

Green Space Planning and Health: Research Summary

Public Health

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Abbreviations

BMI – Body Mass Index

GLUD – Generalised Land Use Database

IMD – Index of multiple deprivation

LSOA – Lower super output area

SES – Socioeconomic status

2 EXECUTIVE SUMMARY

Health

The presence of green spaces is associated with reduced all-cause mortality and reduced cardiovascular mortality. This is likely by reducing the risk of non-communicable diseases associated with reduced physical activity and mental stress. The most benefits are achieved through green space visibility and utility. Research highlights the importance of accessibility, size, quality and distance to such spaces to maximise use.

Quality

The features in a green space are important to support the physical and wellbeing outcomes of green spaces. Perceived quality is related to a variety of greenery types including trees, lawns, water and features that attract wildlife. Walking paths, signage and local services are also important. Variation in the number of perceivable landscapes provides a greater variety of benefits.

Perceived Safety

Perceived safety is an important motivator for green space visits and utility. Perceived personal visibility (openness) and the visibility of nearby dwellings contribute to feelings of natural surveillance. Therefore, dense, isolated areas with low visibility of local human activity and a lack of lighting may be associated with reduced safety. Similarly, a lack of maintenance and signs of vandalism contribute to feelings of anti-social behaviour and lower utility. Access to green spaces by safe road crossings is important to encourage utility.

Physical Activity

Access to larger, attractive green spaces is associated with more walking and recreational physical activity. Smaller green spaces may not be able to encourage physical activity. Local access (preferably <500m) is important for the frequency of visits. Shade provided by tree cover, benches and paths support recreational walking. High-quality green spaces are important contributors to child physical activity as variations in vegetation and elevation encourage play and may affect cognitive and motor skill development. Sports facilities and playground amenities also contribute to child and adolescent physical activity.

Wellbeing

Higher quality green spaces contribute to overall neighbourhood wellbeing. Streetscape scenery such as street trees and views of green spaces are associated with reduced stress.

Social Cohesion

Views of from home and perceived access to and utility of green spaces is related to social cohesion. This is enhanced by green space maintenance such as the absence of vandalism or litter. Green spaces provide areas for many types of social activities such as hosting local events, enjoyment of nature and sports activities.

Attractive areas with a variety of maintained greenery types enhance a sense of place and natural heritage.

Limitations

Research into health outcomes limited to measures of distance, proximity or visits if available. There are few green space intervention evaluations. Planning recommendations mainly come from qualitative literature. Current access and quality of green spaces in Hampshire unclear.

3 INTRODUCTION

Urban and natural green spaces are associated with a variety of positive health outcomes and alleviate the impact of urban stressors. Providing public open space for all, by sex, age, or disability, is part of the United Nations Sustainable Development Goals framework (11.7 UN (SDGs 2015)). There is currently no legislation in the UK for the provision of public spaces (The Parliamentary Office of Science and Technology 2016) although its conservation is encouraged by the Natural Environment White Paper (2012).

Despite this, green space has declined in many urban areas in England since 2000 (Dallimer, Tang et al. 2011). Public Health England recommends that healthy neighbourhoods have a high level of walkability, access to services and connectivity (Pinto, Bird et al. 2017). Providing green spaces and green walkways can help achieve these recommendations.

3.1 PURPOSE OF THIS REPORT

This document provides a brief state of the evidence for the association of green space and health with a particular focus on British studies. The districts of Hampshire provide proportionally low levels of urban green spaces. Although there is natural green space such as woodlands or grasslands, evidence suggests that these natural green spaces may be inaccessible to many residents, leaving them with no contact with this resource (Table 4).

This report also briefly investigates the research methods used to define green spaces and the importance of considering accessibility and quality of green space for health outcomes. This is concluded with a summary of practical guidelines for green space planning.

4 DEFINING GREEN SPACE

There is no formal definition of green space (Taylor, Hochuli 2017). Published research relies on definitions provided by land cover databases, local authority data (such as Bristol GIS database) and survey participant perceptions. Perceived observations of the environment by individuals have been found to match well to objective estimates and can serve as a proxy measure (Coldwell, Evans 2018). Land cover

databases are produced using satellite methods and definitions often change by year. Local authority data may use land cover data that is then supported by ground truth data¹.

