



# Future Parks

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# **Future Parks**

## **Urban green space and health**

### **Literature review**

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This review summarises evidence of the link between urban green space and health, considers whether investing in parks as a health resource is cost effective, and suggests potential challenges and opportunities in optimising this relationship.

# Urban green space and health

## 1 Summary

Parks are, and have always been, a public health resource. The landmark Public Health Act (1848) provided funds to towns for the creations of public parks and walks. Presenting a select committee report on the benefit of ‘public walks’ a decade and a half earlier, MP and proto-parks campaigner Robert Slaney told the House of Commons that ‘public walks would not only promote the health and morality of the people, but be beneficial to the mere wealth of the country.’

What was true in the nineteenth century is true today.

- Good quality green-space is associated with good physical health, mental wellbeing and social cohesion.
- Long- and short-term benefits to physical health associated with urban green space include increased life expectancy and reductions in obesity (and health problems associated with obesity and physical inactivity, such as cardio-vascular disease), heart rate and blood pressure.
- Spending time in green spaces may help reduce stress, mental-health related hospital admissions, improve mood and self-esteem and reduce fatigue.
- Improving green space may help reduce health inequalities, having a disproportionately significant effect on the health and wellbeing of socio-economically deprived communities.
- Green space-based public health interventions are of growing interest to central government, local authorities and health professionals. However, to have the greatest effect, interventions must be audience and life-stage specific, collaborative and have clear outcomes that can demonstrate effectiveness and unlock future funding.

## 2 What health benefits do parks and green spaces offer?

Quantity, quality and proximity of green space are important social determinants of good public health. The Marmot Review claimed that ‘green space and green infrastructure improve mental and physical health and have been shown to reduce health inequalities. Well designed and maintained green spaces can encourage social interaction, exercise, play and contact with nature.’<sup>1</sup> In their Public Health Outcomes Framework, Public Health England incorporate people’s use of outdoor space for exercise/health reasons as one indicator of the wider determinants of health.<sup>2</sup>

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<sup>1</sup> Marmot Review (2010) *Fair Society, Healthy Lives: the Marmot Review* 131

<sup>2</sup> Public Health England (2014) Public Health Outcomes Framework <http://www.phoutcomes.info/public-health-outcomes-framework#gid/1000041/pat/6/ati/102/page/0/par/E12000004/are/E06000015>

Various studies show that places where green space density is higher are home to healthier populations. UK cities with the highest child obesity levels have twice the housing density and nearly a third less green space than the healthiest areas.<sup>3</sup> One Dutch study found that 10% more green space in people's living environment led to a decrease in the number of symptoms of disease equivalent to a decrease in life expectancy of five years.<sup>4</sup> A longitudinal study found that city-dwellers moving to greener urban areas experience lasting benefits to their mental health.<sup>5</sup>

There is, however, a problem with these area-based studies, particularly around cause and effect. The effect (improved health) cannot necessarily be put down to the availability or amount of green space in an area. It is worth noting that availability of green space in an area may be a proxy for socio-economic factors, which would help to explain the supposed health effects of green space.<sup>6</sup> The most affluent 20% of council wards in England have five times the number of parks and amount of green space (excluding gardens) per person than the most deprived 10% of wards – as well as the considerably higher life expectancy that one would expect from wealthier areas.<sup>7</sup> However, studies that investigate socio-economic factors have also found a relationship between green space and positive mental and physical health, which may serve to reinforce the findings of the more general, area-based studies.<sup>8</sup>

It is also important to note that different *types* of green space may have different effects on health. There are few studies comparing typologies with health effects, but it has been suggested that natural scenes where water is present are better at restoring attention than scenes where there is no water.<sup>9</sup> Broadly, certain communities appear to respond especially well to particular types of green space: those of Asian and African heritage, for example, are less attracted to 'wildness' than Caucasians;<sup>10</sup> and a higher proportion of people of Indian and Pakistani heritage visit urban green spaces for 'exercise' than their white British counterparts.<sup>11</sup>

The ways in which green spaces contribute to public health are explored below.

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<sup>3</sup> RIBA (2014) *City Health Check: how design can save lives and money*

<http://www.architecture.com/TheRIBA/AboutUs/InfluencingPolicy/CityHealthCheck.aspx/#.UypVgdJdX6I>

<sup>4</sup> de Vries, S., Verheij, R., Groenewegen, P., Spreeuwenberg, P. (2003) 'Natural environments – health environments?: an exploratory analysis of the relationship between green space and health' *Environment and Planning* 35 (10) 1717-1731

<http://nvl002.nivel.nl/postprint/pppp1696.pdf>

<sup>5</sup> Alcock, I., White, M., Wheeler, B., Fleming, L., Depledge, M. (2014) 'Longitudinal effects on mental health of moving to greener and less green urban areas' *Environmental Science and Technology* 48 (2) 1247-1255

<sup>6</sup> Groenewegen, P., van der Berg, A., de Vries, S., Verheij, R. (2006) 'Vitamin G: effects of green space on health, well-being, and social safety' *BMC Public Health* 6 (149) doi:10.1186/1471-2458-6-149

<sup>7</sup> CABE Space (2010) *Urban green nation*

<sup>8</sup> Mitchell, R. & Popham, F. (2008) 'Effect of exposure to natural environment on health inequalities: an observational population study', *The Lancet* 372 (9650) 1655-1660 <http://eprints.gla.ac.uk/4767/1/4767.pdf>

<sup>9</sup> Thompson Coon, J., Boddy, K., Stein, K., Whear, R., Barton, J., Depledge, M. (2011) 'Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review', *Environmental Science and Technology* 45 (5) 1761-72 <http://www.ncbi.nlm.nih.gov/pubmed/21291246>

<sup>10</sup> Risbeth, C. (2004) 'Ethno-cultural representation in the urban landscape' *Journal of Urban Design* 9 (3) 311-333

<sup>11</sup> CABE Space (2010) *Community Green*

<http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/files/community-green-full-report.pdf>

## 2.1 Obesity and physical inactivity

Physical inactivity is a major contributing factor in health problems such as obesity and cardio-vascular disease. A third of eleven year-olds and two thirds of adults in England are obese or overweight.<sup>12 13</sup>

Reducing inactivity is of growing importance to politicians and health professionals. In October 2014, Public Health England published *Everybody active, every day: a framework to embed physical activity into daily life*, a national framework on increasing activity.<sup>14</sup> In Sheffield, the *Joint Health and Wellbeing Strategy* identifies obesity and physical inactivity as a priority area for action.<sup>15</sup> Alongside cancer, cardiovascular disease is the main cause of premature mortality in Sheffield (accounting for c.60% of premature deaths).

Documented benefits of physical activity include its positive effects in reducing the likelihood of contracting cardio-vascular and cerebro-vascular disease, diabetes, colorectal cancer, osteoporosis, depression, fall-related injuries, mental functioning and may have long lasting psychological benefits.<sup>16</sup>

When people have good access to green space (perceived or actual) they are 24% more likely to be physically active.<sup>17</sup> Children living near green spaces are less likely to experience an increase in body mass index (BMI).<sup>18</sup> In adults, 'green exercise' has been shown to have a greater effect on improving self-reported mood, reducing self-reported fatigue or effort and reducing stress than exercise in grey environments (although children may not experience those same benefits).<sup>19 20</sup>

Programmes that encourage physical activity in the outdoors, such as Natural England's Walking for Health and the Conservation Volunteers' Green Gym are cost effective alternatives to clinical interventions (see section 3, below).

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<sup>12</sup> Health & Social Care Information Centre [HSCIC] (2013) *National Child Measurement Programme: England school year 2012/13* [https://catalogue.ic.nhs.uk/publications/public-health/obesity/nati-chil-meas-prog-eng-2012-2013-rep.pdf](https://catalogue.ic.nhs.uk/publications/public-health/obesity/nati-chil-meas-prog-eng-2012-2013/nati-chil-meas-prog-eng-2012-2013-rep.pdf)

<sup>13</sup> [Butland, B., Jebb, S., Kopelman, P., McPherson, K., Thomas, S., Mardell, J., Parry, V., \(2007\) Foresight – tackling obesity: future choices](#)

<sup>14</sup> <https://www.gov.uk/government/publications/everybody-active-every-day-a-framework-to-embed-physical-activity-into-daily-life>

<sup>15</sup> <https://www.sheffield.gov.uk/caresupport/health/health-wellbeing-board/joint-health-and-wellbeing-strategy.html>

<sup>16</sup> Lee, A.C.K., Maheswaran, R. (2010) 'The health benefits of urban green spaces: a review of the evidence', *Journal of Public Health* 10

<sup>17</sup> Natural England (2009) *An estimate of the economic health value and cost effectiveness of the expanded Walking for Health Initiative scheme 2009*. Natural England Technical Information Note TIN055. <http://publications.naturalengland.org.uk/publication/35009>

<sup>18</sup> Bell, J., Wilson, J., Liu, G. (2008) 'Neighbourhood greenness and two-year changes in body mass index of children and youth', *American Journal of Preventative Medicine* 35 (6) 537-553

<sup>19</sup> Reed, K., Wood, C., Barton, J., Pretty, J., Bohan, D., Sandercock, G. (2013) 'A repeated measures experiment of green exercise to improve self-esteem in UK school children' *PLoS ONE* 8 (7)

<sup>20</sup> Thompson Coon et al (2011)



Involvement in community growing projects can increase the likelihood of having a healthy diet and improve attitudes towards healthy eating.<sup>21</sup> People who participate in community gardening programmes are 3.5 times more likely to consume the recommended five portions of fruit and vegetables than those in their household who did not participate in the programmes.<sup>22</sup>

## 2.2 Improving wellbeing and emotional resilience

Mental illness accounts for a quarter of all illness in the UK and costs approximately £105bn a year in England alone.<sup>23</sup> One in ten children under 15 suffers from a mental health disorder.<sup>24</sup> The World Health Organisation has predicted that depression will be the second biggest cause of disability world-wide by 2020.<sup>25</sup>

Evidence suggests that activity in the natural environment (particularly group activity) can improve a range of health and social outcomes for those with mental health problems. Spending time in green space is thought to result in:

