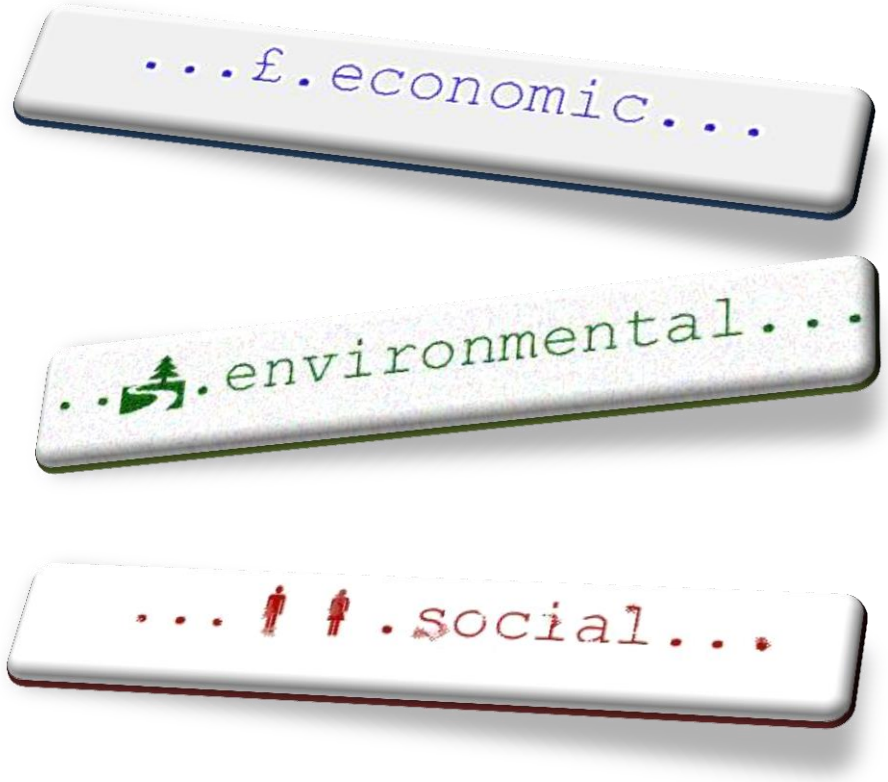
Scottish Natural Heritage
Dualchas Nàdair na h-Alba
All of nature for all of Scotland
Nàdar air fad airson Alba air fad

Greenspace Team

People & Places Unit

Urban Green Infrastructure Benefits Factsheets

September 2014



Facts and figures from research and reports on the potential contribution of urban green infrastructure to the quality of life of people and to the quality of the urban environment.

For further information on this report please contact:

John O'Neil
Scottish Natural Heritage
Caspian House
2 Mariner Court, 8 South Avenue
Clydebank Business Park
CLYDEBANK
G81 2NR

E-mail: john.oneil@snh.gov.uk

...£.economic...

Inward investment:	proximity to high-quality parks increases inward investment and property values				
3-20% premium added to value of land near greenspace	on average, developers would be willing to pay at least 3% more for land in close proximity to greenspace, with some putting the premium as high as 15-20% (Gensler et al, 2011)	£800k-£2m additional council tax revenue added by improved greenspace	the improvement of the Glasgow Green landscape and amenities increased the attractiveness of the surrounding area, leading to additional council tax revenue of £800k – £2m (GEN Consulting, 2006)	+40% boost to town centre trade from integrated green infrastructure	green infrastructure within town centres can boost commercial trading by up to 40% (Natural Economy North West, 2008)

Visitor spending:	quality of parks impacts on the number of visitors attracted to, and spending in, the local area; urban greenspaces themselves are important visitor attractions				
1 in 3 visitors to UK visit parks or gardens	 more people visit parks than museums, castles, historic houses or art galleries	£7.8m spent by visitors to parks	a third of the 31 million people who visit Britain each year visit parks or gardens (more than those who visit museums, castles, historic houses or art galleries) and spend approximately £7.8 billion (VisitBritain, 2013)	+ $ £ € ¥ investment in greenspace increases visitor spending	£15 million investment in Glasgow Green attracted visitors who spent £30 million net additional worth of sales in the wider economy (GEN Consulting, 2006)