Urban green space refers specifically to vegetated surfaces that are in contact with urban and suburban land. This may exclude country parks, woodlands, golf courses, and national parks that are not directly accessible to populated areas. This is an important consideration when using objective assessments of local green space as most studies are in relation to a participant's home at the postcode or small area level. Analyses at the small area level are prone to statistical fallacy in that they assume equal accessibility within the area and ignore the relevant accessibility of neighbouring wards.

4.1 LAND COVER DATA

Land cover databases for the UK classify green space into three main forms of grassland, woodland and arable land. Features such as parks and sports grounds are defined under land use characteristics and may not be identifiable by land cover data alone (Table 1).

Table 1 Categorising green space by land cover datasets

	CORINE 2012	LCM 2015	Description
Artificial	Urban Green Areas Sport, Leisure Facilities	Not defined – Classified under improved grassland and woodland.	Parks bordered by urban land. Camping, sports, golf, leisure parks.
Arable	Non-Irrigated Arable Land	Arable & Horticulture	Crops, nurseries, produce
Grass	Pastures	Improved Grassland	Grass, floral, may be used for grazing
Natural	Forestry (broad-leaved, coniferous, mixed), natural grassland, moors.	Land cover and land use are similar descriptions.	Trees, shrubs, minimally modified.

CORINE - Coordination of Information on the Environment

LCM – Land Cover Map

The CORINE Land Use Classification (Coordination of Information on the Environment) is a 44-class definition using satellite data, map references and aerial photography to produce land cover data at a scale of 1:100,000 (EEA ref). It provides full coverage of land use but only to larger spaces (25 ha) for 2012 (Figure 1). Its five main groups include artificial, agricultural, natural, wetlands and water bodies.

Land Cover Map data (LCM2015) is provided by the Centre for Ecology and Hydrology at a scale of 25m² per pixel. It does not include land use data. The

¹ Ground truth refers to visiting locations in person to confirm data provided by satellite measures.

Generalised Land Use Database (GLUD) is an Ordnance Survey sourced data that captures land use and land cover at a scale of 1:1250 /5m² (small area level) for England (Harrison 2006). GLUD and CORINE were found to capture green space quantity similarly with a reasonable agreement for health outcomes (Mitchell, Astell-Burt et al. 2011).

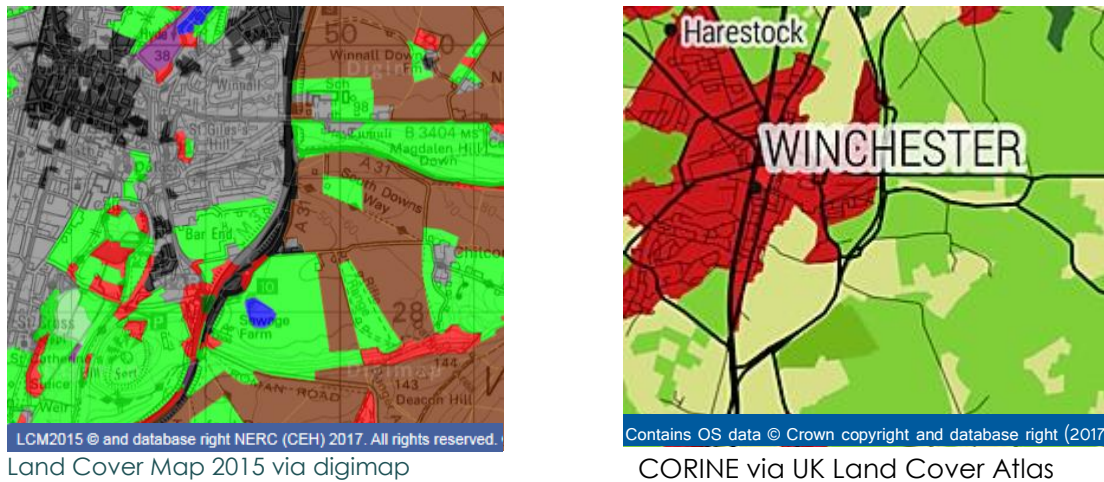


Figure 1 Examples of difference in scale provided by L and cover data.

4.2 ACCESSIBLE NATURAL GREEN SPACE STANDARD

Although the presence and visibility of green space alone appear to provide health benefits [section 5], stronger outcomes are likely obtained by visiting such spaces for recreation. Large natural areas may not be accessible to the public, particularly for urbanised communities. Recognising this issue, Natural England developed a recommended standard for accessible natural green space, defined as natural land that is also potential wildlife habitat (Box 1). Through contact with local agencies, trusts and relevant public bodies, the known accessibility of natural spaces is assessed by these standards.