- reducing stress by immersing people in natural settings or encouraging them to be physically active (impact can be measured objectively, through reductions in measures of sympathetic outflow, like heart rate and blood pressure,<sup>26 27</sup> serum cortisol,<sup>28</sup> and urine adrenaline);<sup>29</sup> reduction in instances of stress-related illness;<sup>30</sup>
- improvements in recovery from attention fatigue and increase concentration;<sup>31</sup>
- improvements in self-reported mood, confidence and self-esteem;<sup>32</sup>
- fewer visits to hospital and reductions in instances of self-harm;<sup>33</sup>

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<sup>21</sup> Schmultz et al (2014) *The benefits of gardening and growing for health and wellbeing*

<sup>22</sup> Alaimo, K., Packnett, E., Miles, R. A., Kruger, D. (2008) 'Fruit and vegetable intake among urban community gardeners', *Journal of Nutrition, Education and Behaviour* 40 (2) 94-101

<sup>23</sup> Mind (2012) *No health without mental health: a guide for Directors of Public Health*

[http://www.mind.org.uk/media/343126/No\\_Health\\_Without\\_Mental\\_Health\\_Directors\\_of\\_Public\\_Health.pdf](http://www.mind.org.uk/media/343126/No_Health_Without_Mental_Health_Directors_of_Public_Health.pdf)

<sup>24</sup> Office for National Statistics (2005) *Mental health of children and young people in Great Britain, 2004*

<http://www.hscic.gov.uk/catalogue/PUB06116/ment-heal-chil-youn-peop-gb-2004-rep2.pdf>

<sup>25</sup> World Health Organisation (2013) *Mental Health Action Plan, 2013-2020*

[http://www.who.int/mental\\_health/publications/action\\_plan/en/](http://www.who.int/mental_health/publications/action_plan/en/)

<sup>26</sup> Ulrich, R., Simons, R., Losito, B., Fiorito, E., Miles, M., Zelson, M. (1991) 'Stress recovery during exposure to natural and urban environments', *Journal of Environmental Psychology* 11 201-230

<sup>27</sup> Gladwell, V., Brown, D., Barton, J., Tarvainen, M., Kuoppa, P., Pretty, J., Suddaby, J., Sandercock, G. (2012) 'The effects of views of nature on autonomic control', *European Journal of Applied Physiology* 112 (9) 3379-3386

<http://dx.doi.org/10.1007/s00421-012-2318-8>

<sup>28</sup> Roe, J. (2013) 'Urban green space and stress', Environment and Human Health briefing, openSPACE

<http://www.greenspacescotland.org.uk/SharedFiles/Download.aspx?pageid=131&mid=127&fileid=432>

<sup>29</sup> Li, Q. (2010) 'Effect of forest bathing trips on human immune function', *Environmental Health and Preventative Medicine* 15 (1) 9-17 <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2793341/>

<sup>30</sup> Grahn, P. & Stigsdotter, U. (2003) 'Landscape planning and stress', *Urban Forestry and Urban Greening* 2 1-18 <http://data0.eclablog.com/sociotopes/perso/documents/landscape%20planning%20and%20stress.pdf>

<sup>31</sup> Irvine, K., Warber, S., Devine-Wright, P., Gaston, K. (2013) 'Understanding urban green space as a health resource: a qualitative comparison of visit motivation and derived effects among park users in Sheffield, UK' *International Journal of Environmental Research and Public Health* 10 417-442; Kaplan, R. & Kaplan, S. (1989) *The Experience of Nature: a psychological perspective*

<sup>32</sup> Roe (2013) 'Urban green space and stress'

- reducing symptoms by a third for children with ADHD;<sup>34</sup>
- increasing social interaction and combatting loneliness, especially among older people;<sup>35</sup>
- improving emotional resilience, particularly in children, making them better at coping with stressful life events;<sup>36</sup>
- retaining memory, wellbeing and cognitive functioning in people with dementia.<sup>37</sup>

A meta-analysis of mental health outcomes of various types of green exercise, from horse-riding to gardening, revealed that the greatest number of positive health outcomes (particularly to self-esteem) were felt by those suffering from mental health problems.<sup>38 39</sup>

Mental health charity, Mind, advocate ‘Ecotherapy’, using natural environments to improve mental health and wellbeing. An overwhelming majority (94%) of mental health patients who took part in green exercise projects run under their Ecominds programme say green exercise alleviates symptoms and improves mental health.<sup>40</sup> Through reduced benefit payments, NHS costs and increased tax contributions, a sample of five ecotherapy patients were each estimated to save the state £7,082 per year on average.<sup>41</sup>

### 2.3 Preventing premature mortality

The most common causes of premature death (before the age of 75) in England are heart disease, stroke, cancer, lung disease and liver disease.<sup>42</sup>

Urban green space contributes to reducing physical inactivity, which is an important contributory factor in cardio-vascular disease, colon cancer and breast cancer.<sup>43</sup> There is also

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<sup>33</sup> Schmultz, U., Lennartsson, M., Williams, S., Devereaux, M., Davies, G. (2014) *The benefits of gardening and growing for health and wellbeing* [http://bosf.org.uk/birmingham-open-spaces-forum/wp-content/uploads/2014/04/GrowingHealth\\_BenefitsReport.pdf](http://bosf.org.uk/birmingham-open-spaces-forum/wp-content/uploads/2014/04/GrowingHealth_BenefitsReport.pdf)

<sup>34</sup> Faber, A., Kuo, F., Sullivan, W. (2001) ‘Coping with ADD: the surprising connection to green play setting’, *Environment and Behaviour* 33 (Jan 2001) pp.54-77

<sup>35</sup> Clark, P., Mapes, N., Burt, J., Preston, S. (2013) *Greening Dementia – a literature review of the benefits and barriers facing individuals living with dementia in accessing the natural environment and local green space*. Natural England Commissioned Reports Number 137.

<sup>36</sup> Wells & Evans (2003) ‘Nearby Nature: a buffer of life stress among rural children’ *Environment and Behaviour* 35 311-330

<sup>37</sup> Andrea, S., Batavia, M., Sasson, N. (2007) ‘Effect of horticultural therapy on preventing the decline of mental abilities of patients with Alzheimer’s type Dementia’, *Journal of Therapeutic Horticulture* 18

<sup>38</sup> Barton, J. & Pretty, J. (2010) ‘What is the best dose of nature and green exercise for improving mental health? A multi-study analysis’ *Environmental Science and Technology* 44 (10) 3947-3955

<sup>39</sup> Clark et al (2013)

<sup>40</sup> Mind (2007) *Ecotherapy: the green agenda for mental health*

[http://www.mind.org.uk/assets/0000/2138/ecotherapy\\_report.pdf](http://www.mind.org.uk/assets/0000/2138/ecotherapy_report.pdf)

<sup>41</sup> Mind (2013) *Feel better outside, feel better inside: Ecotherapy for mental wellbeing, resilience and recovery*

<http://www.nhs.uk/Livewell/over60s/Pages/The-top-five-causes-of-premature-death.aspx>

<sup>43</sup> de Moor, D. (2013) *Walking works: making the case to encourage greater uptake of walking as a physical activity and recognise the value and benefits of Walking for Health*

[http://www.walkingforhealth.org.uk/sites/default/files/Walking%20works\\_LONG\\_AW\\_Web.pdf](http://www.walkingforhealth.org.uk/sites/default/files/Walking%20works_LONG_AW_Web.pdf)

evidence to suggest the natural environment can improve emotional resilience when faced with diseases such as cancer.<sup>44</sup>

It is reckoned that mortality burden in Sheffield caused by long term exposure to (current levels of) particulate air pollution is the equivalent of between 231 and 292 deaths per year.<sup>45</sup> Nationally, the health costs of air pollution have been reckoned at between £8.5bn and £20.2bn per year.<sup>46</sup>

Green spaces help improve air quality, reducing the quantity of harmful particulates in the atmosphere. One study estimated that green infrastructure in a 10km<sup>2</sup> area of East London contributed to the aversion of two deaths and two hospital admissions through reductions in air pollution.<sup>47</sup> In another study, researchers found a link between quantity of green space in an area and the prevalence of asthma in children.<sup>48</sup>

The amount and, more importantly, the quality of local accessible and walkable green space has been positively linked to increasing life expectancy,<sup>49</sup> particularly in older people.<sup>50</sup>

## 2.4 Reducing health inequalities

Green space provision and quality is distributed unequally in favour of the wealthy and those of non-BME origins.

- The most affluent 20% of wards have five times the amount of parks and green space (excluding gardens) per person than the most deprived 10% of wards.<sup>51</sup>
- Half of people in the most deprived neighbourhoods are satisfied with their local area.<sup>52</sup>
- 82% and 66% of all visits to the natural environment by BME groups and people living in the most deprived neighbourhoods were to urban green spaces.<sup>53</sup>

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<sup>44</sup> Faculty of Public Health (2009) *Great outdoors: how our natural health service uses green space to improve wellbeing* [http://www.fph.org.uk/uploads/r\\_great\\_outdoors.pdf](http://www.fph.org.uk/uploads/r_great_outdoors.pdf)

<sup>45</sup> Sheffield Clinical Commissioning Group, Healthwatch Sheffield, Sheffield City Council (2013) *Sheffield Joint Strategic Needs Assessment* <https://www.sheffield.gov.uk/caresupport/health/health-wellbeing-board/JSNA.html>

<sup>46</sup> Pretty, J. (2011) *Chapt. 23: Health Values from Ecosystems. UK National Ecosystems Assessment: technical report* <http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=KHZuV08uyEs%3D&tabid=82>

<sup>47</sup> Tiwary, A., Sinnott, D., Peachey, C., Chalabi, Z., Vardoulakis, S., Fletcher, T., Leonardi, G., Grundy, C., Azapagic, A., Hutchings, T. (2009) 'An integrated tool to assess the role of new planting in PM10 capture and the human health benefits: a case study in London' *Environmental Pollution* 157 2645-2653

<sup>48</sup> Lovassi et al (2008) 'Children living in areas with more street trees have lower prevalence of asthma'

<sup>49</sup> Jonker, M., van Lenthe, F., Donkers, B., Mackenbach, J., Budorf, A. (2014) 'The effect of urban green on small-area (healthy) life expectancy' *Journal of Epidemiology and Community Health* (online) <http://jech.bmj.com/content/early/2014/07/22/jech-2014-203847.abstract>

<sup>50</sup> Takano, T., Nakamura, K., Watanabe, M. (2002) 'Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces' *Journal of Epidemiology and Community Health* 56 (9) 913-918

<sup>51</sup> CABE Space (2010) *Urban green nation*

<sup>52</sup> CABE Space (2010) *Urban green nation*

<sup>53</sup> Stewart, D. (2013) *Monitor of Engagement with the Natural Environment: the national survey on people and the natural environment*. Natural England Commissioned Report NECRI22.



