



TOPICAL INTEREST PAPER



Report prepared for the City of London Corporation  
by BOP Consulting  
Published July 2013

# Green Spaces: The Benefits for London





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## Foreword

London has 35,000 acres of public green spaces – equivalent to 40% of its surface area – making it one of the greenest cities of its size in the world. The City of London Corporation is proud to be the custodian of almost 11,000 acres of green spaces, in and around London. This ranges from 200 'small' spaces, such as the parks, squares and gardens within the Square Mile, to 14 'large' spaces outside of the City boundaries, including Epping Forest, Hampstead Heath, Burnham Beeches, Ashted Common and Highgate Wood, among others.

London's green spaces help to improve the lives of its residents and workers, as well as providing a significant draw for visitors. This report looks in detail at the range of benefits these spaces provide for the community; some apparent, others perhaps more subtle. The report highlights four headline areas in which green spaces have been shown to provide benefits – the environment, physical and mental health and well-being, social interaction, and the economy – drawing on a comprehensive range of both academic and wider 'grey' literature, and applying these findings to London. Together, the benefits these green spaces provide, contribute towards London's competitiveness as a world city.

It is therefore vital that these spaces are effectively and continuously maintained. As one of the largest providers of green spaces in London, the City Corporation plays its full part in this, through its involvement in a number of initiatives;

- Projects to improve facilities for millions of visitors. For example the Branching Out Heritage Lottery Funded project at Epping Forest to improve access to the landscape, and a new visitor centre, The View, which tells the story of this 600 acre Forest;
- A sustainable grazing strategy which involves projects across City Corporation sites – including the City Commons, Epping Forest and Burnham Beeches. Using cattle and sheep grazing, as opposed to machine mowing; for improved biodiversity and wildlife habitats. The work includes the trial installation of "invisible" fences at two sites;
- A strong volunteering programme across City Corporation green spaces, with over 46,000 hours contributed in 2012/13;
- The creation of a new sustainable Wood at Epping Forest – Gifford Wood – part of the Lord Mayor's Appeal; and
- Tackling the tree diseases which threaten London's green spaces, as detailed in the City Corporation's June report.

We commend this report for clearly evidencing the breadth and depth of the benefits that London's green spaces provide for those who reside, visit and work in the capital, and which underpin London's offer as a world class city.



Mark Boleat  
Chairman of Policy & Resources  
Committee  
City of London



Alderman Robert Hall  
Chairman of Open Spaces &  
City Gardens Committee  
City of London



## Introduction

### Green spaces and big cities

More so than ever before, people across the world are living in urban areas. Indeed, as of 2010, more than half of the world's population lives in cities<sup>1</sup>. These cities are growing both in size and number: while the world was home to two "mega-cities" – New York and Tokyo – in 1950<sup>2</sup>, this number is predicted to increase to 22 by 2015<sup>3</sup>. Inevitably, this brings huge challenges around how to develop a sustainable infrastructure for these global cities.

Green spaces within cities – publicly accessible parks, gardens, squares and cemeteries – are an often overlooked component of this, and international comparisons indicate a huge variation in how much area is given over to green spaces by world cities. As Table 1 shows, London is the third greenest world city, with nearly 40% of its surface area consisting of public green spaces.

**Table 1: World cities' public green spaces (parks and gardens), by proportion of surface area, 2012**

City	Figure (%)
Singapore	47
Sydney	46
London	38.4
Johannesburg-Gauteng	24
Berlin	14.4
New York	14
Paris	9.4
Tokyo	3.44
Shanghai	2.6
Mumbai	2.5
Istanbul	1.5

Source: World Cities Culture Report, BOP 2012

<sup>1</sup> Cities Alliance (2010).

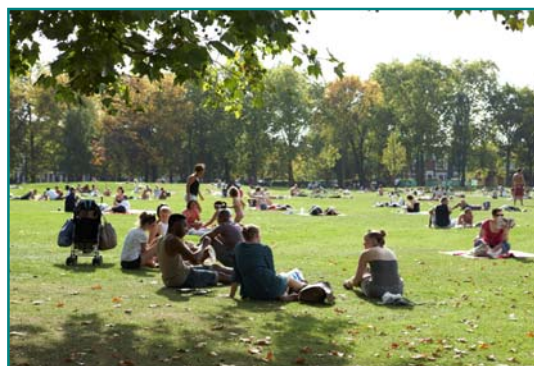
<sup>2</sup> Cities with 10 million inhabitants or more.

<sup>3</sup> United Nations, Department of Economic and Social Affairs, Population Division (2006).

This poses the question: what benefits do green spaces bring to London? This is harder to answer than, say, what are the benefits of housing or transport. However, in a context where pressure on land use is only going to intensify and people live increasingly removed from nature, it is nevertheless a question that needs to be answered.

London has 35,000 acres of green spaces, of which the City of London Corporation (referred to as "the City Corporation" in this report) owns and manages 3,684 acres. A further 7,245 acres of green spaces belonging to the City Corporation sit on the London 'fringe': that is, areas immediately surrounding London, including green spaces such as Epping Forest.

This report therefore sets out to investigate the question "*What have green spaces ever done for London?*" In particular, it aims to identify the benefits that residents, workers, businesses and visitors in Greater London and within the City of London, derive from green spaces in and around London, including those spaces belonging to the City Corporation. It also considers the role green spaces play in maintaining London's international competitiveness as a world city.



Queens Park

## The City of London Corporation's green spaces

The City of London Corporation owns and manages almost 11,000 acres of public green spaces in and around London. This includes wildlife habitats, nature reserves, sites of special scientific or historic interest, and outdoor spaces for sport, recreation and enjoyment.

Loosely defined, the City Corporation's green spaces can be divided into around 200 'small' spaces within the City boundaries i.e. the 'Square Mile', and 14 'large' spaces outside of the City boundaries, in and around London. Within the Square Mile, these green spaces include squares, disused churchyards and other landscaped areas, many of which came into being as the result of The Great Fire of London in 1666 and The Blitz in 1940/41. The Square Mile is also home to the oldest public park in London – Finsbury Circus Garden, dating back to 1606. Overall, these spaces are home to over 2,800 trees and thousands of plants, and have a number of Green Flag Awards (14 granted in 2012)<sup>4</sup> and Green Heritage Site Status (awarded to eight sites in 2012/13)<sup>5</sup> to their name.

Some of the green spaces beyond the City boundaries of the Square Mile lie partly outside of Greater London. The largest of these is Epping Forest, which accounts for slightly more than half of all of the City Corporation's green spaces by area. Others include Hampstead Heath, Queens Park and Highgate Wood, as well as spaces perhaps less known to be owned and managed by the City Corporation, such as Burnham Beeches and Stoke Common in Buckinghamshire, West Ham Park, and the seven City

Commons on the borders of South London and Surrey (see Figure 1).