Employment generation:	developing and maintaining green infrastructure provides jobs				
55,000 people in Scotland employed in natural environment sector	estimated that recreational and cultural services linked to the natural environment directly employ 55,000 in Scotland, 2.7% of all jobs in the country (RPA & Cambridge Econometrics, 2008)	27,000 public greenspaces maintained	in the UK, local authorities manage and maintain 27,000 greenspaces, at an annual revenue cost of around £1.1 billion (NAO, 2006)	+15% more jobs added in area with regenerated park compared to other areas	Glasgow Green generated £8 million in additional salaries, and 35 FTE jobs. Increase in jobs was 28% 1998-2006. Increase in employees in other parts of the city for the same period was 13% (GEN Consulting, 2006)

Volunteering & community:	green infrastructure provides economic benefits and contributes to social cohesion				
£17-£35m contributed by work of community in greenspaces	annual economic value of the work of community groups in parks and greenspaces across the UK ranges between £17 million and £35 million (GreenSpace, 2003)	90% of young environmental volunteers learn something new	nine out of ten young environmental volunteers in the UK said they learnt something new, and 98% said they wanted to do it again (BTCV, 2008)	400% return on every £ invested in environmental volunteering	£1 invested in environmental volunteering in the UK can lead to a return of up to £4 (BTCV, 2008)

Increasing property value for home owners:	the value impact of parks increases with proximity - parks have a greater impact on property values than other types of greenspaces				
+19% potential £ premium for property on edge of park	+£££ city parks add 10%, local parks 9% and amenity spaces 2.6% to value of nearby property	 larger parks with facilities have a more significant impact	location on edge of a park attracts a premium up to 19% on house prices in Aberdeen and property located near types of greenspace also attract a premium (Dunse et al., 2007)	+7% £ premium for property in areas with trees	properties increase in price by an average of 7% in environments landscaped with trees (CABE, 2005)

Reduced costs and energy consumption:	green infrastructure can be cheaper to install and maintain than engineered solutions and can also reduce energy use				
-50% of capital cost of traditional drainage to install SUDS	in Scotland capital costs of traditional drainage are more than double that of SUDS, yearly maintenance costs are 20-25% cheaper for SUDS and around half the cost over a 60 year life span (Duffy et al., 2008)	4.5ºC warmer inside buildings in the winter and also cooler in the summer as a result of green roofs and walls	green roofs and walls can provide an insulating effect that reduces the transfer of heat between the external and internal environment, reducing the internal heating and cooling costs (CIRIA, 2007)	£2.3m annual contribution of a city's trees by removing air pollutants	the air pollution removal function alone of Edinburgh's 600,000 trees (at 100 metric tonnes per year) was worth more than £2.3 million in 2011 (Hutchings et al., 2012)

...environmental...

Water management:	urban greenspace, swales, rain gardens, green roofs and other green infrastructure components can reduce the amount of water runoff due to increased infiltration rates, and improve water quality by removing pollutants from runoffs				
+10% greenspace could reduce run-off in residential areas by 5%	and increasing tree cover by the same amount could cause a further reduction of 5.7% (Gill et al., 2007)	17-20% reduction in run-off by using green roofs in high density urban areas	adding green roofs to all buildings in town centres, retail and high-density residential could reduce run off by 17 - 20% (Gill et al., 2007)	2.54cm of rainfall absorbed by greenspace without run-off	grass areas can absorb far more than 2.54cm of rain water without runoff (assuming it's not coming down too fast) (Whiting et al., 2005)

Protecting ecosystem state and biodiversity:	urban greenspaces provide habitat and can be linked together by green corridors, helping to conserve and promote biodiversity				
+50% species movement when habitats connected by green corridors	movement between habitat patches was approximately 50% greater if corridors were in place compared to patches that were not connected by corridors (Gilbert-Norton et al., 2009)	+  more birds in streets with trees that are connected to greenspace	streets with trees can contain a higher number and diversity of birds if they connect directly to an urban park (Fernandez-Juricic & Jokimäki, 2000)	5,000 invertebrate species in a single mature oak tree	a mature oak can host up to 5,000 different species of invertebrate that will form the basis of a healthy food chain that benefits birds and mammals (Forestry Commission, 2010)