- Disabled people, carers and people from other excluded groups such as asylum seekers are significantly less likely to access green spaces for health and recreation. The health benefits of green exercise programmes may be felt most strongly by those suffering from mental ill health.<sup>54</sup>

#### 2.4.1 Ethnicity

Certain ethnic groups on average experience worse health. Bangladeshi and Pakistani people and Afro-Caribbean women are more likely to report bad or very bad health than the rest of the population in England.<sup>55</sup>

People of Asian and African heritage may be less attracted to ‘wildness’ than white British people. Asian and African groups are also significantly less likely to use a park for exercise, preferring them as spaces more for family gatherings and social interaction.<sup>56</sup>

#### 2.4.2 Socio-economic deprivation

Health inequality, like green space inequality, is strongly related to socio-economic status. Green spaces may help reduce health inequalities: communities living in greener environments appear to enjoy lower levels of income deprivation related health inequality.<sup>57</sup>

Good-quality green spaces and programmes that encourage people to improve those spaces can help increase social interaction and promote community cohesion.<sup>58 59</sup> Designing parks that are open, well lit and visibly well cared for can improve people’s views of their local space, increase use and – as a consequence – reduce anti-social behaviour.<sup>60</sup>

However, where spaces are perceived to be of poor quality then they may have the opposite effect. Concern about personal safety is the biggest barrier to people using green spaces regularly.<sup>61</sup> It has been suggested that fear of crime and the resulting isolation and sedentary lifestyles may be a factor in BME groups experiencing disproportionately more ill health outcomes.<sup>62</sup>

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<sup>54</sup> Forest Research (2010) *Benefits of Green Infrastructure*

[http://www.forestry.gov.uk/pdf/urgp\\_benefits\\_of\\_green\\_infrastructure\\_main\\_report.pdf/\\$FILE/urgp\\_benefits\\_of\\_green\\_infrastructure\\_main\\_report.pdf](http://www.forestry.gov.uk/pdf/urgp_benefits_of_green_infrastructure_main_report.pdf/$FILE/urgp_benefits_of_green_infrastructure_main_report.pdf)

<sup>55</sup> CABE Space (2010) *Community green*

<sup>56</sup> Risbeth (2004)

<sup>57</sup> Mitchell & Popham (2008)

<sup>58</sup> Kweon, B.S., Sullivan, W.C., Wiley, A. (1998), ‘Green common spaces and the social integration of inner city older adults’ *Environment and Behaviour* 30 <http://eab.sagepub.com/content/30/6/832>

<sup>59</sup> Kuo, F. Sullivan, W. Coley, R. Brunson, L. (1998) ‘Fertile Ground for Community: Inner City Neighbourhood Common Spaces’ *American Journal of Community Psychology* 26 6 823-851

[http://sfrc.ufl.edu/urbanforestry/Resources/PDF%20downloads/Kuo\\_1998.pdf](http://sfrc.ufl.edu/urbanforestry/Resources/PDF%20downloads/Kuo_1998.pdf)

<sup>60</sup> CABE Space (2005) *Decent parks? Decent behaviour?*

<http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/files/decent-parks-decent-behaviour.pdf>

<sup>61</sup> CABE Space (2010) *Community green*

<sup>62</sup> CABE Space (2010) *Community green*

### 3 Is investing in parks as a health resource cost effective?

The Public Services (Social Value) Act, 2012, places a duty on public procurement bodies to take account of how procurement might improve the economic, social and environmental wellbeing of the relevant area, as well as considering a project's cost-effectiveness. There is considerable evidence to show how urban green space positively contributes to economic, social and environmental wellbeing.

- Nationally, it has been calculated that the Walking for Health scheme could save the NHS £81m in life-cost aversion. Were everyone given equal access to quality green space it is estimated that costs to the NHS of treating inactivity-related health problems would drop by £2.1bn.<sup>63</sup> One review compared cost-effectiveness evaluations of three public health interventions designed to improve mental wellbeing in over-65s, finding a community walking programme to be significantly more cost-effective than physical activity counselling or the provision of health promotion information by community nurses.<sup>64</sup>
- Many of the Ecominds projects encouraged users into employment or training, consequently reducing their dependence on the state through benefit payments and high-end health and social care infrastructure, weathering them from the full impact of welfare reform (highlighted as being of particular concern in the Sheffield Joint Strategic Needs Assessment).<sup>65</sup> Natural England has demonstrated the value of 'green exercise'-type programmes in developing skills and employability of young people not in education, employment or training.<sup>66</sup>
- Green spaces help reduce the costs of air pollution, urban flooding and the urban heat island effect (see the following Urban green space and ecosystems services literature review).
- Investing in green space can help create jobs, attract business and further investment. The Glasgow Landscaping improvements at Riverside Park, Clydebank and Winsford yielded over 16% and 13% respectively of net growth in employment.<sup>67</sup> Growing projects produce food that can be sold (or at least valued).<sup>68</sup>

### 4 What needs to happen? Barriers and bridges

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<sup>63</sup> Natural England (2009) *An estimate of the economic health value and cost effectiveness of the expanded Walking for Health Initiative scheme 2009*. Natural England Technical Information Note TIN055.

<http://publications.naturalengland.org.uk/publication/35009>

<sup>64</sup> Windle, G., Hughes, D., Linck, P., Russell, I., Morgan, R., Woods, B., Burnholt, V., Edwards, R., Reeves, C., Yeo, S. (2008) *Public health interventions to promote mental well-being in people aged 65 and over: systematic review of effectiveness and cost-effectiveness* <http://www.nice.org.uk/guidance/ph16/resources/mental-wellbeing-of-older-people-effectiveness-and-cost-effectiveness-review-final2>

<sup>65</sup> Vardakoulias, O. (2013) *The Economic Benefits of Ecominds: a case study approach*. New Economics Foundation. <http://www.mind.org.uk/media/338566/The-Economic-Benefits-of-Ecominds-report.pdf>

<sup>66</sup> Natural England (2013) *Changing young lives: engaging NEET young people in the natural environment*

<sup>67</sup> Forest Research (2010) *Benefits of green infrastructure*

[http://www.forestry.gov.uk/pdf/urgp\\_benefits\\_of\\_green\\_infrastructure.pdf/\\$FILE/urgp\\_benefits\\_of\\_green\\_infrastructure.pdf](http://www.forestry.gov.uk/pdf/urgp_benefits_of_green_infrastructure.pdf/$FILE/urgp_benefits_of_green_infrastructure.pdf)

<sup>68</sup> Neighbourhoods Green (2014) *Case study: the value of green infrastructure – the Green Square Group* (online)

<http://www.neighbourhoodsgreen.org.uk/casestudy/display?casestudy=43>

Local government has a considerable influence not just over how public open space is managed and improved, but how priorities are made with regard to commissioning health services locally.

At a time of austerity, when budgets are tight or short-termist, concerted effort needs to go into prioritising audiences and areas of greatest need – as well as identifying new funding opportunities, including:

- A joined up approach to health and the natural environment that brings together NGOs, local government and health authorities is beginning to emerge, for example Birmingham, where the council is working with local agencies to intensively ‘green’ areas of high multiple deprivation and environmental and health inequality.<sup>69</sup>
- There is currently no standard approach to data collection or evaluation on health across the environment sector, making comparison of projects difficult. Clinical Commissioning Groups (CCG) prefer standardised information (especially where relevant to their fifteen standardised data indicators) to make comparison easy.
- Green space-related health programmes should be appropriate for audience, taking a so called ‘life course approach’ with interventions appropriate for people at every stage in their life.
- Identifying particularly vulnerable groups may help unlock CCG funding. Under law, CCGs must have regard to reduce health inequalities.<sup>70</sup>
- In and of itself, green space does little to improve health and wellbeing. People need to *use* it. Poorly designed urban green space can give rise to anti-social behaviour which discourages use. This risk is increased where staffing levels are low.<sup>71</sup> Investment in extra staffing may be needed to ensure that parks are used as a health resource.<sup>72</sup> Police and Crime Commissioners could be tasked with investing in parks to help reduce anti-social behaviour in parks and improve people’s feelings of safety.<sup>73</sup>
- Encouraging GPs to use ‘green’ or ‘social’ prescribing, where patients are ‘prescribed’ a particular activity such as attending a green gym rather than medication, have been advocated as a potential way to increase funding for parks services.<sup>74</sup>

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<sup>69</sup> Birmingham City Council (2013) *Green Living Spaces Plan* <http://www.birmingham.gov.uk/greenlivingspaces>

<sup>70</sup> Health and Social Care Act 2012 s26 14T <http://www.legislation.gov.uk/ukpga/2012/7/section/26/enacted>

<sup>71</sup> CABE Space (2005)

<sup>72</sup> Wheeler et al (2007)

<sup>73</sup> Drayson, K. (2014) *Green Society: policies to improve the UK’s urban green spaces*

<http://www.policyexchange.org.uk/images/publications/green%20society.pdf>

<sup>74</sup> Drayson (2014) *Green Society*

# **Future Parks**

## **Urban green space and ecosystems services**

### **Literature review**

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This review explores the various benefits that urban green spaces offer – including ‘regulating’, ‘provisioning’ and ‘cultural’ services – and considers how the true economic value of parks and urban green spaces might be appreciated.