Green spaces are considered a vital resource for the London's residents, workers and visitors. This is reflected, for example, by the number of visitors they regularly attract. For example, in 2012/13, annual visits to green spaces in and beyond the Square Mile were estimated at 23 million<sup>6</sup>. Polling in 2009 indicated that the green spaces within the Square Mile are used by 74% of residents, and results also reflected high satisfaction rates: 77% of businesses, 69% of City executives and 84% of residents reported satisfaction with the spaces.

A City Corporation Gardens Customer Survey in 2012 revealed that most visitors to Square Mile green spaces seek "relaxation and passive recreation", followed by "passing through and meeting friends". Most visit on weekdays at lunchtime (42%) and stay for relatively short periods of time, indicating frequent use by City workers. However, across London's green spaces, there is also plenty of scope for, and evidence of, more 'active' recreation. For instance, in 2012/13 alone, over 46,000 volunteer hours were contributed by local residents in helping to tend and maintain the green spaces supported by the City Corporation<sup>7</sup>.

Recognising these and other benefits, the City Corporation strives to protect its green spaces for the future, and encourages local communities to enjoy them. For example, the City Corporation's green spaces are already home to a number of special initiatives. Most prominent among these is the annual City of London Festival. In 2012, the 'Green to Gold' campaign was launched as part of the celebrations for the London 2012 Olympics – to further engage and inspire communities to use London's green spaces.

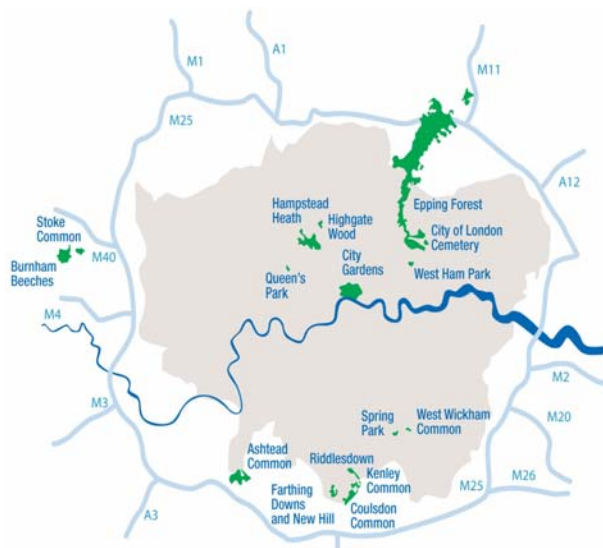
<sup>4</sup> <http://greenflag.keepbritain tidy.org/>

<sup>5</sup> <http://www.english-heritage.org.uk/professional/advice/advice-by-topic/parks-and-gardens/public-parks-and-open-spaces/green-flag-awards-and-green-heritage-site-scheme/>

<sup>6</sup> City of London Corporation (2013).

<sup>7</sup> Ibid.

**Figure 1: The City of London Corporation's green spaces**



## The value of green spaces to London and Londoners

### How did we do the research?

To answer the question of what benefits London's green spaces provide, including consideration of green spaces belonging to the City Corporation, this report considers a number of areas in which green spaces are commonly said to provide benefits. These include the environment, physical and mental health and well-being, social benefits, and economic impacts.

The report is based on a literature review of the latest international evidence in these four areas of research, including academic literature, 'grey' literature (i.e. non-academic publications by policy bodies, foundations, trusts and charities), comparative city-based indices and studies, as well as existing data that the City Corporation has on its own green spaces.

Through this literature review, we identified the main ways (or 'mechanisms') by which these four

benefits are most consistently credited as being delivered. Each of these 'mechanisms' is presented in brief sections below, which include information on:

- The hypothesis behind the mechanism, i.e. what issue(s) is it addressing and how? Are these issues increasing or decreasing in salience?
- The findings of the main studies;
- The strength of the evidence to date.

Each section concludes with an overview table that links the mechanisms by which benefits occur to London overall and specifically to the City of London.

These tables first illustrate the level of evidence found for the main mechanisms with regards to both smaller and larger green spaces. This distinction is not scientific – it is intended instead to be indicative, to be used as a guide. 'Large' green spaces are therefore understood as those "where you don't see the boundaries once inside" – spaces the size of Hyde Park or Regents Park, or the City Corporation's own Hampstead Heath. In turn, 'small parks' are those with boundaries clearly visible from all angles, such as squares and City gardens.

Based on the strength of the evidence found, the tables then consider the impacts of the mechanisms on residents, workers and businesses in Greater London more widely and within the City of London. In order to avoid double-counting benefits for workers, impacts on businesses should be understood here as strictly those benefits which have an immediate impact on businesses' bottom line, rather than indirect impacts, such as on employees' health.



### Literature reviewed

There exists a large body of international academic literature on the various potential benefits of green spaces. Studies cited in this report include literature from Europe, the United States, Australia and Asia. For example, a large proportion of the studies on the environmental impact of green spaces come from Asia. Studies cited within this report date back to the mid-1980s.

The volume of existing research is reflected in the fact that there already exists a large number of both systematic and narrative literature reviews. In part, this report is therefore a meta-review of these studies.

Finally, much of the relevant 'grey literature' reviewed for this report consists of primarily re-framing academic literature. This means that, unusually, both academic and grey literature fundamentally rests on the same research evidence.

Both literature reviews and individual studies frequently point out the need for further systematic research in all areas to increase the evidence base (a common feature of all research). Quality issues related to the literature that are raised most frequently include the 'case study-type' approach of studies (i.e. focusing on specific parks or species), or studies being based on a 'modelling' simulation approach rather than on actual empirical research, both of which may make drawing more general conclusions difficult.

Nevertheless, much international cross-citing among academic studies can be found, indicating a certain level of consensus on various findings across continents and societies. A number of key studies and authors are mentioned particularly frequently.



Gardens by St Paul's Cathedral

## 1. Environmental benefits

### 1.1 Cooler air through shade and ground cover with less heat retention

#### Hypothesis

Across the world, metropolitan areas are significantly warmer than their surrounding areas. The main causes for this are urban land surfaces, which use materials which retain heat, as well as waste heat generated by the high level of energy usage in cities. This effect may be intensified in the context of global warming. Through creating a break in a city's heat-retaining surfaces and providing shade during the day, green spaces mitigate this effect.

A systematic review in 2010 of a range of studies investigating temperatures within and outside urban parks, found that studies were generally consistent in finding lower surface temperatures in green spaces than in built-up spaces. An analysis of the temperature reductions put forward by the various studies showed that average temperature reductions in green spaces were just below 1°C during the day and 1.15°C at night. The authors of the review thus concluded that research clearly points towards the potential of green spaces to reduce urban air temperature<sup>8</sup>.