Box 1 Accessible Natural Green space Standard (ANGSt) Recommendations for green space by Natural England, 2010.

Natural Green space should be:

- of at least 2 hectares in size, no more than 300 metres (5 minutes walk) from home;
- at least one accessible 20 hectare site within two kilometre of home;
- one accessible 100 hectare site within five kilometres of home; and
- one accessible 500 hectare site within ten kilometres of home; plus
- a minimum of one hectare of statutory Local Nature Reserves per thousand population.

4.3 QUALITY ASSESSMENT

The Neighbourhood Green Space Tool (NGST) and follow up Natural Environment Scoring Tool (NEST) are available to assess the quality of urban and natural green spaces using a point system (Gidlow, van Kempen et al. 2018, Gidlow, Ellis et al.

2012). A summary of the domains considered are in Table 2. Several audits have been performed to assess suitability across a range of green environments.

For example, in an assessment of Stoke-on-Trent using NGST, the lowest scores were found for aesthetics and natural features whilst highest scores were found for accessibility, utility and (lack of) incivilities. Although the differences were small, higher SES areas generally scored higher points than deprived areas (Gidlow, van Kempen et al. 2018).

Table 2 NEST tool domains summary

Domain	Examples of
Access	Pathways – access points, quantity, quality
Recreational Facilities	Quantity and quality – sports grounds, playgrounds, informal open spaces
Amenities	Benches, bins, toilets, cafes
Aesthetics	Natural - Foliage Artificial – Water features, artwork
Incivilities	Litter, vandalism, signs of substance abuse
Natural features	Blue space, views, forestry
Utility	Suitability for sports, walking, socialising, wildlife watching.

Source: (Gidlow, van Kempen et al. 2018)

5 OVERVIEW OF HEALTH OUTCOMES

Green space has been associated with health benefits for centuries but only in recent years has research begun to assess these outcomes empirically. Three recent systematic reviews, one focusing on urban green space and the others on generalised 'greenness' all found exposure to green space was significantly associated with reduced all-cause and cardiovascular mortality (Kondo, Fluehr et al. 2018, van den Bosch, Ode Sang 2017, Twohig-Bennett, Jones 2018).

A 2015 academic review suggested there was strong evidence for the association of objectively measured green space with perceived mental health (van den Berg, Wendel-Vos et al. 2015). A similar review found mostly significant reductions of poor mental health risk in relation to green space exposure (Gascon, Triguero-Mas et al. 2015). In children, a recent systematic review found that access to green space was associated with better child health, mental wellbeing and cognitive development (McCormick 2017).

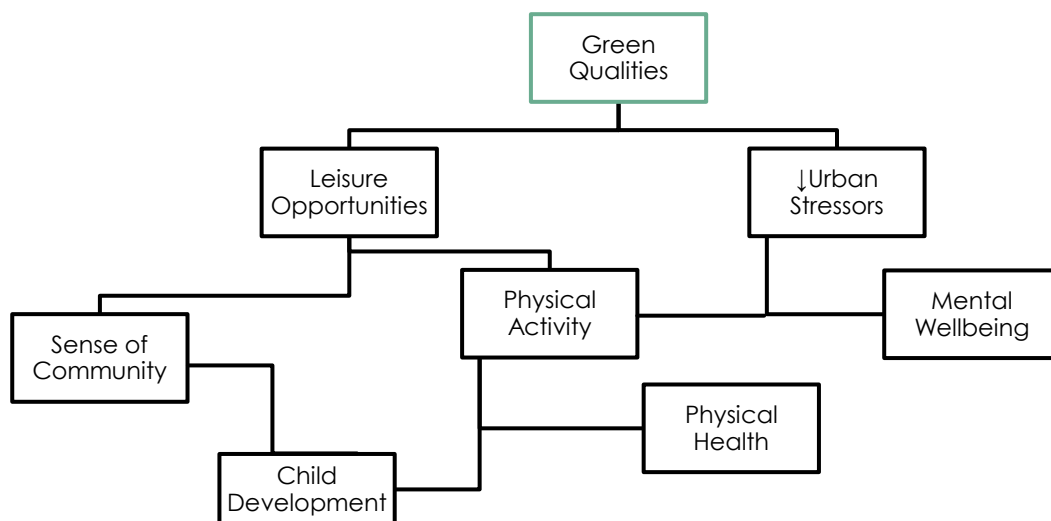
5.1 MECHANISMS

The pathways to these outcomes are currently unclear. There is strong evidence for the effect of green space for improving mood and reducing heat stress with weaker evidence for physical activity (van den Bosch, Ode Sang 2017). Theoretical pathways suggest that green space has restorative properties by reducing exposure to urban stressors such as pollution and noise. It provides space for people to be

active in a low-stress environment and provides areas for people to gather and meet with others, both important for wellbeing (Markevych, Schoierer et al. 2017) (Shanahan, Bush et al. 2016).