# Urban green space and ecosystems services

## 1 Summary

*'Too many of the benefits we derive from nature are not properly valued. The value of natural capital is not fully captured in the prices customers pay, in the operations of our markets or in the accounts of government or business. When nature is undervalued, bad choices can be made.'*<sup>1</sup>

*Natural Environment White Paper, 2011*

Green infrastructure in towns and cities makes an important contribution to a local and national economy in the form of direct and indirect economic outputs, cost reductions to private/public sector and the management of risk.<sup>2</sup>

Specifically, it does this through:

- Inward investment: improving the attractiveness of an area increases inward investment and boosts property prices.
- Visitor spending: the more attractive an area is and the better its parks, the more visitors it will attract.
- Environmental cost-saving: by providing regulating services like flood risk reduction, mitigation of temperature extremes and reducing air pollution, green infrastructure can reduce damage costs to property and people.
- Health improvement: proximity, quantity and quality of green infrastructure have a strong impact on mental and physical wellbeing – particularly through increasing physical activity, productivity and social interaction.
- Market sales: there is some growing interest in urban food production in recent years. Whilst this contributes to economic growth, its contribution is tiny compared with other forms of economic activity.
- Employment: creation and management of green spaces helps support jobs. Over 100,000 jobs in the North West of England alone are in environmental and related fields (see section 4.3, below).

These various factors can be associated, broadly, with a number of core 'ecosystems services' that green infrastructure offers. Defined broadly as the 'benefits people obtain from ecosystems',<sup>3</sup> these services include: cultural services, regulating services and provisioning services. How they deliver value in urban areas is outlined in the diagram below. Underlying

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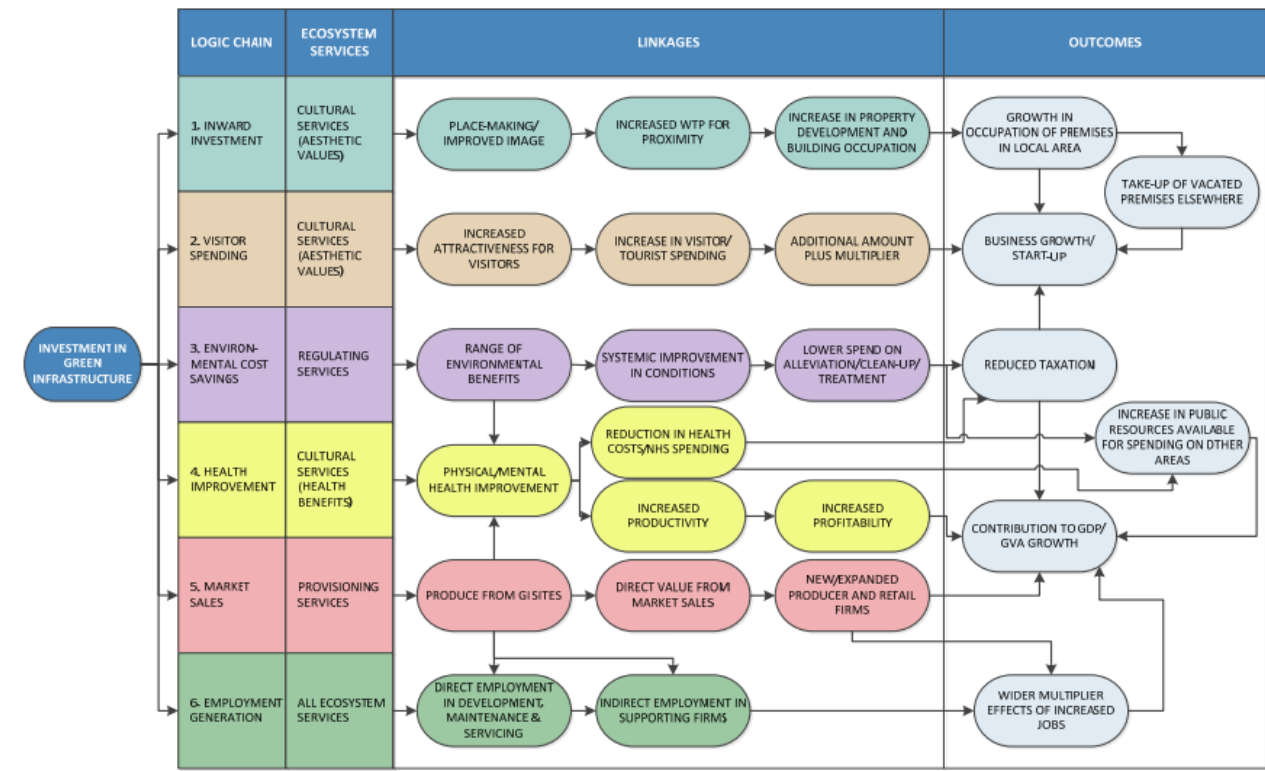
<sup>1</sup> Department for Environment, Food and Rural Affairs (2011) *The Natural Choice: securing the value of nature* [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/228842/8082.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228842/8082.pdf)

<sup>2</sup> Eftec (2013) *Green Infrastructure's contribution to economic growth: a review* <http://www.shu.ac.uk/research/cresr/sites/shu.ac.uk/files/green-infrastructures-contribution-growth.pdf>

<sup>3</sup> Hassan, R., Scholes, R., Ash, N. (2005) *Ecosystems and Human Well-being: Current State and Trends, vol.1* (Millennium Ecosystems Assessment), vii <http://www.millenniumassessment.org/documents/document.766.aspx.pdf>



all of these are ‘supporting services’, processes like soil formation that are necessary for the delivery of other ecosystems services.<sup>4</sup>



Source: *Eftec (2013) Green Infrastructure's contribution to economic growth: a review*

## 2 Regulating Services

### 2.1 Flood risk management

- It is estimated that urban flooding costs a minimum of £270m per year in England and Wales.<sup>5</sup> If no action is taken, this is could reach £27bn per year by the 2080s.<sup>6</sup>
- In the UK, 5 million properties are exposed to low to moderate probability of river or coastal flooding.<sup>7</sup>
- The high proportion of impermeable surfaces in towns and cities heighten the risks of flooding: in the UK-wide floods of 2007 it is estimated that 70% of flooding was from surface flooding.<sup>8</sup>

<sup>4</sup> UK National Ecosystems Assessment (2011) *Chapter 10: Urban*, 362

<sup>5</sup> Parliamentary Office of Science and Technology (2013) *Urban Green Infrastructure*

<http://www.parliament.uk/business/publications/research/briefing-papers/POST-PN-448/urban-green-infrastructure>

<sup>6</sup> The Pitt Review (2008) *Learning the lessons from the 2007 floods*

[http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/\\_/media/assets/www.cabinetoffice.gov.uk/flooding\\_review/pitt\\_review\\_full%20pdf.pdf](http://webarchive.nationalarchives.gov.uk/20100807034701/http://archive.cabinetoffice.gov.uk/pittreview/_/media/assets/www.cabinetoffice.gov.uk/flooding_review/pitt_review_full%20pdf.pdf), 28; Parliamentary Office of Science and Technology (2007) *Urban flooding* <http://www.parliament.uk/documents/post/postpn289.pdf>

<sup>7</sup> UK National Ecosystems Assessment (2011) *Chapter 22: Economic Values from Ecosystems*, 1092

<sup>8</sup> POST (2013), 2

- Total economic costs of the 2007 floods were thought to be £3.2bn (including insurance claims, damage to public infrastructure, impacts on public health and employment).<sup>9</sup> In Sheffield, floods caused £15m-worth of damage to heavy engineering firm Sheffield Forgemaster's works by the River Don. Council officials estimated the wider clean-up operation would cost £30m.<sup>10</sup>

Green spaces can act as a natural floodplain, reducing surface run off after rains through infiltration, absorption and evapotranspiration (the sum of evaporation and plant transpiration).<sup>11</sup> Increasing the quantity and quality of green spaces can reduce risk of surface water and fluvial flooding. Modelling based upon Manchester data estimates that increasing green cover by 10% in urban residential areas reduces run off during heavy rainfall by 4.9%. Increasing tree cover by 10% reduces the run off by 5.7%.<sup>12</sup>

Water companies recognise the value of green infrastructure in reducing surface-water flooding in towns and cities.

- In Hull, the local authority has worked with Yorkshire Water to develop plans for a new country park created out of high amenity grass fields (see section 5 below for further detail).
- In Llanelli, south Wales, Welsh Water have spent £850,000 constructing a swale (a shallow vegetated channel) on a playing field, intending it to capture water during periods of particularly high rainfall. It is anticipated that the swale will remove over 4.3bn litres of water from the sewer network each year.<sup>13</sup>
- Other projects are aimed more at developing open spaces to reduce fluvial flood risk. Milton Keynes Parks Trust, for example, have turned a 48 hectare area of former grazing land by the River Great Ouse into a 'floodplain forest' designed to flood regularly when water levels rise. Work to create water channels and develop marsh habitats was financed and partly enabled by granting Hanson Aggregates the rights to remove gravel from the site.<sup>14</sup>

<sup>9</sup> Environment Agency (2010) *The costs of the summer 2007 floods in England*

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/291190/scho1109brja-e-e.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291190/scho1109brja-e-e.pdf)

<sup>10</sup> BBC News (2007) 'Floods "will cost Sheffield £30m"', *BBC News* (12/7/2007)

[http://news.bbc.co.uk/1/hi/england/south\\_yorkshire/6896710.stm](http://news.bbc.co.uk/1/hi/england/south_yorkshire/6896710.stm) (accessed 10/10/2014)

<sup>11</sup> It is, however, worth noting that not all soil-types infiltrate surface water at the same rate. Sandy soils, for example, infiltrate at a much higher rate than clay soils.

<sup>12</sup> Gill, S., Handley, J., Ennos, A., Pauleit, S. (2007) 'Adapting Cities for Climate Change: the role of green infrastructure', *Built Environment* 33 (1) 115-33

<sup>13</sup> Welsh Water (2014) 'RainScape Llanelli', online (accessed 10/10/2014) <http://www.dwrwymru.co.uk/en/My-Wastewater/RainScape/RainScape-Llanelli.aspx>

<sup>14</sup> The Parks Trust (2014) 'Floodplain forest', online (accessed 10/10/2014) <http://www.theparkstrust.com/parks/floodplain-forest>

Increases in the proportion of urban areas under impermeable hard surfacing heighten the risk from surface-water flooding, and hard surfacing coverage in cities is on the rise.