A wide-ranging study in 2007 of 61 city parks in Taipei came to the same conclusion – urban parks were on average cooler than their surroundings. The researchers also found that larger parks were on average cooler than smaller ones (though the relationship was non-linear). Park characteristics such as the size of natural, as opposed to built-up areas (e.g. paths), and the type of vegetation used, were also found to influence the level of impact<sup>9</sup>.

<sup>8</sup> Bowler et al (2010).

<sup>9</sup> Chang et al (2007).

Considering the geographical extent of this cooling effect, a 2005 study of two parks in Singapore again came to the same conclusion as the two studies cited above, adding that average temperatures were lower inside parks, and became warmer with increasing distance from the park. The authors thus concluded that research has overall confirmed the importance of large city green spaces on urban heat<sup>10</sup>.

### 1.2 Less rainwater run-off through water infiltration, storage and pollutant removal

#### Hypothesis

Due to their impermeable quality, urban surface materials are more prone to causing flooding than natural surface material. This problem is exacerbated by the fact that urban flooding is frequently polluted. Again, climate change is predicted to increase the risk of flooding in the future – a tendency which already seems visible<sup>11</sup>. Through providing natural drainage, water interception, infiltration and storage, as well as pollutant removal from soil and water, green infrastructure contributes to surface flow reduction, resulting in flood alleviation and better water quality.

Researchers in China in 2012 claimed that only a few studies so far have explored the benefits of rainwater run-off reduction by urban green spaces.

However, one study from 1999 that is frequently cited concluded that Stockholm's lawns, parks, urban forests, cultivated land and wetland provide an important contribution to the city's drainage system<sup>12</sup>. As the study explained, this is due to the soft ground

<sup>10</sup> Yu and Hien (2005).

<sup>11</sup> Indeed, much of the 2000 flooding is said to have been caused by failing urban drainage systems unable to cope with the floods caused by urban surfaces - Forest Research (2010).

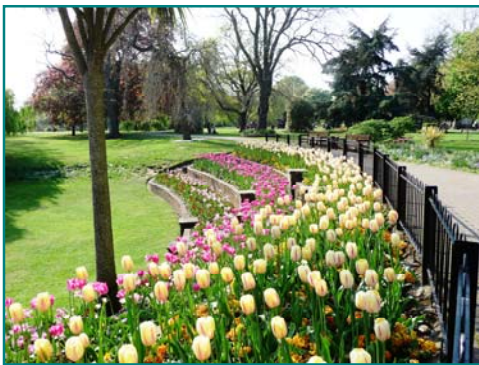
<sup>12</sup> Bolund and Hunhammar (1999), cited in Forest Research (2010).

allowing water to seep through rather than run-off, as well as vegetation storing and releasing water through evapotranspiration<sup>13</sup>.

Supporting this, the above mentioned 2012 Chinese study went on to analyse the rainwater run-off potential of all green spaces in Beijing. It estimated that together, they stored a total volume of 154 million cubic meters of rainwater, reducing potential run-off by 2,494 cubic meters per hectare of green area<sup>14</sup>.

Similarly, researchers in the UK who developed a 2080 surface run-off model for Greater Manchester have suggested that by increasing green ground cover in residential areas by 10%, run-off could be reduced in these areas by 4.9%, and that increasing tree cover by the same amount could cause a further reduction of 5.7%<sup>15</sup>.

Looking in particular at the quality of water collected in green spaces, other research in Beijing also found that the water stored in green areas was superior in quality to the run-off from roofs and roads, thus reducing purification costs<sup>16</sup>.



Walled garden in the Square Mile

### 1.3 Better air quality through pollutant absorption

#### Hypothesis

Due to the increased concentration of vehicle emissions, power production and industrial activity and aviation, cities are 'pollution hotspots'. In addition to causing damage to a city's built and natural environment, this aggravates cardiovascular and respiratory diseases among the urban population. Through its ability to absorb pollutants, urban green infrastructure helps to improve air quality.

A systematic review in 2013 concluded that, as most existing studies looking at the contribution that urban green spaces make to air quality rely on modelling rather than empirical research, there is currently only relatively weak evidence that urban parks improve air quality by capturing pollutants and particles<sup>17</sup>.

Forest Research in its 2010 review of the benefits of green infrastructure was, however, considerably more unequivocal. It concluded that air quality can indeed be directly altered by trees through their capacity to absorb gaseous pollutants, intercept particles at leaf surface, and produce oxygen during photosynthesis<sup>18</sup>.

The review cites a number of studies which appear to provide evidence of this effect. One study in 1994 found that trees in Chicago were estimated to remove 6,190 tonnes of pollution per year, equating to an average improvement in air quality of approximately 0.3%, with the possibility of further improvements to air quality of 5% to 10% through increased tree cover<sup>19</sup>. Closer to home, researchers in London in 2009, who based their research on a 10km by 10km area of

<sup>13</sup> Bolund and Hunhammar (1999), cited in Zhang et al (2012).

<sup>14</sup> Zhang et al (2012).

<sup>15</sup> Gill et al (2007).

<sup>16</sup> Hou (2006), cited in Zhang et al (2012).

<sup>17</sup> Konijnendijk et al (2013).

<sup>18</sup> Forest Research (2010).

<sup>19</sup> Nowak (1994), cited in Forest Research (2010).

the East London Green Grid, demonstrated the potential for green space to reduce particulate pollution (PM10)<sup>20</sup>. Research completed in China has provided similar results: assessing the impact of urban vegetation on air pollution in Guangzhou, researchers found results indicating a removal of sulphur dioxide, nitrogen dioxide and total suspended particulates of about 312.03mg annually<sup>21</sup>.

While the strength of the evidence base for this mechanism is contested, many authors nevertheless conclude their reports by suggesting tree planting as a cost-effective measure to reduce different types of air pollution<sup>22</sup>. This is an indication that there is certainly some consensus with regard to the role green spaces can play in contributing to pollution reduction.

#### 1.4 Climate change mitigation through carbon capture

##### Hypothesis

Carbon emissions, again a particular problem in big cities, have been linked to increasing global warming. Similar to pollution, urban green infrastructure, and in particular trees, enable carbon capture and sequestration, thereby mitigating emissions and their negative effects.

To date, little high-profile research exists specifically on the effects of urban green spaces on carbon capture. However, studies looking at the link between green spaces and pollution more generally often list carbon capture alongside green spaces' capacity for pollution and particle absorption.

One study that looked more specifically at carbon capture was the 2009 'Read Report' for the National Assessment of

UK Forestry and Climate Change Steering Group, which concluded that UK forests and trees have a significant role to play in the country's response to the challenges posed by climate change. Indeed, the report claims that a 4% increase in woodland in the UK could deliver annual emissions abatement equivalent to 10% of total greenhouse gas emissions (GHG)<sup>23</sup>. While it does not specifically mention urban vegetation (although it includes trees generally), Forest Research in turn drew on this study to conclude that urban green infrastructure, too, contributes to carbon capture by, for example, building up soil carbon reserves over time<sup>24</sup>.