Figure 2 describes a theoretical pathway of the effects of green space qualities and health. Green spaces with adequate space or facilities promote physical activity in children and adults. Physical activity is a well-known promoter of both physical and mental health. Areas that promote physical activity also facilitate social interactions either through group activities, organised community events or simply viewing other members of the public. This facilitates a sense of community and a reduction in anti-social behaviour through interaction of a shared space. This combination of activity and social interaction promotes motor and social development in young children and maintains cognitive health in older adults. Green space also impacts health through the reduction of urban stressors, such as noise, heat, pollution, or unsightly architecture. This improves mental wellbeing that also impacts physical health and quality of life.

Figure 2 Theoretical Pathways to Health Outcomes



5.2 EVIDENCE LIMITATIONS

The current evidence base is limited by predominantly cross-sectional studies that limit conclusions on causality. For example, poor mental health may lead to fewer interactions with green space rather than green space exposure causing a reduced risk of mental health issues. Whilst objective quantity and distance have been assessed, there is limited work on the impact of quality and types of green spaces on health outcomes, particularly using quality assessment tools. Many of the benefits of green space may depend on the accessibility and utilisation of such spaces, which in turn depends on their features and qualities. This issue will be discussed later in this report after a review of the current research into green space health outcomes.

6 EVIDENCE FOR HEALTH OUTCOMES

6.1 PHYSICAL HEALTH

Studies using British data have supported the physical health outcomes found in systematic reviews utilising global studies, particularly for mortality.

Mortality

Generalised analyses of England using land use and cover data (2001, 2005) at the local authority level found that all-cause and cardiovascular mortality was lower in areas with a greater quantity of green space. The association was strongest in deprived areas (using IMD) (Lachowycz, Jones 2014, Gidlow, Smith et al. 2016), households with a low income (Mitchell, Popham 2008), and in men (Richardson, Mitchell 2010). A recent meta-analysis suggests the cardiovascular outcomes may be related to the significant improvement of green space on blood pressure, and heart rate (Twohig-Bennett, Jones 2018).

Type II Diabetes

Localised studies in Leicestershire (Bodicoat, O'Donovan et al. 2014) and Norfolk (EPIC) (Dalton, Jones et al. 2016) using land cover buffers around the home (3km and 800m) both found higher quartiles of green space was associated with reduced type II diabetes and a 19% lower risk of developing diabetes.

Cognitive Health

A recent study using the Lothian Birth Cohort (Scotland) (Cherrie, Shortt et al. 2018) found that using a 1500m home buffer, public park availability across the lifecourse was associated with an improved cognitive function in later life. This effect was strongest for women and those of low socioeconomic status. Cognitive health is supported by the social interaction and physical activity opportunities provided by green space.

Obesity

Systematic reviews of global studies suggest a weak and inconsistent association of BMI and green space in adults (Kondo, Fluehr et al. 2018, Lachowycz K., Jones 2011). However, a study of middle-aged adults using over 333,000 participants from UK Biobank suggested that the density of 'greenness' (private or public) was associated with lower BMI (Sarkar 2017). This was possibly due to higher greenness being associated with more active travel.

In a recent study of children, using the Millennium Cohort Study, low levels of local green space and lack of access to a garden were associated with childhood obesity in low education households. In higher educated households, living in a perceived poor quality neighbourhood area (assessed by surveyors for litter, traffic, vandalism) was associated with childhood obesity (Schalkwijk, van der Zwaard et al. 2018).

6.2 MENTAL HEALTH

The strength of the evidence for green space on mental health is generally considered weaker with mixed results for exposure of urban green space associated with reduced stress or depression (Kondo, Fluehr et al. 2018). There are numerous cases from the UK supporting a positive association in older adults and children thus the effect on mental health may be specific to certain population groups.