- A study comparing aerial photographs of one suburban area in Leeds noted an increase in impermeable surfaces of 13% between 1971 and 2004, leading to a 12% increase in the average annual run-off. Three-quarters of this increase in hard surfacing was due to paving of private gardens.<sup>15</sup>
- DCLG have estimated an 18.9% decrease in vacant land and 5.8% decline in derelict land in urban areas between 2002 and 2007.<sup>16</sup> Being generally more permeable, such land is more likely to regulate risks from flooding than developed land.

### 2.1.1 Reducing flood risk – green versus grey infrastructure

In reference to flood risk reduction, it is hard to establish the wider cost benefit associated with green infrastructure interventions, as the benefits are so often experienced locally. However, in monetising the benefits of flood risk reduction, natural capital calculators take into account the savings cost of ‘green’ alternatives.<sup>17</sup> These include:

- Energy and carbon emissions savings from the reduced volume of water entering combined sewers.
- Savings in wastewater treatment costs to domestic and commercial water customers.
- Avoided costs of having to build traditional water drainage infrastructure. For example, an evaluation of water retention ponds at a development in central Scotland found that the capital costs of building traditional drainage were more than double those for the sustainable drainage system (SUDS), with annual average maintenance costs for the SUDS 20-25% lower than for the traditional system.<sup>18</sup>
- Accidental benefits, such as to education or visitor numbers and spend. The removal of concrete channelling along the River Quaggy as it runs through Sutcliffe Park in south east London and the restoration of the wetland habitat has not only lessened the flood risk to 600 homes (two months after the park opened in 2007 the SUDS were put to the test, successfully retaining over 6 million litres of water). The park has also seen a 73% increase in visitor numbers since it reopened.<sup>19</sup>

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<sup>15</sup> Perry, T. & Nawaz, R. (2008) ‘An investigation into the extent and impacts of hard surfacing of domestic gardens in an area of Leeds, United Kingdom’, *Landscape and Urban Planning* 86 (1) 1-13

<http://dx.doi.org/10.1016/j.landurbplan.2007.12.004>

<sup>16</sup> National Ecosystems Assessment (2011) *Chapter 10: Urban*

<sup>17</sup> Grenecon (2011) *Building natural value for sustainable economic development: the green infrastructure valuation toolkit user guide*  
[http://www.greeninfrastructurenw.co.uk/resources/Green\\_Infrastructure\\_Valuation\\_Toolkit\\_UserGuide.pdf](http://www.greeninfrastructurenw.co.uk/resources/Green_Infrastructure_Valuation_Toolkit_UserGuide.pdf)

<sup>18</sup> Duffy, A., Jeffries, C., Waddell, G., Shanks, G., Blackwood, D., Watkins, A. (2008) ‘A cost comparison of traditional drainage and SUDS in Scotland’, *Water Science and Technology* 57 (9) 1451-9

<sup>19</sup> CABE (2011) ‘Case Study: Quaggy River’, online (accessed 13/10/2014)

<http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/case-studies/quaggy-river>

## 2.2 Water quality

The UK falls significantly short of the EU average on water quality as required under the Water Framework Directive (WFD). Only 25% of surface water bodies meet the requirement set out in the WFD that all bodies reach ‘good’ or ‘high’ levels for ecological, hydrological and chemical quality.<sup>20</sup>

In urban areas particularly water quality can be adversely affected by high speed water runoff, diffuse pollution running into rivers and ponds, and reduced infiltration of rainfall due to (in the main) a higher proportion of hard surfacing.<sup>21</sup>

Green infrastructure can help improve water quality by providing storage and interception at source, filtration of pollutants by trees (both in the canopy and infiltration through the roots) and reduce sediment run off by improving soil quality and retention. Certain habitats, such as saltmarshes and reed beds, help to purify water (for example through plants using pollutants like nitrogen to aid growth) and provide long term storage of both nutrients and contaminants.<sup>22</sup> The water quality improvement benefits from Birmingham’s wetlands have been estimated at £81,000 annually in avoided costs to water companies of water treatment.<sup>23</sup>

Catchment scale payment for ecosystem services schemes have been shown – at a smaller scale – to be effective in improving water quality. South West Water has worked in collaboration with local conservation organisations, Devon and Cornwall Wildlife Trust and Westcountry Rivers Trust, on the Upstream Thinking project to tackle water pollution from farms upstream. South West Water’s £9m spending on moorland and farmland projects (with Devon Wildlife Trust) and £1m on mapping and investigating catchment (by Westcountry Rivers Trust) comes to just 1% of total capital expenditure by the water company from 2010 to 2015. The programme provides a cost-benefit ratio for South West Water’s investment of 1:65 through savings in treatment infrastructure investment and indirect savings to society more broadly.<sup>24</sup>

## 2.3 Climate regulation

Green infrastructure contributes to reducing temperature extremes, lowering air temperatures through evaporation and by providing shade and helping to counter the ‘urban heat island’ effect.

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<sup>20</sup> Parliamentary Office of Science and Technology (2014) *Diffuse Pollution of Water by Agriculture*. Postnote 478

<sup>21</sup> Forestry Commission (2010)

<sup>22</sup> Defra (2007) *An assessment of the economic value of England’s terrestrial ecosystem services*. NR0108. 13

<sup>23</sup> Holzinger et al (2013)

<sup>24</sup> Defra (2013) *Developing the potential for Payments for Ecosystems Services: an Action Plan*

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/200889/pb13918-pes-actionplan-20130522.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/200889/pb13918-pes-actionplan-20130522.pdf)

- Modelling of Manchester data suggests that an increase in green space coverage of 10% would reduce maximum surface temperature by 2.2°C.<sup>25</sup>
- During the 2003 heat wave temperature differences between the London Weather Centre (north-central London) and a rural reference site at Wisley, Surrey, reached 8-9°C on several occasions.<sup>26</sup> The heatwave is blamed for a considerable spike in capital's mortality rates.<sup>27</sup>
- The benefits of green infrastructure in reducing surface temperature are recognised in the Heatwave Plan for England, which recommends a multi-agency approach to 'greening the built environment'.<sup>28</sup>

The size of the cooling effect depends on the size and nature of the open space or park. Broadly, the larger the park the wider the cooling effect. One Japanese study suggested that a 100m wide green space cools to a distance of 300m, while a 400m wide space cools to 400m. The researchers recommended that parks be spaced no more than 300m apart for optimum air cooling effect.<sup>29</sup>

The main predictor of this cooling effect is the type and quantity of vegetation. A mix of high and wide canopy trees and higher tree/shrub coverage results in cooler parks compared to the surrounding area. It has been found that an urban park covered entirely by grass (e.g. high amenity grassland like public sports fields) can in fact be warmer than the surrounding built-up area. Where paved surfaces are equal to or exceed half of the land area temperatures in a park are on average warmer than their surroundings.<sup>30</sup>

## 2.4 Air quality

It is reckoned that the mortality burden from long term exposure to particulate air pollution at current levels within the Sheffield population is the equivalent of between 231 and 292 deaths per year.<sup>31</sup> (This figure has been calculated differently by Public Health England, who estimate that there are 269 deaths attributable to particulate pollution per year). It is hard to directly compare cities based upon Public Health England's mortality figures; however, deaths attributable to particulate pollution in Bristol (population of 289,000) have been estimated at 196 per year, in Leeds (population 516,700) at 350 deaths per year and

<sup>25</sup> Gill, S., Handley, J., Ennos, A., Pauleit, S. (2007) 'Adapting cities for climate change: the role of the green infrastructure', *Built Environment* 33 (1) 115-133

<sup>26</sup> POST, 'Urban Green Infrastructure', p.3.

<sup>27</sup> GLA (2006) *London's Heat Island: a summary for decision makers* [http://legacy.london.gov.uk/mayor/environment/climate-change/docs/UHI\\_summary\\_report.pdf](http://legacy.london.gov.uk/mayor/environment/climate-change/docs/UHI_summary_report.pdf)

<sup>28</sup> Public Health England (2014) *Heatwave Plan for England 2014* [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/310598/10087-2902315-TSO-Heatwave\\_Main\\_Plan\\_ACCESSIBLE.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/310598/10087-2902315-TSO-Heatwave_Main_Plan_ACCESSIBLE.pdf)

<sup>29</sup> Quoted in Doick, K & Hutchings, T. (2013) *Air temperature regulation by urban trees and green infrastructure*. Forestry Research Note [http://www.forestry.gov.uk/pdf/FCRN012.pdf/\\$FILE/FCRN012.pdf](http://www.forestry.gov.uk/pdf/FCRN012.pdf/$FILE/FCRN012.pdf)

<sup>30</sup> Chang, C., Li, M., Chang, S. (2007) 'A preliminary study on the local cool-island intensity of Taipei city parks', *Landscape and Urban Planning* 80 (4) 386-395 10.1016/j.landurbplan.2006.09.005

<sup>31</sup> Sheffield Clinical Commissioning Group, Healthwatch Sheffield, Sheffield City Council (2013) *Sheffield Joint Strategic Needs Assessment* <https://www.sheffield.gov.uk/caresupport/health/health-wellbeing-board/JSNA.html>



Manchester (population 298,100) at 219 deaths.<sup>32</sup> Nationally, the direct health cost of air pollution has been reckoned at between £8.5bn and £20.2bn per year.<sup>33</sup>

Green spaces help improve air quality. Vegetation directly removes pollutants in the air during photosynthesis reducing the quantity of PM<sub>10</sub> in the atmosphere (the larger particles up to 10 micrometers in size that can have severe effects on human health). It is estimated that two deaths and two hospital admissions could be averted each year as a consequence of the creation of a mixed grassland/broadleaf woodland green space in East London.<sup>34</sup>

There is considerable potential for urban green spaces to capture and store considerable quantities of Carbon Dioxide from the atmosphere. A mixed woodland/open space of 2.16ha in Germany is estimated to sequester 218 tonnes of CO<sub>2</sub> per hectare (once the carbon costs of maintenance are factored in).<sup>35</sup>

### 3 Provisioning services

Provisioning services are the ‘products obtained from ecosystems’, such as fresh water, food, raw materials, wild species diversity (sometimes also classified as a ‘supporting service’).<sup>36</sup> Beyond providing a range of habitats to foster biodiversity, the range and quantity of provisioning services offered by urban green spaces is limited.