Temperature modification:	green infrastructure can moderate temperature increases in urban areas through the effects of evapotranspiration, cooling the leaf and the temperature of the air surrounding the leaf, and shading from trees, preventing the warming of the surface and air				
+10% greenspace can maintain current urban summer temperatures up to 2080	despite projected effects of climate change, adding 10% green space in high density urban areas will maintain current summer temperature levels up to 2080 (Gill et al., 2007)	-10% greenspace will see increases of 7-8.2°C in urban areas by 2080	if green cover in urban areas is reduced by 10%, surface temperatures will be 7°C or 8.2°C warmer by the 2080s (Gill et al., 2007)	up to 8ºC reduction in urban temperatures from vegetation	vegetation can reduce the Urban Heat Island effect and cool the air by between 2ºC and 8ºC (Forestry Commission, 2013)

Ambient air quality:	high levels of particulate matter (PM) air pollution are associated with excess mortality and morbidity; urban greenspaces help remove air pollutants				
1 in 26 deaths in Scotland attributable to particulate air pollution ($PM_{2.5}$)	2,000 deaths in Scotland (3.9% or 1 in 26) of adults over 25 attributable to particulate air pollution ($PM_{2.5}$) in 2010 (5.3% or 1 in 20 in UK) (Gowers et al., 2014)	**9.1%** of suspended particles removed by urban vegetation	urban vegetation could contribute to 9.1% of suspended particles removal, 5.3% of Sulphur Dioxide (SO_2) and 2.6% of Nitrogen Dioxide (NO_2) (Yin et al., 2011)	**12%** of air pollution in urban areas is attributable to the Urban Heat Island effect	due to temperature dependent formation of pollutants such as VOCs and Ozone, therefore the planting of street trees to reduce air temperature can also have a significant effect on air pollution (Beckett et al., 1998)

Carbon sequestration:	the removal and storage of carbon from the atmosphere in carbon sinks (such as oceans, forests or soils) through physical or biological processes; urban greenspaces provide a sink to offset carbon emission		
3.16kg of carbon is stored per one square metre of urban vegetation	estimated that 3.16kg of carbon is stored per one square metre of urban vegetation in Leicester (Davies et al., 2011)	**12-15 million** tons of carbon stored in urban greenspaces in USA	carbon sequestration by urban green spaces in the USA is estimated to sequester 12 to 15 million tons of carbon per year (Qian & Follett, 2002)

Noise regulation:	environmental noise has been linked to increased risk of hypertension and stress and has a negative effect on education performance		
-3dB reduction in noise by using grass instead of concrete	grass surfacing reduces noise levels by up to 3 decibels compared to concrete paving (Bolund & Hunhammer, 1999)	**10m** wide strip of tree and shrub planting provides an effective noise buffer	planting vegetation to a width of 10 metres can reduce noise from traffic and other sources by 3-8 decibels, and is more effective than man-made barriers (Fang & Ling, 2003; 2005)

...social...

Health issues:	UK has the highest adult obesity levels in Europe; meeting recommended levels of physical activity can have a positive impact on people's health due to reduced risk of premature death through exercise				
-50% decrease in risk of heart disease, stroke and type 2 diabetes (Department of Health, 2011)	-9% reduction in deaths from chronic heart disease (The King's Fund, 2009)	-7% decrease in the likelihood of being obese, saving the NHS £360m a year (Nuffield Health, 2013)	as a result of meeting recommended levels of physical activity (30 minutes 5 days a week)	26% of adults in Scotland are obese in 2012 up from 17% in 1995 (Scottish Government, 2013)	£85m a year could be saved by the NHS in Scotland if just one in 100 inactive people took adequate exercise (Bird, 2003)

Physical activity/ reducing obesity:	access to greenspace is an important predictor of increased physical activity ("active living") and reduced risk of obesity				
-40% less likely to be overweight or obese if living in a highly green urban area	European residents of areas with the most greenery were 3 times as likely to be physically active and 40% less likely to be overweight or obese, than those living in the least green settings (Wolf, 2010)	x4 more likely to use greenspace regularly if located close to home	people in Scotland who have greenspace close to where they live are four times more likely to use it regularly (Scottish Government, 2014)	24% are more likely to be active if have access to greenspace	people were 24% more likely to meet physical activity recommendations with access to greenspace (Coombes et al., 2010)

Physical activity/ reducing obesity:	the quality of the outdoor environment is an important factor in encouraging daily exercise				
 number of parks in an area and access to greenspace are associated with achieving physical activity targets	achieving/increasing recommended levels of walking/cycling are associated with: the number of parks and sports grounds in an area (Maller, et al., 2009); and access to a greenspace (Foster et al., 2004)	-30% fall in number of UK children playing in natural places	likelihood of children across the UK visiting greenspace has halved in a generation (less than 10% play in natural places compared to 40% of adults when they were young) (Natural England, 2009)	¼ of Scots never visit greenspace	while two thirds (68%) of people in Scotland have access to greenspace close to their homes, only half (49%) use their local space at least once a week, and a quarter (24%) never make any visits (Scottish Government, 2014)