#### 1.5 Better bio-diversity/eco-system health by providing natural habitats

##### Hypothesis

A city's built-up urban area of houses, roads and offices provides only very limited space for any sort of wildlife. In contrast, a city's green infrastructure, by creating a 'green network', offers a home to various species and provides opportunities for animals and insects to move, spread and colonise new habitats.

A number of research reviews claim that, while sound in theory, there is little evidence of the overall value of green spaces for *all* species. While many studies have researched wildlife within urban areas, they frequently consider only a particular species' use of urban green spaces. Forest Research, for example, lists studies that looked specifically at the number of deer, badgers and foxes in urban areas (by counting vehicle collisions), at insect populations in urban roundabouts, and at birds' use of urban green infrastructure<sup>25</sup>.

<sup>20</sup> Tiwary et al (2009), cited in Forest Research (2010).

<sup>21</sup> Jim and Chen (2007).

<sup>22</sup> For example in Jim and Chen (2007), as well as in Tiwary et al (2009), cited in Forest Research (2010).

<sup>23</sup> Read et al (2009).

<sup>24</sup> Forest Research (2010).

<sup>25</sup> Forest Research (2010).

While such studies provide evidence that urban green spaces are used by certain types of animals or insects, they are more limited in providing evidence of the value of urban green networks on wildlife as a whole (and, as such, on biodiversity). However, as one study pointed out, action to provide urban green networks as “conduits for wildlife” nevertheless often takes place due to an absence of alternatives, and ‘ecological networks’ have thus become a popular element of urban planning<sup>26</sup>.

## 1.6 Summary

The existing evidence points to a clear advantage of large spaces compared to small spaces with regard to their air cooling capacity. However, small spaces such as those in the Square Mile are able to deliver crucial environmental benefits through a variety of other mechanisms. Impacts are most likely to be felt by London residents and workers, followed by City of London residents and workers. Direct benefits for businesses are less significant – only reducing rainwater run-off can convincingly be argued to have a direct impact on businesses’ bottom line; a reflection of the potential costs of flood damage, which they may be faced with.

**Table 2: Environmental benefits and mechanisms linked to the City of London portfolio**

Key: CoL = City of London, R+W = residents & workers, Bus = businesses, in this and all following tables

	Evidence		Impact			
	Large spaces	Small spaces	CoL R+W	CoL Bus.	London R+W	London Bus.
Air cooling	√√√				√√√	
Reducing rainwater run-off	√√	√√	√√	√√	√√	√√
Pollutant absorption	√√	√√	√√		√√	
Carbon capture	√	√	√		√	
Supporting biodiversity	√				√	

<sup>26</sup> Haddad and Tewsbury (2005) and Jongman and Pungetti (2004), cited in Tzoulas et al (2007).



## 2. Physical, mental health and well-being benefits

### 2.1 Lower obesity and better cardiovascular and respiratory health through space for exercise

#### Hypothesis

Poor air quality, urban heat and an increasingly 'sedentary lifestyle' among today's urban population<sup>27</sup> are frequently linked to problems of ill health. In particular, they have been found to contribute to cardiovascular and respiratory diseases and increasing levels of obesity in adults and children. By providing spaces for physical exercise and contributing to better air quality, green spaces help to counteract such health problems.

A 2011 literature review for NHS Ashton Leigh and Wigan cites a number of studies from the past ten years which have reported finding links between urban green spaces and better physical health among the local population. Studies in the review focused on indications of reduced obesity, reduced risk of coronary heart disease and strokes, decreased blood pressure and lower cholesterol, as well as better overall perceived health<sup>28</sup>.

Such findings are supported by a large-scale UK study of patient records in 2008, which found that income deprivation-related health inequalities in mortality from circulatory diseases were lower among populations resident in the greenest areas. Having controlled for other factors that may be associated with mortality as well as for certain area characteristics, the authors concluded that access to green spaces helps to reduce health inequalities in regard to circulatory diseases<sup>29</sup>.

Studies most commonly link such health benefits to green spaces' capacity to promote physical activity. Reviews looking at links between the two vary in their assertiveness. One study, for example, concluded that the amount of green spaces in peoples' living environment is *not* related to their meeting health recommendations for physical activity<sup>30</sup>. Similarly, another claimed that while based on strong theory and supported by a large amount of observational evidence, the existence of a causal relationship between green spaces and physical activity was still uncertain<sup>31</sup>.

Other studies are more assertive. A 2010 meta-review of the evidence for the health benefits of urban green spaces<sup>32</sup>, for instance, concluded that several existing reviews support the view that green spaces offer opportunities for exercise. Similarly, another study that year concluded that landscapes indeed do appear to be able to promote physical well-being through encouraging higher levels of physical activity<sup>33</sup>.

Such claims are further supported by an analysis of survey data in Bristol, which found that respondents who lived closest to a park were more likely to achieve recommended levels of physical activity, and less likely to be overweight or obese<sup>34</sup>. Similarly, a 2005 study based on a secondary analysis of a number of surveys estimated that the likelihood of being physically active is more than three times as high for respondents living in residential environments with high levels of greenery, and the likelihood of being overweight or obese about 40% less. While conceding limitations to the analysis, the authors suggested that more attention should be paid to

<sup>27</sup> Shah and Peck (2005).

<sup>28</sup> Richardson and Parker (2011).

<sup>29</sup> Mitchell and Popham (2008).

<sup>30</sup> Maas et al (2008), cited in Richardson and Parker (2011).

<sup>31</sup> Mytton et al (2012).

<sup>32</sup> Lee and Maheswaran (2010).

<sup>33</sup> Abraham et al (2010).

<sup>34</sup> Coombs et al (2010).

environmental facilitators and barriers in order to promote physical activity and reduce weight<sup>35</sup>.

## 2.2 Reduced stress, mental fatigue and attention deficit through the aesthetic experience

### Hypothesis

The aesthetic experience of looking at or being in green spaces can have a positive “psychosomatic” effect on people by reducing stress, lowering blood pressure, and alleviating cognitive disorders and attention deficit disorder. The potential not only to relax, but also to exercise outdoors in green areas, contributes to better mental health and well-being.

Several recent literature reviews have concluded that green spaces have the potential to benefit people's mental health and well-being. Developing a theory of how natural environments may have a “restorative effect”, Kaplan and Kaplan, influential researchers in this field, ascribed a combination of attributes to green spaces, among which they included “aesthetically pleasing stimuli, which promote ‘soft fascination’”<sup>36</sup>.

In its 2010 review, Forest Research concluded that there is a strong body of evidence which suggests that physical activity in green spaces has stronger mental health benefits than physical activity in non-green spaces, and that “more passive forms of usage” can also have a beneficial impact on mental well-being and cognitive function. In some studies, this is even related simply to the ability to view green spaces from afar<sup>37</sup>. A 2010 scoping study similarly concluded that by helping to reduce stress, evoke positive emotions and restore attention,

landscapes have the potential to promote mental well-being<sup>38</sup>. This is also supported by a 2007 literature review, which cited experimental studies which looked at the effects of green spaces on attention fatigue, psycho-physiological stress, blood pressure, mental fatigue and attention deficit<sup>39</sup>.