#### 3.1 Water provision

Green spaces can help improve groundwater recharge (and thereby water provision) by increasing infiltration rates.<sup>37</sup> Green infrastructure interventions like riparian strips (trees and other vegetation lining watercourses) can help reduce diffuse water pollution from the urban environment.<sup>38</sup> Better water quality brings improvements in other ecosystems services, such as increased species diversity.

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<sup>32</sup> Public Health England (2014) *Estimating local mortality burdens associated with particulate air pollution*

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/332854/PHE\\_CRCE\\_010.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/332854/PHE_CRCE_010.pdf) (Both the PHE and Sheffield Clinical Commissioning Group reports look at the effect of PM<sub>2.5</sub> pollution on human health, rather than the larger PM<sub>10</sub> particles).

<sup>33</sup> Pretty, J. (2011) *Chapt. 23: Health Values from Ecosystems. UK National Ecosystems Assessment: technical report*

<http://uknea.unep-wcmc.org/LinkClick.aspx?fileticket=kHZuV08uyEs%3D&tabid=82>

<sup>34</sup> Tiwary, A., et al. (2009) ‘An integrated tool to assess the role of new planting in PM10 capture and the human health benefits: a case study in London’ *Environmental Pollution* 157 2645-2653

<sup>35</sup> European Commission (2012) *Carbon storage of urban green space estimated*

[http://ec.europa.eu/environment/integration/research/newsalert/pdf/281na1\\_en.pdf](http://ec.europa.eu/environment/integration/research/newsalert/pdf/281na1_en.pdf)

<sup>36</sup> Hassan et al (2005) *Millennium Ecosystems Assessment*, 51

<sup>37</sup> UNEP (2014) *Green infrastructure guide for water management: ecosystem-based management approaches for water-related infrastructure projects*, 39 [http://www.unepdhi.org/-/media/microsite\\_unepdhi/publications/documents/unep/web-unep-dhigroup-green-infrastructure-guide-en-20140814.pdf](http://www.unepdhi.org/-/media/microsite_unepdhi/publications/documents/unep/web-unep-dhigroup-green-infrastructure-guide-en-20140814.pdf)

<sup>38</sup> See also Defra (2012) *Tackling water pollution from the urban environment*

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/82602/consult-udwp-doc-20121120.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/82602/consult-udwp-doc-20121120.pdf)

## 3.2 Food

Food production in cities is limited in yield, but attracting growing interest from communities and policymakers. DCLG advocates the creation of growing spaces for relaxation, to increase biodiversity, and act as 'natural defences against the effects of climate change'.<sup>39</sup>

Around 10% of land in Greater London is used for farming, the vast majority of which is located within the Green Belt. 500 hectares are known to be used for vegetable and fruit growing. A study of 160 community growing spaces established under the Mayor of London-supported Capital Growth programme found that they produced over 21 tonnes of produce over 2013-14 (March – February), estimating the value of the produce at £150,744.<sup>40</sup>

Landscape consultants Arup predict that high rise farming, with 'urban farms' set upon the tops and sides of tall buildings, will become an increasing feature of the 21<sup>st</sup> century city scape.<sup>41</sup> Already, Gotham Greens operates three commercial-scale rooftop greenhouses in Brooklyn and Queens, New York, supplying Whole Foods supermarkets in the city. The first of these greenhouses, measuring 15,000ft<sup>2</sup>, produces over 100 tonnes of salad vegetables annually.<sup>42</sup> The Biospheric Project produces food (mostly fruit, vegetables and eggs) from a Salford rooftop for local community-run wholesalers and a local vegetable box scheme.<sup>43</sup>

## 3.3 Wild species diversity

Improvements in urban green spaces are associated with growth in wild species diversity. Urban parks and (particularly) gardens can support a wide variety of species, including bees and invertebrates.<sup>44 45</sup>

Past decades have seen considerable biodiversity/habitat loss as cities expand and lifestyles change. In the Sheffield area 75% of unimproved grassland has disappeared since 1980.<sup>46</sup> Ambitions outlined in the current Sheffield Biodiversity Action Plans for grassland, wetland, heathland and woodland, include: mapping of habitats and species, a conservation

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<sup>39</sup> Department for Communities and Local Government (2012) *Space for food growing: guide*

<https://www.gov.uk/government/publications/space-for-food-growing-a-guide>

<sup>40</sup> Capital Growth (2014) *Reaping rewards: can communities grow a million meals for London?*

<sup>41</sup> Arup (2014) *Cities Alive*

<sup>42</sup> Gotham Greens (2014) 'Greenpoint, Brooklyn', online <http://gothamgreens.com/our-farm> (accessed 16/10/2014)

<sup>43</sup> Biospheric Foundation (2014) 'Projects: production', online <http://www.biosphericfoundation.com/projects/production/> (accessed 16/10/2014)

<sup>44</sup> Fortel, L, Henry, M., Guilbaud, L., Guirao, A.L., Kuhlmann, M., Mouret, H., Rollin, O., Vaissiere, B. (2014) 'Decreasing abundance, increasing diversity and changing structure of the wild bee community (Hymenoptera: Anthophila) along an urbanization gradient', *PLoSone* 10.1371/journal.pone.0104679

<sup>45</sup> Manchester City Council, Deputy Chief Executive (Growth and Neighbourhoods) (2014) 'Manchester Green Infrastructure Strategy: progress update'. Report to the Manchester City Council Neighbourhoods Scrutiny Committee (4/4/2014) [www.manchester.gov.uk/download/.../5\\_green\\_infrastructure\\_strategy](http://www.manchester.gov.uk/download/.../5_green_infrastructure_strategy)

<sup>46</sup> Sheffield Biodiversity Partnership (2011) *Biodiversity Action Plan: Grassland* <https://www.sheffield.gov.uk/out--about/parks-woodlands--countryside/ecology-service/biodiversity-action-plans/sheffield-local-biodiversity-action-plan.html>

scheme for the White-Clawed Crayfish, increasing the number of grassland schemes under Higher Level Stewardship by 10, and creating 1.2ha of heathland, by 2016.<sup>47</sup>

Wild species diversity can also be understood as a cultural service; something that improves the quality of a place and increases people's willingness to spend time in it and protect it. People's willingness to pay for ancient, semi-broadleaf woodland habitats, for example, have been calculated at £1.13 per household (in 2002 prices).<sup>48</sup> Using this estimate, the total annual value of woodland in Birmingham as habitat for species is calculated at £246,000.<sup>49</sup>

## 4 Cultural services

### 4.1 Quality of place

People enjoy spending time in quality green space. It forms an important part of cementing people's attachment to place.

- In 2007 91% of those polled for the Best Values Performance Indicators survey thought it was fairly important to have green spaces close to where they lived. By 2009 this figure had risen to 95%.<sup>50</sup>
- A Fabian Society report has pointed to people's attachment their local environment as a core factor in shaping their sense of identity.<sup>51</sup>

There is a strong link between quality and proximity of green space and an increase in property prices.<sup>52</sup>

- In London, a 1% increase of green space in an area is associated with a 0.3% to 0.5% increase in average house prices.<sup>53</sup>
- The average premium paid for houses close to green spaces varies depending on the nature of the space: city parks (premium: 10.1%), local parks (9.0%) and amenity grassland (2.6%). It is suggested that long, narrow parks are preferable to square or circular parks for raising local house prices.<sup>54</sup>

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<sup>47</sup> Sheffield Biodiversity Partnership (2011-12) Biodiversity Action Plans for: *Grassland; Heathland; Woodland; Wetlands*. <https://www.sheffield.gov.uk/out--about/parks-woodlands--countryside/ecology-service/biodiversity-action-plans/sheffield-local-biodiversity-action-plan.html>

<sup>48</sup> Hanley, N., Willis, K., Powe, N., Anderson, M. (2002) *Valuing the benefits of biodiversity in forests* [http://www.forestry.gov.uk/pdf/Biorep3.pdf/\\$FILE/Biorep3.pdf](http://www.forestry.gov.uk/pdf/Biorep3.pdf/$FILE/Biorep3.pdf)

<sup>49</sup> Holzinger, O., Coles, R., Christie, M., Grayson, N. (2013) *Ecosystem Services Evaluation for Birmingham's Green Infrastructure* (Appendix 1, *Birmingham Green Living Spaces Plan*)

<sup>50</sup> CABE Space, *Urban Green Nation*, p. 37.

<sup>51</sup> Fabian Society (2014) *Pride of Place* <http://www.fabians.org.uk/wp-content/uploads/2014/06/Pride-of-Place.pdf>

<sup>52</sup> Natural England (2012) *Microeconomic Evidence for the Benefits of Investment in the Environment* <http://publications.naturalengland.org.uk/publication/32031?category=39013>, p. 13.