In a longitudinal study, it was found that moving home to greener areas was significantly associated with better mental health than those who moved to less green areas (Alcock, White et al. 2014). A ward level analysis of England found the mental health improvements associated with green space were age specific with the greatest benefits for men of younger age and women of older age (Astell-Burt, Mitchell et al. 2014).

6.2.1 Older adults

Localised analyses of Manchester, Blackburn, Leeds, Harrogate, Bristol and Bath found that visits to urban green space were associated with reduced anxiety (Coldwell, Evans 2018). Similarly, a ward level analysis of older adults (aged 74y) in Cambridgeshire, Nottingham, Newcastle and Oxford found that higher quartiles of green space were associated with reduced anxiety and co-occurrence of anxiety and depression (Wu, Prina et al. 2015).

6.2.2 Children

In children aged 3-7 years from the Millennium Cohort Study, access and utility of private gardens and the percentage of local green spaces were associated with reduced conduct, peer, and hyperactivity problems with fewer emotional problems in those of low SES (Flouri, Midouhas et al. 2014). Perceiving green space to be at least a 20-minute walk in parents was associated with increased screen time and worse mental health in children (Aggio, Smith et al. 2015).

In boys aged 10-12 from Scotland with extreme behaviour problems, forest settings allowed these children to develop more natural behaviours through exploration and social cohesion (Roe, Aspinall 2011).

7 MECHANISMS OF ACTION

7.1 PHYSICAL ACTIVITY

7.1.1 Mechanism

Meeting the physical activity guidelines is associated with reduced risk of cardiovascular disease, diabetes, high blood pressure, and certain cancers (Lee, Shiroma et al. 2012). In older adults, physical activity can help maintain functional movement. As well as green space providing open spaces to be physically active in, 'green exercise' may provide additional effects for stress reduction and mood

(Thompson Coon, Boddy et al. 2011). Green spaces provide an important source of active play in children (Brockman, Fox et al. 2011).

However, the overall evidence of the effect of green space on physical activity is mixed depending on the target group and physical activity outcomes such as meeting physical activity requirements or frequency of engagement. This is likely due to the need for individuals to visit such spaces regularly which ties into issues of motivation, perceived quality and accessibility (Kaczynski, Henderson 2008).

7.1.2 Evidence

Individuals who visited their local green spaces at least once a week were four times more likely to meet the physical activity guidelines compared to those who never visited (Flowers, Freeman et al. 2016). The Active People Survey found the local quantity of green space was associated with the number of days walked per week, particularly for recreation (Lachowycz, Jones 2014). A localised study of Bristol suggested that meeting physical activity requirements was most associated with visits to 'formal park' with closer distance associated with greater frequency of use (Coombes, Jones et al. 2010).

Using the MENE Survey, the quantity of green space was associated with meeting physical activity requirements but only in dog walkers (White, Elliott et al. 2018, Christian, Westgarth et al. 2013). In Health Survey for England, individuals living in the greenest quintiles of England were found to engage in more physical activity, but from gardening and DIY rather than recreational activity (Mytton, Townsend et al. 2012). This suggests an important role of private gardens.

A study in Canada found that the number of parks within a 1km buffer of the home was more important than the closest distance for physical activity (Kaczynski, Potwarka et al. 2009). Proximity to larger green spaces encouraged more walking (Sugiyama, Francis et al. 2010). However, an Australian longitudinal study found that local green space was associated with maintenance of walking but not initiation of walking behaviour (Sugiyama, Giles-Corti et al. 2013).

7.1.3 Older Adults

A cross-sectional survey of British adults aged over 65 years found that the quality of footpaths was associated with walking behaviour (Sugiyama, Thompson et al. 2009). However, a national study of adults aged 69+ years found that for moderate physical activity the social environment was more important than the physical environment in this age group (Hawkesworth, Silverwood et al. 2018).

Using a 400m buffer in the Welsh Caerphilly Prospective study, a greater quantity of green space was associated with more physical activity participation by older men (Gong, Gallacher et al. 2014).

7.1.4 Children

In the Bristol PEACH cohort of 10-11 year olds, a GPS based study found that time spent in green space contributed to a third of moderate physical activity on weekdays and between 40-60% on weekends (Lachowycz, Jones et al. 2012, Wheeler, Cooper et al. 2010).