Studies looking at links between the environment and mental health and well-being are frequently based on self-reporting by respondents, which has been shown to correlate closely to actual health. For example, a Swedish study in 2003 found statistically significant relationships between the use of urban green spaces and self-reported levels of stress, regardless of respondents' age, sex or socio-economic status<sup>40</sup>. Dutch researchers in 2010 established that the “restorative quality” of nature is corroborated by surveys in several countries, which show that people consider contact with nature as “one of the most powerful ways to obtain relief from stress”<sup>41</sup>.

Two UK studies, each taking a very different approach, also support this conclusion. The first, a 2002 study by researchers at the University of Sheffield, was based on a number of focus groups<sup>42</sup> across the UK. The researchers found that across all focus groups, participants pointed out “psychological reasons” for visiting urban green spaces. In particular, participants highlighted their use of green spaces to escape from the city, from pollution and from people<sup>43</sup>.

The second is a long-term study based on an analysis of data from the annual British Household Panel Survey responses from 1991 to 2008. This allowed researchers to trace self-reported psychological health from over 10,000

<sup>35</sup> Ellaway et al (2005).

<sup>36</sup> Kaplan (1985), Kaplan (1995) and Kaplan and Kaplan (1989), cited in Forest Research (2010).

<sup>37</sup> Forest Research (2010).

<sup>38</sup> Abraham et al (2010).

<sup>39</sup> Tzoulas et al (2007).

<sup>40</sup> Grahn and Stigsdotter (2003).

<sup>41</sup> van den Berg et al (2010).

<sup>42</sup> With users and non-users of urban green spaces.

<sup>43</sup> Dunnett et al (2002).

participants across an 18 year period. The researchers found that respondents were happier when living in urban areas with large amounts of green spaces, showing significantly lower mental distress levels and higher well-being (life satisfaction) levels. Importantly, the longitudinal approach made it possible for the researchers to control for other impacts on respondents' lives, such as income, employment status, marital status, health and housing type<sup>44</sup>.



### 2.3 Summary

The evidence that green spaces contribute to people's physical and mental health and well-being is more relevant to large green spaces in and around London, than small spaces in London, and is therefore more pronounced for Greater London as a whole, than for the City of London specifically.

This is particularly due to the capacity of large spaces to offer room for physical exercise (sometimes promoted through sport facilities, for example in Hampstead Heath). Physical health benefits through better air quality are also likely to be more pronounced for Greater London (as, again, they accrue mainly from large spaces). This means for example, that the benefits to air quality of spaces such as Epping Forest can be considered as distributed across the whole of London.

The research does however provide some evidence of the benefits of small spaces for mental health – through their 'restorative' capacity – which means that this is likely to impact residents and workers across London, including within the City of London.

**Table 3: Physical, mental health and well-being benefits and mechanisms linked to the City of London portfolio**

	Evidence		Impact			
	Large spaces	Small spaces	CoL R+W	CoL Bus.	London R+W	London Bus.
Space for exercise	√√				√√	
Better air quality	√√		√		√√	
Aesthetic experience/ 'restorative' power	√√	√√	√√		√√	

<sup>44</sup> White et al (2013).

### 3. Social benefits

#### 3.1 Enhanced cognitive and motor skills and socialisation for children via spaces for play and challenge

##### Hypothesis

Urban green spaces offer children a space for unrestricted, versatile and 'challenging' play in a social environment. In doing so, they help to improve children's creativity, cognitive and motor skills, emotional resilience and socialisation.

Two studies cited frequently with regard to the impact of urban green spaces on child development researched the play behaviour of children in inner-city Chicago. Both found that children playing in green spaces displayed higher levels of creative play, played for longer, and more collaboratively than children playing in built-up spaces<sup>45</sup>.

These findings are supported by a 2000 Norwegian study, which found that playing in woodland provided a more stimulating and varied play environment for children, and noticeably improved their motor fitness<sup>46</sup>.

Such impacts are visible to, and valued by, parents and children's carers, as shown by the University of Sheffield focus groups. Taking children to green spaces was one of the most frequently mentioned reasons for adults to visit such areas. Respondents widely held the view that green environments provided important spaces where children could explore and "let off steam", and where they could come into contact with nature as well as meet other children and adults – a valuable aspect to children's social development<sup>47</sup>. This is corroborated by

<sup>45</sup> USDA Forest Service (2001), cited in Land Use Consultants (2004) and in Shah and Peck (2005) & Taylor et al (1998), cited in Forest Research (2010).

<sup>46</sup> Fjortoft and Sageie (2000).

<sup>47</sup> Dunnett et al (2002).

the 2009/12 Monitor of Engagement with the Natural Environment Survey, which showed that 15% of the total visits taken by the English adult population were driven by motivations to 'entertain' or 'play' with children<sup>48</sup>.

Alongside providing potential for more 'free', unplanned play, parks also provide important space for beneficial planned activities (i.e. in an education environment). A 2008 study for the then Department for Children, Schools and Families found that children that were engaged in 'learning outside the classroom' activities, including in parks and other natural environments, achieved higher class test scores, high levels of physical fitness and motor skills, as well as increased confidence, self-esteem and social competences<sup>49</sup>.

#### 3.2 Greater social interaction and community cohesion through inclusive, free space

##### Hypothesis

Urban areas are often associated with promoting anonymity or loneliness. Green spaces, by being publicly accessible and free, as well as by providing space for events, offer a natural meeting point for the local population. This contributes to community cohesion and social integration, and supports an increased sense of belonging to an area as well as closer neighbourhood ties.

Green spaces' role in promoting social interaction and community cohesion is certainly a concept which has found interest in the academic world. However, conflicting research results mean that there is a lack of consensus on the strength of the existing evidence.

A 2012 study by the Heritage Lottery Fund concluded that there is currently little evidence of how culture and

<sup>48</sup> TNS (2012).

<sup>49</sup> Malone (2008).

heritage (including parks and green spaces) can contribute to concepts such as social capital, community cohesion, social inclusion and civic society, when compared with evidence of benefits experienced by individuals<sup>50</sup>. More recently, authors conducting a systematic literature review for the International Federation of Parks and Recreation Administration concluded that while there are indications across studies that parks promote social cohesion, the small number and varying quality of studies mean the current evidence is weak<sup>51</sup>.