<sup>53</sup> GLA Economics (2003) *Valuing greenness: green spaces, house prices and Londoners' priorities* [http://www.london.gov.uk/mayor/economic\\_unit/docs/valuing\\_greenness\\_report.pdf](http://www.london.gov.uk/mayor/economic_unit/docs/valuing_greenness_report.pdf)

<sup>54</sup> Amion (2008) *The economic benefits of green infrastructure: an assessment framework for the NWDA*. Northwest Regional Development Agency. 17

## 4.2 Recreation and Tourism

The economic success of tourism and recreation lies once again with the attractiveness of a place or area. Green Infrastructure can play a vital role in attracting visitors to an area.<sup>55</sup>

- Urban parks and gardens are the most visited type of ‘natural environment’, according to Natural England, with an estimated 817.6 million visits in June 2013 to May 2014 (27% of all visits to the natural environment).<sup>56</sup>
- The UK National Ecosystems Assessment estimates that the 2858m visits made per annum to the natural environment generate a direct expenditure of £20.4bn.<sup>57</sup>
- People are prepared to pay more for goods in landscaped shopping areas. Asked to put a price on 15 items in a shopping basket, respondents taking part in a green, landscaped shopping area suggested a price 11% higher than those in a no-tree district.<sup>58</sup>

## 4.3 Employment and attracting inward investment

Green infrastructure can prompt changes in employment which have a lasting effect on the local economy. A report for Natural England suggests that 5% of jobs in North West England (122,000 in total) are directly linked to the green space sector (including parks maintenance, conservation and concessions).<sup>59</sup>

Investment in green infrastructure can attract businesses, generating further employment:

- Landscaping improvements at Glasgow’s Riverside Park, Clydebank, and Winsford yielded over 16% and 13% respectively of net growth in employment – both in construction and in attracting inward investment.<sup>60</sup>
- The canal-side development in Birmingham city centre sustained c.700 construction jobs for a year and, between 2001 and 2007, helped generated 85 full-time equivalent jobs in businesses attracted by visitor numbers.<sup>61</sup>

The increase in employment associated with green spaces will provide downstream economic benefits due to higher levels of spending in the local economy. What assessments of job creation by green infrastructure projects often fail to address, however, is the opportunity cost: whether alternative forms of job creation might be more efficient or expensive.<sup>62</sup>

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<sup>55</sup> Eftec, ‘Green Infrastructure’s contribution to economic growth: a review’, p.29.

<sup>56</sup> Natural England (2014) *Visits to the natural environment: quarterly statistical release – March – May 2014*  
[http://www.naturalengland.org.uk/Images/mene-report-march-may-2014\\_tcm6-38132.pdf](http://www.naturalengland.org.uk/Images/mene-report-march-may-2014_tcm6-38132.pdf)

<sup>57</sup> UK National Ecosystems Assessment ‘Chapter 22: Economic Values from Ecosystems’, p.1122.

<sup>58</sup> Wolf, K. (1998) *Trees in business districts: positive effects on consumer behaviour!* <http://www.naturewithin.info/CityBiz/Biz3Ps-FSS.pdf>

<sup>59</sup> Eftec, ‘Green Infrastructure’s contribution to economic growth: a review’, p.5.

<sup>60</sup> Forest Research (2010) *Benefits of green infrastructure*

[http://www.forestry.gov.uk/pdf/urgp\\_benefits\\_of\\_green\\_infrastructure.pdf/\\$FILE/urgp\\_benefits\\_of\\_green\\_infrastructure.pdf](http://www.forestry.gov.uk/pdf/urgp_benefits_of_green_infrastructure.pdf/$FILE/urgp_benefits_of_green_infrastructure.pdf)

<sup>61</sup> Eftec, ‘Green Infrastructure’s contribution to economic growth: a review’, p.39.

<sup>62</sup> UK National Ecosystems Assessment ‘Chapter 22: Economic Values from Ecosystems’, p.1096.

## 4.4 Health

The benefits of green infrastructure to human physical health and mental wellbeing have been dealt with in the Urban green space and health literature review, above. In brief, however:

- Long- and short-term benefits to physical health associated with urban green space include increased life expectancy and reductions in obesity (and health problems associated with obesity and physical inactivity, such as cardio-vascular disease), heart rate and blood pressure. UK cities with the highest child obesity levels have twice the housing density and nearly a third less green space than the healthiest areas.<sup>63</sup> In 2004 William Bird estimated the value of Sheffield's parks' contribution to the local economy by increasing physical activity to be £1,090,000 (between £1.37m and £1.5m today) and the cost-averted to the NHS by reducing inactivity-related illness to be £226,000 (£284k - £314k today).<sup>64</sup>
- The role of green spaces in improving air quality and cooling urban spaces (tackling the urban heat island effect) has been cited as among the reasons why areas with more accessible (walkable) green space are home to healthier people who live longer lives.<sup>65</sup> Modelling undertaken by one Dutch study suggests that a 10% increase in the quantity of green space in a local area could lead to a decrease in the symptoms of disease equivalent to a decrease in life expectancy of five years.<sup>66</sup>
- Spending time in green spaces may help reduce stress, mental-health related hospital admissions, improve mood and self-esteem and reduce fatigue. An overwhelming majority (94%) of mental health patients who took part in green exercise projects run under mental health charity Mind's Ecominds programme say green exercise alleviates symptoms and improves mental health.<sup>67</sup> Ecominds proved cost effective: 60% of participants went on to employment, education or training; through reduced benefit payments, NHS costs and increased tax contributions, a sample of five ecotherapy patients were each estimated to save the state on average £7,082 per year.<sup>68</sup>

The health benefits of spending time in green spaces are not being equally shared, however:

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<sup>63</sup> RIBA (2014) *City Health Check: how design can save lives and money*

<http://www.architecture.com/TheRIBA/AboutUs/InfluencingPolicy/CityHealthCheck.aspx/#.UypVgdIdX6I>

<sup>64</sup> Bird, W. (2004) *Natural Fit* [http://www.rspb.org.uk/Images/natural\\_fit\\_full\\_version\\_tcm9-133055.pdf](http://www.rspb.org.uk/Images/natural_fit_full_version_tcm9-133055.pdf)

<sup>65</sup> Jonker, M., van Lenthe, F., Donkers, B., Mackenbach, J., Budorf, A. (2014) 'The effect of urban green on small-area (healthy) life expectancy' *Journal of Epidemiology and Community Health* (online)

<http://jech.bmj.com/content/early/2014/07/22/jech-2014-203847.abstract>

<sup>66</sup> de Vries, S., Verheij, R., Groenewegen, P., Spreeuwenberg, P. (2003) 'Natural environments – health environments?: an exploratory analysis of the relationship between green space and health' *Environment and Planning* 35 (10) 1717-1731

<http://nvl002.nivel.nl/postprint/pppp1696.pdf>

<sup>67</sup> Mind (2007) *Ecotherapy: the green agenda for mental health*

[http://www.mind.org.uk/assets/0000/2138/ecotherapy\\_report.pdf](http://www.mind.org.uk/assets/0000/2138/ecotherapy_report.pdf)

<sup>68</sup> Mind (2013) *Feel better outside, feel better inside: Ecotherapy for mental wellbeing, resilience and recovery*



- The most affluent 20% of wards have five times the amount of parks and green space (excluding gardens) per person than the most deprived 10% of wards.<sup>69</sup>
- Areas that have few BME residents boast six times as many parks than wards where more than 40% of the population are black or minority ethnic.<sup>70</sup>
- In Wales, 63% of more affluent wards have tree cover greater than 15%, whereas this figure is true for only 23% of less well-off wards.<sup>71</sup>
- Poor areas of towns and cities are exposed to a larger share of environmental risks and dangers. These areas are more likely to experience and suffer from flooding and the urban heat island effect.<sup>72</sup>
- It has been suggested that improving the quality of green spaces in poorer urban areas may have a disproportionately large effect on the health of their inhabitants than investing in more wealthy areas.<sup>73 74</sup>

## 5 Barriers and opportunities

### 5.1 Payment for Ecosystem Services

The idea of paying for the benefits ecosystems services provide is growing in popularity. Defra have published guidance on developing and implementing Payment for Ecosystem Services (PES) schemes, where the beneficiaries of a particular ecosystem service like flood risk management (i.e. property owners, water company customers) pay those responsible for maintaining the ecosystem (farmers, land managers, NGOs, etc).<sup>75</sup> Whilst schemes are growing in number and awareness of the practice is on the up, there remains a significant perception problem: people still take the benefits derived from green infrastructure for granted.

- Many of the existing PES schemes have focussed primarily on regulating services, particularly reducing flood risk. These schemes may focus on payment for one ‘service’ (e.g. flood risk management), with other services drawing benefits from the improvement to the one: the Dane Park pilot PES scheme in Hull, for example, where Yorkshire Water are looking at reducing surface water flood risks in the area through the creation of a

<sup>69</sup> CABE Space (2010) *Urban green nation: building the evidence base*

<http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/files/urban-green-nation.pdf>

<sup>70</sup> CABE Space (2010) *Urban green nation: building the evidence base*

<http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/files/urban-green-nation.pdf>

<sup>71</sup> Natural Resources Wales (2014) *Tree Cover in Wales' Towns and Cities: understanding canopy cover to better plan and manage our urban trees* <http://naturalresourceswales.gov.uk/content/docs/pdfs/our-work/community-and-woodlands/tree-cover-in-wales-towns-and-cities-2014-study.pdf?lang=en>

<sup>72</sup> Neighbourhood Green, ‘Community Green’ (2010),

<http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/files/community-green-full-report.pdf>,

p.4.