Healthcare/stress reduction:	access to greenspace has a positive impact on mental ill-health and stress; just being in, or viewing, greenspace for a few minutes reduces stress				
 people are happier when living in urban areas with large amounts of greenspaces	people are happier when living in urban areas with large amounts of greenspaces, showing lower mental distress levels and higher well-being (life satisfaction) levels (White et al., 2013)	 self-reported stress is linked to the amount of greenspace in an area	significant relationship between self-reported stress and proportion of greenspace in the local area (Ward Thompson et al., 2012)	 positive effect on mental health if move to an area with good access to greenspace	people who moved to greener areas reported considerably improved mental health three years after leaving their previous neighbourhood (Alcock et al., 2014)

Direct and indirect health benefits:	the accessibility, amount and quality of urban greenspace in an area are associated with better health				
 both quality and quantity of greenspace linked to better health	both quality and quantity of greenspace were correlated to general health, health-related complaints and general mental health (Van Dillen et al., 2011)	 greenspace effects on health not related to socio-economic status	better health is related to greenspace regardless of socio-economic status (Greenspace Scotland, 2008)	use & proximity positively influence self-reported health	people in Scotland who regularly use greenspace and those who live close to greenspace are more likely to describe themselves as being in good or very good health (Scottish Government, 2014)

Greater social interaction & community cohesion:	urban greenspaces provide community resources that are inclusive and free to use				
83% believe greenspaces provide a focal point for community	83% of respondents in UK believed that parks and greenspaces provided a focal point for their communities (Greenspace, 2007)	 Scots in the most deprived areas are more likely to have poor greenspace provision	people in Scotland who live in the most deprived areas are more likely to have less greenspace close to home, less likely to make visits and likely to be the most dissatisfied with their greenspace (Scottish Government, 2014)	 poor quality greenspaces are less appealing, which has a negative effect on visits and potential benefits	as the quality of a greenspace declines and is perceived as neglected and unsafe, the most vulnerable members of society stop visiting and benefitting first (CABESpace, 2005)

References

Economic

BTCV (2008). *Inspiring People, Improving Places: The positive impact and behavioural change achieved through environmental volunteering with BTCV*.

CABESpace (2005). *Decent Parks? Decent Behaviour? The link between the quality of parks and user behaviour*.

CABE Space (2010). *Green space skills 2009: national employer survey findings*.

CIRIA (2007*). Building Greener: Guidance on the use of green roofs, green walls and complementary features on buildings*. Report No.C644.

Duffy, A., Jefferies, C., Waddell, G., Shanks, G., Blackwood, D. & Watkins, A. (2008). A cost comparison of traditional drainage and SUDS in Scotland. *Water Science & Technology*, 57, 1451-1459.

Dunse, N., White, M. and Dehring, C. (2007). *Urban parks, open space and residential property values*. RICS Research Paper Series. September 2007. RICS, London.

GEN Consulting (2006). *Glasgow Green Renewal Benefits Analysis*. Report to Glasgow City Council.

Gensler and the Urban Land Institute (2011). *Open Space: An asset without a champion?* Report for the Urban Investment Network.

GreenSpace (2003). *Community Networking Project: Final Report*. Reading.

Hutchings,T., Lawrence, V. & Brunt, A. (2012). *Estimating the Ecosystem Services Value of Edinburgh's Trees*.

National Audit Office (2006). *Enhancing Urban Green Space*.

Natural Economy North West (2008). *The economic benefits of Green Infrastructure: The public and business case for investing in Green Infrastructure and a review of the underpinning evidence*.

RPA & Cambridge Econometrics. (2008). *The Economic Impact of Scotland's Natural Environment*. Scottish Natural Heritage Commissioned Report No.304 (ROAME No. R07AA106).

VisitBritain (2013). *Overseas Visitors to Britain's Parks and Gardens Spend £7.8 Billion*.

Environmental

Beckett, K.P., Freer-Smith, P.H. & Taylor, G. (1998). Urban woodlands: their role in reducing the effects of particulate pollution. *Environmental Pollution,* 99, 340–360.