Other literature reviews have come to more positive conclusions. A wide-ranging literature review in 2010, for example, concluded that existing research certainly suggests that landscapes have the potential to promote social well-being through social integration, engagement, participation and support<sup>52</sup>. Forest Research, meanwhile, cited two studies that each looked at particular demographic groups and the benefits they gain from access to green spaces. One, a Chicago-based study, looked specifically at older adults in deprived areas, and found clear indications of links between access to green spaces and social integration<sup>53</sup>. The second, a Swiss-based study on opportunities for young people to interact with other young people from different cultural backgrounds, found that the city's urban forests and parks were a particularly conducive place for socialising and interaction<sup>54</sup>. Based on such studies, Forest Research concluded that evidence suggests that green spaces can offer opportunities to promote interaction between people who may not normally interact, which

helps to develop social ties and community cohesion<sup>55</sup>.

This particular aspect of stronger community ties was also the focus of a 2004 study by Kim and Kaplan, which suggested that natural features and open spaces in residential areas play an important role both in residents' interaction with each other, and their feelings of attachment towards their local community<sup>56</sup>. Similarly, a more recent Belgian study found that people's perception of the "greenness" of their neighbourhood was the most important predictor of neighbourhood satisfaction<sup>57</sup>.

Such studies are further supported by the findings of a 2007 survey of 20,000 members of the UK public, which found that 83% of respondents believed that parks and green spaces provided a focal point for their communities<sup>58</sup>. The University of Sheffield research similarly revealed that many of the focus group participants identified green spaces as "the hub or the spirit of their community". This benefit may well transcend differences in background, as focus groups with women, people from ethnic minorities and disabled people particularly suggested that such spaces are "important for whole families"<sup>59</sup>.

### 3.3 Summary

There is evidence that large green spaces, which generally include more wild, untamed and woodland-type elements, with more room to run around, explore and 'let off steam', than small spaces, can play a significant role in child development. Of those spaces supported by the City Corporation, Epping Forest and Hampstead Heath are prime examples

<sup>50</sup> Maer et al (2012).

<sup>51</sup> Konijnendijk et al (2013).

<sup>52</sup> Abraham et al (2010).

<sup>53</sup> Kweon et al (1998), cited in Forest Research (2010).

<sup>54</sup> Seeland et al (2009), cited in Forest Research (2010).

<sup>55</sup> Forest Research (2010).

<sup>56</sup> Kim and Kaplan (2004), cited in Tzoulas et al (2007).

<sup>57</sup> Van Herzele and de Vries (2011).

<sup>58</sup> Greenspace (2007).

<sup>59</sup> Dunnett et al (2002).



of such areas. Due to the lack of room for these elements in smaller spaces, it may be assumed that this benefit is less pronounced for small inner-city, green spaces such as those in the Square Mile.

With regard to general space for social interaction, the evidence suggests that the smallest scale at which positive social benefits arise is likely to be neighbourhood park level. This is so because (i) there needs to be a certain level of space/amenity provided - enough to hold small community events, room to walk dogs, space for a playground, etc. – but equally (ii) there has to be a ‘community’ that can interact in these spaces.

Though small green spaces such as those within the Square Mile generally do not meet these requirements, larger green spaces, such as the City Corporation’s spaces that lie outside of the Square Mile - Queen’s Park or West Ham Park for example - clearly do, and are therefore very likely to support the forms of community interaction discussed in the research.



**Table 4: Social benefits and mechanisms linked to the City of London portfolio**

	Evidence		Impact			
	Large spaces	Small spaces	CoL R+W	CoL Bus.	London R+W	London Bus.
Space for play & challenge (children)	√√				√√	
Space for social interaction and meeting	√	√			√	
Space for social interaction and meeting	√	√			√	

## 4. Economic benefits

This section explores studies that have sought to demonstrate how economically valuable a part of, or all of, the amenity provided by green spaces is for different stakeholders. These studies are essentially concerned with how the direct environmental, health and social benefits of green spaces also have secondary positive economic impacts that can be measured financially.

### 4.1 Cost savings for government related to environment and health expenditures

#### Hypothesis

By providing a range of environmental, health and social benefits (as outlined in previous sections), green spaces contribute to reducing the costs incurred by government in addressing these challenges. Green spaces are thus able to provide a number of indirect economic benefits to society.

There are few studies that focus on establishing the monetary value that governments and related bodies might derive from the various benefits of green spaces<sup>60</sup>. However, those that do exist provide positive indications of the likely indirect economic impacts of green spaces.

Two such studies looked in particular at the financial value of environmental benefits. The previously mentioned 2012 study of rainwater run-off reduction through Beijing's green spaces valued this effect at 21.77 renminbi per hectare of open space, calculating that the total economic benefit was equivalent to three quarters of the green spaces' maintenance cost<sup>61</sup>. An earlier study of the potential of urban trees to act as

pollutant removers in Chicago estimated the annual value of this benefit in the city at US\$9.2million<sup>62</sup>.

Natural England followed up a claim in another study that people in the UK are 24% more likely to be physically active if they have easy access to green spaces. They estimated that if the whole English population had equally easy access to green spaces, and consequently all were 24% more likely to be physically active, the life-cost averted saving to the NHS would be around £2.1 billion per annum<sup>63</sup>.

Such estimates highlight the difficulties of providing any conclusive financial calculations for these benefits. Rather than attempting to calculate cost savings, many studies therefore instead highlight the current costs to government in meeting socio-economic and environmental challenges in areas in which green spaces have a positive effect; thereby implying the ability of green spaces to reduce these costs.

Forest Research, for example, cites research which has estimated that the current economic impact of urban flooding in England and Wales lies at £270 million per year and may increase to £1 billion and £10 billion per year in the future if no action is taken<sup>64</sup>.

Both Forest Research and the new economics foundation (nef) cite works that estimate the costs of ill health to government. The DCMS Strategy Unit, cited by nef, in 2002 for example estimated the cost of physical inactivity and obesity, risk factors in chronic conditions such as heart disease, at £8.2 billion for England alone<sup>65</sup>. Other studies have tried to value the cost to

<sup>60</sup> Esteban (2012) makes this point in particular with regard to studies considering the monetary value of the benefit of green spaces on well-being.

<sup>61</sup> Zhang et al (2012).

<sup>62</sup> Nowak (1994) and McPherson et al (1997), cited in Jim and Chen (2007).

<sup>63</sup> Coombs et al (2010) and Natural England (2009), cited in Richardson and Parker (2011).

<sup>64</sup> Parliamentary Office of Science and Technology (2007) and Evans et al (2004), cited in Forest Research (2010).

<sup>65</sup> Department of Culture, Media and Sport Strategy Unit (2002), cited in Esteban (2012).

government of mental illness, and while figures vary significantly, there is consensus that costs range in the tens of billions of pounds<sup>66</sup>.

## 4.2 Increasing property and land value for home owners

### Hypothesis

Urban residents are willing to pay a premium on house or rent levels in order to live in areas close to green spaces. This results in local increases of property and land value, linked directly to their proximity to green spaces.