<sup>73</sup> Mitchell, R. & Popham, F. (2008) ‘Effect of exposure to natural environment on health inequalities: an observational population study’, *The Lancet* 372 (9650) 1655-1660 <http://eprints.gla.ac.uk/4767/1/4767.pdf>

<sup>74</sup> Allen, J. & Balfour, R. (2014) *Natural solutions for tackling health inequalities* UCL Institute for Health Equity

<sup>75</sup> Defra (2013) *Payments for Ecosystems Services: a best practice guide*

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/200920/pb13932-pes-bestpractice-20130522.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/200920/pb13932-pes-bestpractice-20130522.pdf)

country park that incorporates a mix of sustainable drainage treatments (swales, bunds, ponds, permeable road and path surfaces, and conversion of amenity grasslands to semi-natural grassland and woods).<sup>76</sup>

- Improvements to a bundle of ecosystem services may be packaged together and sold to a number of beneficiaries. So, money from insurance company RSA Ltd, Mayor of London and Natural England have helped create Mayesbrook Park in east London, the UK's first park deliberately designed to counter the impact of climate change (including drought and flooding, rises in temperature and loss of wildlife habitat). It has been estimated that the park will contribute c.£880,000 annually in ecosystem service benefit: regulating services, cultural services (such as tourism and education) and provisioning services (fresh water, fuel, food, biochemical, etc.).<sup>77</sup>
- Other schemes effectively explore payment for the cultural services that green infrastructure encourages:
  - A Policy Exchange report advocates the development of a local levy, paid by residents and businesses living or working near to parks and other green spaces. Wimbledon and Putney Commons, for example, are maintained through a levy raised on top of council tax for residents living within a short distance of the commons (band 'D' tax properties pay an additional £27.84 on top of its normal council tax). The system works on the principle that those who live closest to the Commons derive the greatest benefit from the space: to their health, to their property prices and the satisfaction of living in a 'desirable' area.
  - It may be possible to gain capital market funding for green space improvement through, for instance, bonds. In the US and some other countries constituents can vote to allow their local authority to issue bonds to fund green space investment. These bonds are repaid over no more than 30 years, with the interest funded through taxation or commercial revenue streams. In the UK, councils regularly partner with the private sector, entering into 'special purpose funding vehicles' (SPVs) to, for example, promote regeneration. Councils often contribute land to the SPV, which can be used as security for debt financing. For example, Liverpool City Council established an SPV to regenerate Sefton Park, redeveloping the Palm House within the park to finance the wider regeneration project.<sup>78</sup>
  - Developer contributions could also help support green infrastructure financially.<sup>79</sup> The Community Infrastructure Levy (CIL) can be paid in land and not just cash, allowing for more asset-based endowments. Alternatively, developer contributions might be internally 'taxed' by a local authority to provide revenue streams for green infrastructure. Birmingham City Council has proposed the creation of a 'Tree Bond' that would support the maintenance and expansion of the urban

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<sup>76</sup> Ursus Consulting (2013) *Payment for ecosystem services: pilot on flood reduction in Hull – final report to Defra*

<sup>77</sup> Natural England (2013) *Mayesbrook Park - green infrastructure case study: creating the UK's first climate change park in east London*. NE394. <http://publications.naturalengland.org.uk/publication/11909565>

<sup>78</sup> CABE Space (2006) *Paying for Parks: eight models for funding urban green spaces*

<http://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/files/paying-for-parks.pdf>

<sup>79</sup> Drayson (2014) *Green Society*

- forest through a 1% levy on the council's annual energy procurement contracts and CIL revenue, producing an estimated £500,000 annual income.<sup>80</sup>
- Unlocking funding for parks from health bodies (or for the purposes of improving public health) is becoming more and more popular (see the Urban green space and health literature review, above). Whilst most of the focus is on exploiting green spaces to increase physical activity, the more interesting projects – such as Birmingham City Council's attempt to map biodiversity against health inequalities and intensively 'green' particular problem areas – take a holistic approach that sees the public health potential of green infrastructure is seen as part of a wider suite of ecosystem services.
  - Ordnance Survey is creating a free online map of all the publicly accessible green space in England and Wales, scheduled to be published in March 2017.<sup>81</sup> This offers fresh opportunities for innovation, mapping green spaces against social, economic and health needs.
  - CABE Space has pointed to a wide variation in how the value of green spaces are calculated by local authorities and valued on their list of assets. Parks, they suggest, are invisible assets; classed as 'community assets' that have 'no determinable useful life' and are valued at just £1 by many local authorities. CABE advocates a way of measuring the value of green spaces that takes into account their economic, social and environmental value. There is a need to establish how far practice has changed since CABE published their report in 2009.<sup>82</sup>

## 5.2 Taking a city-wide approach to ecosystems services

### 5.2.1 Birmingham

As part of their Green Living Spaces plan in 2013, Birmingham City Council became the first city authority to commission an ecosystems service assessment on a city-wide scale using the National Ecosystems Services Assessment Methodology. Their research estimates the value of ecosystems services in the city at £11.66m annually. The assessments are intended to assist planners, decision makers and wider stakeholders (in the sectors of health and social care, conservation, education, play, etc.).

The Ecosystems Assessment has been used to construct a multiple challenge map, mapping Green/Blue Infrastructure *and* supply and demand of the various ecosystems services to establish areas of greater need. The Green Living Spaces Plan forms part of a wider set of planning guidance and strategy around green infrastructure and informs the Birmingham Development Plan, Your Green City Supplementary Planning Document and Birmingham Green Commission's *Green Vision*. Birmingham has already been declared the UK's first Biophilic City, recognised by the EU as a 'peer city' for its modelling work on climate change

<sup>80</sup> Trees & Design Action Group (2012) *Trees in the Townscape: a guide for decision makers*

[http://www.tdag.org.uk/uploads/4/2/8/0/4280686/tdag\\_trees-in-the-townscape\\_november2012.pdf](http://www.tdag.org.uk/uploads/4/2/8/0/4280686/tdag_trees-in-the-townscape_november2012.pdf)

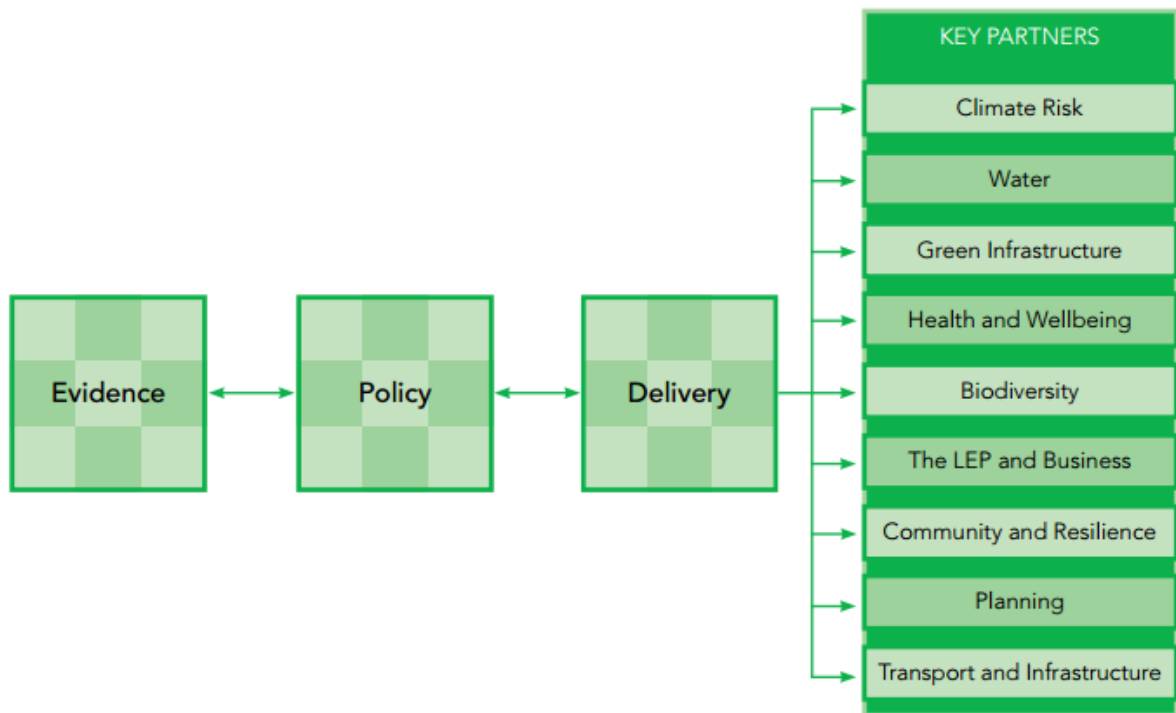
<sup>81</sup> HLF (2016) *State of UK Public Parks 2016*, 20

<sup>82</sup> CABE Space (2009) *Making the invisible visible: the real value of park assets*

adaptation. It is the location for one of Natural England's twelve Nature Improvement Areas, and looks to continue this with various initiatives and plans, including:

- Natural Health Improvement Zones: 'greening' an area of poor health outcomes and poor ecosystems provision and measuring the effect on public health.
- Working with Public Health Birmingham to undertake a Health Impact Assessment of the Green Living Spaces Plan.
- Extension of the BUCCANEER climate change adaptation modelling programme at Birmingham University, which allows planning decisions to take into account likely impacts of climate change to 2100.
- Facilitating a Blue Corridor/Network policy in conjunction with the Canal & Rivers Trust.
- Experiment with new funding mechanisms to pay for management and improvement of urban trees (e.g. the Urban Tree Bond outlined in section 5.1, above).
- Developing a signage network for Birmingham's 'greenway' routes (based mostly around brooks and streams).
- Ongoing ecosystems services assessment work, including a city-wide i-tree Eco tree assessment.
- Support for the Natural Capital City Tool, developed to help assess the impact of proposed developments on ecosystems.

Responsibility for delivering Birmingham's green vision lies with the Green Commission, made up of local government officials and politicians, business representatives, academics, conservationists and health professionals.



The key partners are: **Climate Risk** - leading climate scientists at University of Birmingham; **Water** - Environment Agency, City mains drainage and flood risk, and Severn Trent Water plc.; **Green Infrastructure** - City Parks team; **Health and Wellbeing** - Public Health service and Public Health England; **Biodiversity** - Birmingham and Black Country Wildlife Trust, Nature Improvement Area, and Planning ecologist; **The LEP and Business** - Midlands Environment Business Company and Business Council for Sustainable Development - UK; **Community and Resilience** - Birmingham Open Spaces Forum and Birmingham Resilience Team; **Planning** - Development Strategy team; **Transportation and Infrastructure** - Highways team and cycling and walking.

**FIGURE 3** The 9 piece jigsaw

Source: Birmingham City Council (2013) Green Living Spaces Plan, 28

Other UK cities understand the value of a Green Infrastructure approach. Manchester City Council has mapped the city’s green infrastructure, and published its Green and Blue Infrastructure Strategy in March 2015.<sup>83</sup>

<sup>83</sup> Manchester City Council (2015) *Manchester Green and Blue Infrastructure Strategy*  
[http://www.manchester.gov.uk/download/meetings/id/18562/6\\_appendix\\_1\\_manchester\\_draft\\_green\\_and\\_blue\\_infrastructure\\_strategy](http://www.manchester.gov.uk/download/meetings/id/18562/6_appendix_1_manchester_draft_green_and_blue_infrastructure_strategy)