European Commission (2012) The Multifunctionality of Green Infrastructure.

⁹⁹ Defra (2007) - Securing a healthy natural environment: An action plan for embedding an ecosystems approach.

more of the services involved. For example, there are may be trade-offs to be made between archaeology and diversity of wildlife or flood management.

GI Policy Context

The multifunctional approach to GI is present in the current national policy and has been increasingly and successfully integrated into local policies and actions with growing impetus. The UK policy states that:

Natural Environment White Paper (2011) recognises that nature, economic growth, prosperous communities and personal wellbeing are interconnected. It sees a wider value, in addition to the intrinsic one, to the natural environment which provides a range of benefits and services to different spheres of people's lives. The document suggests that inclusion of green infrastructure, supporting well-functioning ecosystems and coherent ecological networks could increase the value that natural environment generates to the economy and health & wellbeing.

The document emphasises multifunctional benefits of GI which are to:

- support economic growth
- improve public health, wellbeing and quality of life;
- drive biodiversity and the functioning of natural systems such as rivers and flood plains
- reduce the negative impacts of climate change

National Planning Policy Framework (2012) states that Local Plans should address climate change, biodiversity and landscape issues through "planning positively for the creation, protection, enhancement and management of networks of biodiversity and green infrastructure".

Appendix B: Bibliography – *to follow*