7.2 STRESS REDUCTION AND WELLBEING

7.2.1 Mechanism

The nearby presence of green space supports wellbeing by reducing the climatic and visual stressors of urbanisation (van den Bosch, Ode Sang 2017). Prolonged stress has physiological effects on the brain and causes dysregulation of systems in the body (McEwen 2008). Natural environments are associated with restorative effects from mental fatigue, reduced cognitive function and stress through the recovery of physical and emotional resources (Berto 2014). Most forms of nature seem to be restorative except for enclosed spaces, such as those found in woodlands, which may induce safety fears (Gatersleben, Andrews 2013).

7.2.2 Outcomes

A UK wide survey using mobile GPS data found that participants reported greater levels of self-perceived happiness when located within any green or natural space compared to urban environments (MacKerron, Mourato 2013). The evidence is strong to support improvements in mood but it is unclear if this translates into the long-term mental health benefits as previously described. A cross-sectional study suggests that the benefits to mental and social health are more associated with regularly visiting green spaces compared to the overall amount of time spent in green spaces (Cox, Shanahan et al. 2017).

The effects on mood have been observed in the short term. A survey of visitors to National Trust sites in East England found improved self-reported wellbeing and self-esteem after their visit compared to pre-visit (Barton, Hine et al. 2009). A survey of walkers involved in the Walking for Health Project found that group walks in farmland and green corridors were associated with reduced perceived stress compared to walks in urban areas (Marselle, Irvine et al. 2013).

7.2.3 Wellbeing

In an analysis of six urban English cities, visits to the countryside were associated with life satisfaction with visits to urban green space and countryside associated with mental wellbeing (Coldwell, Evans 2018). The distance, perceived safety and pleasantness of green space was associated with quality of life in adults aged 65+ years (Sugiyama, Thompson et al. 2009).

In a national study of England, the amount of green space was associated with self-reported health in urban communities of any income. However in rural areas, only those of low income benefited from more green spaces (Mitchell, Popham 2007).

7.2.4 Urban Deprived

Ward level analyses of unemployed participants in deprived areas of Dundee found that greater quantity of green space was associated with lower perceived stress and objectively measures cortisol levels (Roe, Thompson et al. 2013). Similarly, in a study of urban deprived areas of Edinburgh and Dundee, the amount of green space around the home and access to a garden or allotment were associated with reduced self-reported stress (Ward Thompson, Aspinall et al. 2016). Even just having green views from the home was associated with better self-reported health.

7.3 SOCIAL INTERACTION

Isolation and loneliness have been linked to increased risk of mortality (Holt-Lunstad, Smith et al. 2015). As urban densification increases, open green spaces may provide important areas for communities to gather and interact with each other (Baur, Gómez et al. 2013). In a Welsh longitudinal study, a high level of social cohesion was found to protect deprived communities from poor mental health (Fone, White et al. 2014). In an online UK survey, it was found that nearby views of nature were associated with wellbeing in those with poor social connections (Cartwright, White et al. 2018).

In a study of new housing developments in Perth, Australia, high-quality green spaces were perceived to contribute to a sense of community regardless of whether the green space was used (Francis, Giles-Corti et al. 2012). Qualitative work of Inner Manchester found that the quality of parks combined with the local social cohesion was supportive of social interactions in these green spaces (Kazmierczak 2013).

8 GREEN SPACES IN HAMPSHIRE

8.1 CORINE LAND COVER

Using CORINE 2012, Table 3 describes the percentage of green spaces in Hampshire districts. The data suggest that East Hampshire and the New Forest are well served by grasslands and natural forestry with a large proportion of rural residents.

Winchester, the Test Valley and Basingstoke also serve a number of rural residents but with larger proportions of arable land, which may not be utilisable green space. Hart and Eastleigh, whilst more urbanised provide high levels of grass and woodlands compared to the size of their rural population. The urbanised districts of Havant, Rushmoor and Fareham are served by some grass or woodlands with Rushmoor also served well by urban green spaces. Gosport is the least well-served district with no natural or arable green space.