Studies considering the links between property value and location are most commonly based on the 'hedonic pricing' method, which suggests that the value of a good is based on a combination of its various attributes<sup>67</sup>. Based on this model, many international studies have found strong indications of a correlation between property value and proximity to (urban or semi-urban) green spaces.

In an assessment of London house prices in 2010, GLA Economics found that house prices were boosted by the total green spaces area within a distance of one kilometre from the property. Based on a model which included green spaces, built environment and other location factors (but not socio-economic attributes), the study estimated that location within 600 metres of an urban park added between 1.9% and 2.9% to the total house value<sup>68</sup>.

Research by the Royal Institute of Chartered Surveyors in Aberdeen similarly found that location on the edge of a park had the potential to

attract a premium of up to 19% on house prices. Larger parks with facilities were found to have a more significant impact<sup>69</sup>. CABE Space in turn calculated an uplift of typically around 3% to 5% for properties within the presence of a "high quality park"<sup>70</sup>.

Similar findings are also reported outside the UK: a report commissioned by CABE cites a Dutch study which concluded that having a park nearby could raise house prices by 6% and a view of a park by 8%<sup>71</sup>. A study in Dallas in turn found that for many property owners, proximity to public green spaces was a major factor in their decision to move to the area<sup>72</sup>.

In short, there is general agreement that properties in proximity to green spaces do command a premium price, but the precise value of this uplift will depend on exactly how close the property is, how large the green spaces are, and what facilities they contain.

## 4.3 Promoting tourism by motivating visits

### Hypothesis

Green spaces are not only attractive to a local population, but also to national and international tourists. Some urban parks – in particular large, well-known 'statement' parks such as Regents Park, or Hyde Park in London, Park Güell in Barcelona or the Jardin du Luxembourg in Paris – even contribute to motivating tourists to visit a city. Based on their capacity to make cities more attractive, green spaces play a beneficial role in cities' approaches to marketing themselves.

The topic of how urban parks benefit tourism has been somewhat neglected

<sup>66</sup> See for example Sustainable Development Commission (2008), cited in Forest Research (2010), which estimates care costs at £12 billion and costs to the wider economy at £64 per annum, and The Sainsbury Centre for Mental Health (2002), cited in Esteban (2012), which estimated costs at £23.1 billion.

<sup>67</sup> Smith (2010).

<sup>68</sup> Smith (2010).

<sup>69</sup> Dunse et al (2007), cited in Maer et al (2012).

<sup>70</sup> CABE Space (2005), cited in Maer et al (2012).

<sup>71</sup> Luttki (2000), cited in Woolley and Rose (undated).

<sup>72</sup> Peiser and Schwann (1993), cited in Woolley and Rose (undated).

in academic literature in recent years<sup>73</sup>. Similarly, many visitor surveys conducted in green spaces focus largely on visitor origin and spend, without considering the role that these spaces play in triggering people's decision to visit a city in the first place.

One recent survey, the London Visitor Survey, conducted annually between 2006 and 2010 across London, does however provide strong evidence of the role that London's green spaces play in *attracting* both UK and overseas tourists to London.

Data collected from 4,587 visitors to London in 2008 showed that 80% of overseas tourists, 74% of UK staying visitors, 70% of UK day visitors and 77% of London residents ranked "parks and gardens" as "important" or "very important" in their decision to visit or take a day trip to London. Indeed, visitors frequently ranked "parks and gardens" as more important than other options such as "theatre/music/ arts performances" or "shopping/markets"<sup>74</sup>. Satisfaction rates were also generally high, with an average across all groups of 3.92 (with five equalling 'excellent')<sup>75</sup>.

While one may assume that such potential also translates into place marketing efforts by cities such as London (for example, this is certainly visible on the Visit London website), no studies were found to support this.

#### 4.4 Attracting businesses to locate

##### Hypothesis

In addition to attracting leisure visitors to a city, green spaces play a role in businesses' decisions to locate in a certain area. This is driven by green

spaces' attractiveness for workers as well as their ability to increase customer footfall (due to the areas' general attractiveness for residents and visitors).

Some publications point towards a positive correlation between green spaces and businesses' location decisions, particularly small (consumer-facing) businesses<sup>76</sup>. nef cites research by the US-based Trust for Public Land in 1999, which concluded that small businesses rate non-built up green spaces as their highest priority when choosing their location<sup>77</sup>.

Overall, however, there is little evidence of the effect of green spaces on businesses' decision to locate in a certain area. Forest Research, for example, concluded that there is very little strong or reliable evidence of the impact of green spaces on economic growth and investments<sup>78</sup>. The Trust for Public Land in a 2009 report looking at seven measurable attributes of city park systems that provide economic value did not include business location as a factor<sup>79</sup>.

Perhaps tellingly, existing city monitors such as Mercer's Quality of Living worldwide city ranking<sup>80</sup> or Cushman and Wakefield's European Cities Monitor<sup>81</sup>, which rank cities in order to aid businesses in their location decision-making or to inform salary levels, also do not explicitly include green spaces as indicators.

Another strong indication of the apparent limited importance that businesses place on their proximity to green spaces is provided by the City of London Corporation's own polls among the Square Mile's businesses (both consumer-focused and offices without

<sup>73</sup> Forest Research (2010).

<sup>74</sup> The authors however point out that the surveys were taken during the day, perhaps skewing the research by missing out on evening visitors.

<sup>75</sup> TNS Travel and Tourism (2008).

<sup>76</sup> Publications such as Woolley and Rose (undated) for CABE or Shah and Peck (2005) for nef.

<sup>77</sup> The Trust for Public Land (1999), cited in Shah and Peck (2005).

<sup>78</sup> Forest Research (2010).

<sup>79</sup> Hamik and Welle (2009).

<sup>80</sup> Mercer (2012).

<sup>81</sup> Cushman and Wakefield (2011).

direct consumer focus), and their employees. Survey results from 2009 show that only 4% of businesses and 3% of City executives agreed that “more parks, open space, gardens” are a way to improve the City as a place to do business, and only 13% of workers identified “more parks, open space, gardens” as a priority to improve the City as a place to work.

These findings stand in stark contrast to the 2007 Greenstat survey, which revealed that 82% of people believe that high quality green parks and spaces encourage people and businesses to locate in a town<sup>82</sup>. While surprising at first glance, the results may suggest that a differentiation needs to be drawn between the benefits that people attribute to having green space close to where employees live, as opposed to close to where they work.

#### 4.6 Summary

The evidence on the economic benefits of green spaces is, at present, relatively weak. In particular, the hypothesis that green spaces play a role in businesses’ location decisions cannot be substantiated. Where the evidence is strongest is the premium that green spaces bring to property values (principally home owners). This is an important consideration across London and for those green spaces belonging to the City Corporation and which lie outside the Square Mile.

One substantial economic benefit to society that is not accounted for in this table is the indirect economic benefit that government appears to gain from cost savings linked to the various benefits of green spaces discussed in this report.