Bolund, P. & Hunhammar, S. (1999). Ecosystem services in urban areas. *Ecological Economics*, 29(2), 293-301.

Davies, Z.G., Edmondson, J.L., Heinemeyer, A., Leake, J.R. & Gaston, K.J. (2011). Mapping an urban ecosystem service: Quantifying above-ground carbon storage at a city-wide scale. *Journal of Applied Ecology,* 48(5), 1125-1134.

Fang, C.F. & Ling, D.L. (2003). Investigation of the noise reduction provided by tree belts. *Landscape and Urban Planning,* 63, 187–195.

Fang, C.F. & Ling, D.L. (2005). Guidance for noise reduction provided by tree belts. *Landscape and Urban Planning,* 71, 29–34.

Forestry Commission (2013). *Air Temperature Regulation by Urban Trees and Green Infrastructure*. Forestry Commission Research Note.

Gill, S., Handley, J., Ennos, A. and Pauleit, S. (2007). Adapting cities for climate change: the role of green infrastructure. *Built Environment*, 33 (1), 115–133.

Gowers, A.M, Miller, B.G & Stedman, J.R. (2014*). Estimating Local Mortality Burdens associated with Particulate Air Pollution*. London: Public Health England.

Qian, Y. & Follett, R.F. (2002). Assessing Soil Carbon Sequestration in Turfgrass Systems Using long-Term Soil Testing Data. *Agronomy Journal*, 94, 930-935.

Whiting, D., Tolan, R., Mecham, B., & Bauer, M. (2005). *Water-wise gardening: creating practical turf areas*. Colorado State University Cooperative Extension.

Yin, S., Shen, Z., Zhou, P., Zou, X., Che, S. & Wang, W. (2011). Quantifying air pollution attenuation within urban parks: An experimental approach in Shanghai, China. *Environmental Pollution,* 159(8-9), 2155-2163.

Social

Alcock, I., White, M.P., Wheeler, B.W., Fleming, L.E. & Depledge M.E. (2014). Longitudinal Effects on Mental Health of Moving to Greener and Less Green Urban Areas. *Environmental Science and Technology*, 48, 1247-1255.

Bird, W. (2003). Nature is good for you! *ECOS*, 24(1) pp29-31.

British Heart Foundation (2012). *Physical Activity Statistics. Using data from 'The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006–07 NHS costs'*.

CABESpace (2005). Decent Parks? Decent Behaviour? The link between the quality of parks and user behaviour.

Coombes, E., Jones, A.P. & Hillsdon, M. (2010). The relationship of physical activity and overweight to objectively measured green space accessibility and use. *Social Science & Medicine*, 70, 816-822.

Department of Health (2011). *Physical Activity Guidelines*.

Foster C, Hillsdon M, & Thorogood M (2004). Environmental Perceptions and Walking in English Adults. *Journal of Epidemiology and Community Health*, 58(11), 924-928.

GreenSpace (2007). *The park life report. The first ever public satisfaction survey of Britain's parks and green spaces*.

Natural England (2009). *Childhood and Nature: A Survey on Changing Relationships with Nature Across Generations*.

Nuffield Health (2013). *12 Minutes More… The importance of physical activity, sport and exercise, in order to improve health, personal finances and the pressures on the NHS*.

Maller, C. et al. (2009). *Healthy parks, healthy people.* The George Wright Forum.

Greenspace Scotland (2008). *Health Impact Assessment of green spa*

Scottish G*. Scottish Health Survey 2012 Summary*.

Scottish Government (2014). *Scottish Household Survey Report 2013*.

The King's Fund (2009).*The health impacts of spatial planning decisions*.

Van Dillen, S.M.E., De Vries, S., Groenewegen, P.P. & Spreeuwenberg, P. (2011). Greenspace in urban neighbourhoods and residents' health: Adding quality to quantity. *Journal of Epidemiology and Community Health*.

Ward Thompson, C., Roe, J., Aspinall, P., Mitchell, R., Clow, A. & Miller, D. (2012). More green space is linked to less stress in deprived communities: evidence from salivary cortisol patterns. *Landscape and Urban Planning,* 105(3), 221-229.

White, M., Alcock, I., Wheeler, B. & Depledge, M. (2013*). Would you be happier living in a greener urban area? A fixed effects analysis of panel data*. European Centre for Environment and Human Health.

Wolf, K.L. (2010). *Active Living - A Literature Review. In: Green Cities: Good Health*. University of Washington.