**Table 5: Economic benefits and mechanisms linked to the City of London portfolio**

	Evidence		Impact			
	Large spaces	Small spaces	CoL R+W	CoL Bus.	London R+W	London Bus.
Cost savings for government (capture of environment & health benefits )	√	√				
Enhancing land & property value (capture of environment & health benefits by residents)	√√	√√			√√	
Driving tourism & place marketing	√					√
Promoting business locations						

<sup>82</sup> Greenspace (2007)



## Conclusion

Returning to the question “*What have green spaces ever done for London?*” the strongest evidence currently points to the positive impact they have on the environment and on people's health and well-being. In addition to helping to counteract major urban sustainability challenges such as atmospheric heating, they provide space for exercise, play, events and “getting away from it all”. This is particularly pronounced in larger green spaces. As such, the strongest evidence base is particularly applicable to large green spaces outside the Square Mile, such as Epping Forest and Hampstead Heath.

The benefits of smaller green spaces in London, such as those within the Square Mile, should also not be underestimated. Collectively, they contribute to rainwater storage and pollutant capture, and can provide important space for relaxation, restoration and social events.

It is also important to note that the far-reaching environmental and health benefits created by large green spaces in and around London can be enjoyed by all of London's residents and workers as they are public goods<sup>83</sup>, and ones that contribute to London's overall ecosystem.

However there is currently only little evidence for the importance of green spaces to London's businesses and its international competitiveness. The one exception is the potentially significant contribution that London's green spaces make to its overall appeal as the world's foremost city destination for international tourists. The evidence that does exist is encouraging, but it is very limited.

Figure 2 summarises the key benefits that green spaces deliver for cities. The strength of the current evidence base is indicated by the size of each of the labels. As it shows, the environmental benefits are to the fore, with the health, social and economic benefits being dependent upon the underlying physical characteristics and environmental benefits of green spaces.

London's green spaces, then, play a vital role in the capital's struggle to meet major environmental and health challenges. To tackle these, London currently has ambitious targets on emissions reductions<sup>84</sup>, and (as part of the UK) needs to comply with EU air quality laws – both of which are currently being missed. Green spaces in London provide a hugely important service to London and its capital – and as one of the largest owners of green spaces assets in London, the City of London Corporation plays a key role in contributing to this service.

### Scope for further research

The literature review undertaken for this report also helped identify several potential benefits of green spaces which to date have received little attention from the academic world. These provide scope for areas for further research by academia and in grey literature.

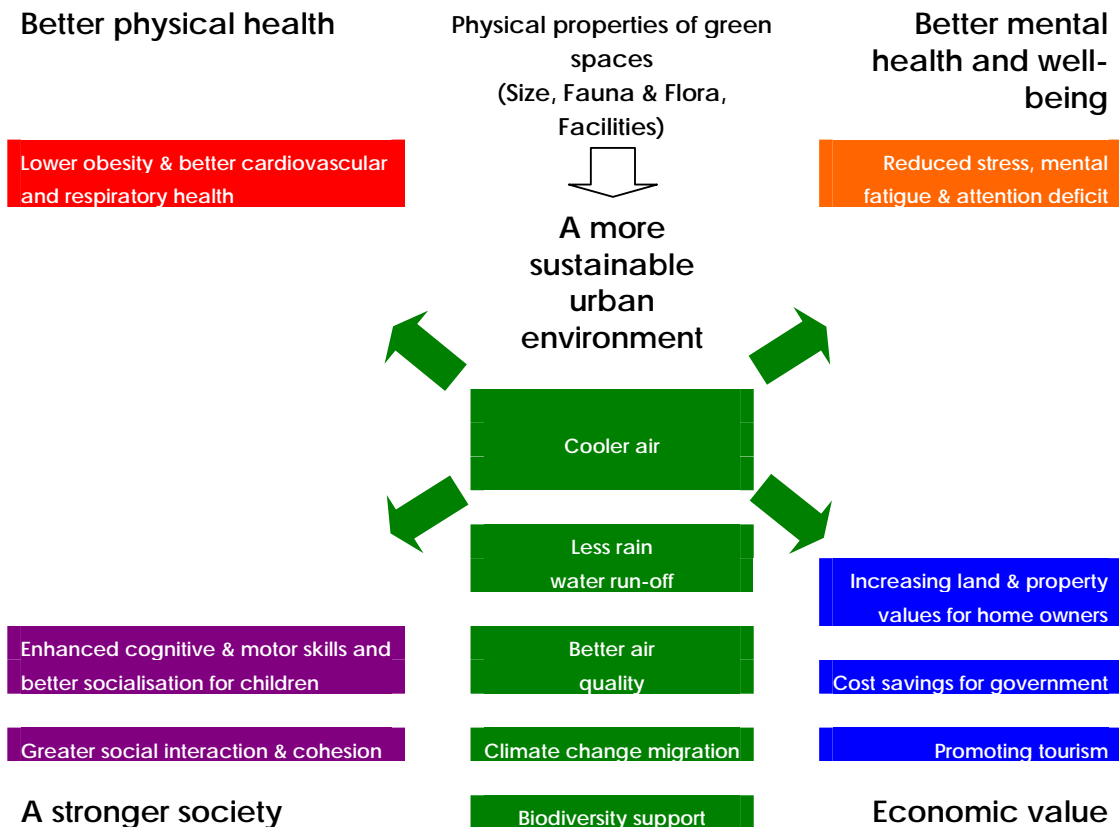
- **Small spaces:** While many studies may reference both smaller and larger green spaces, there is no research specifically into the benefits derived by small, inner-city green spaces. Do they provide specific benefits which may ‘go under the radar’ in more general studies?

<sup>83</sup> In economics, this means that they are ‘non excludable’ but also ‘non rivalrous’ (i.e. consumption by one person does not prevent consumption by another).

<sup>84</sup> London has the most stringent emissions reduction targets of all of the world's global financial centres, aiming for a 60% reduction by 2025 (Tapley et al, 2008).

- Economic impact:** Little academic attention has been paid thus far to the benefits of green spaces in driving tourism. This is a potentially useful area of research for London, given its role as a tourism hub.
- City comparisons:** Despite the benefits they bring to an urban population, there are currently no comparative studies between cities, which look in particular at the provision of green spaces. Given a) the importance of green spaces for an urban population's health, well-being and enjoyment, and b) the role green spaces can play in cities' move towards a more environmentally sustainable future (not least, the need to fulfil international agreements), it could be useful to explore cities' different approaches to green spaces in more detail.
- Blue spaces:** One comparatively new field of research, which is growing out of the study of green spaces, is the assessment of the benefits of "blue spaces" – rivers, lakes and ponds. Many of London's green spaces also include water, not to mention the Thames - what benefits might these bring to London and its inhabitants?

Figure 2: Overview of the evidence of the benefits provided by green spaces



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