Table 3 Composition of Rural, Green and Natural Space in Hampshire Local Authority Districts using CORINE

(see Table 1 for land cover definitions)

Local Authority Districts	Total Population	Rural	Artificial	Agricultural		Natural	Total %	
		Percentage of residents living within rural including hub towns %	Urban Green Areas %	Sport, Leisure Facilities %	Non-Irrigated Arable Land %	Pastures %		Forestry, Moors %
East Hampshire	115,608	82.6	-	1.3	41.5	33.5	17.3	93.6
Winchester	116,595	57.5	-	1.7	55.7	29.6	8.3	95.3
New Forest	176,462	45.3	-	1.3	16.0	27.0	45.5	89.8
Test Valley	116,398	36.5	-	1.5	52.8	29.6	9.5	93.4
Basingstoke & Deane	167,799	35.9	<1%	2.5	59.6	20.1	9.6	91.8
Hart	91,033	30.3	-	2.6	34.2	24.7	23.1	84.6
Eastleigh	125,199	9.4	<1%	2.1	6.6	42.2	4.7	55.6

Havant	120,684	1.6	-	4.0	11.7	19.6	5.5	40.8
Rushmoor	93,807	1.5	6.3	5.9	1.3	1.1	18.2	32.8
Fareham	111,581	0.6	-	2.0	28.7	18.4	4.2	53.3
Gosport	82,622	0.3	9.4	3.8	-	-	-	13.2

Source: Urban-Rural Classification (2011 Census) – ONS. Local authority data – UK Land Cover Atlas (Rae 2017)

8.2 ANGSt

Table 4 describes the results of a review for Hampshire districts in 2007 (McKernan, Grose 2007). It suggests that Havant, New Forest and Hart are the most well served by accessible natural green space. Basingstoke, Winchester and the Test Valley show a small percentage of residents that have no access to natural green spaces. This supports the observations seen in Table 3, that arable land may not be accessible space.

Table 4 Hampshire Local Authority Districts Percentage of Households meeting ANGSt Recommendations

Local Authority Districts	Households	Meeting All ANGSt %	Meeting None %	Within 300m of 2ha+ site (0.02km ²) %
Havant	51,318	30	0	32
New Forest	77,324	22	0	24
Hart	35,638	22	0	46
Fareham	45,448	19	0	30
Eastleigh	49,880	17	0	36
Gosport	35,321	17	0	18
East Hampshire	46,763	13	1	22
Test Valley	47,088	6	11	24
Basingstoke & Deane	65,054	6	14	19
Winchester	46,226	3	12	16
Rushmoor	35,542	3	0	4

Source: (McKernan, Grose 2007) – Defined by natural green spaces, green corridors, country parks.

8.3 NATIONAL CHARACTER AREA PROFILES

Management of natural green spaces involves a less intensive approach, retaining heritage features and biodiversity whilst allowing the public to gain benefits from access to natural landscapes. Natural England has included a brief overview of identified issues for natural green areas in its National Character Area Profiles (Table 5). Overall recommendations include the maintenance of public rights of way and improving non-car dependent access.

Table 5 Hampshire National Character Area Profiles and Recommendations

Area	Public access	Recreational areas	Recommended Promotion/Action	Issues
South Downs	12%	National Park Public rights of way	Maintain and improve rights of way and open access land.	High car dependency for access. New developments

		National Trail Open Access land	Provide alternative transport options to reduce car dependency. Consider new green space outside the national park to reduce visitor pressure.	may provide unwanted traffic, noise, air and light pollution.
New Forest	42%	National Park	Consider green infrastructure in South Hampshire to reduce visitor pressure.	Management of visitor impact on natural habitats. Intrusion from urban developments and main roads.
Hampshire Downs	2%	Rights of way National Park	Improve public transport access and usage issues for nearby Andover, Basingstoke & Winchester. Improve awareness of available facilities.	Need to respect private land. Intrusion from new developments.
South Hampshire Lowlands	8%	Public Rights of way Woodlands Manor Farm Country Park Nature Reserves	Encourage use of the Forest of Bere for adventure play. Consider planting new woodlands to buffer the effect of new housing and transport developments.	New housing developments may impact sensitive biodiversity – alternative quality greenspace may be required.
Isle of Wight	6%	Public Rights of way Open access land	Maintenance and enhancement of rights of way. Preservation of dark sites.	Need for sustainable transport options to reduce environmental impacts.

Source: Natural England 2014

<https://www.gov.uk/government/publications/national-character-area-profiles-data-for-local-decision-making/national-character-area-profiles>

8.4 MENE SURVEY

The MENE survey (Monitor of Engagement with the Natural Environment) 2015/16 suggests in Hampshire the most commonly visited green spaces were green paths, woodlands and urban parks (Figure 3).

The most common reason reported for Hampshire visits to all green destinations was for walking with or without a dog (MENE). Other reasons included horse riding, wildlife watching and playing with children.

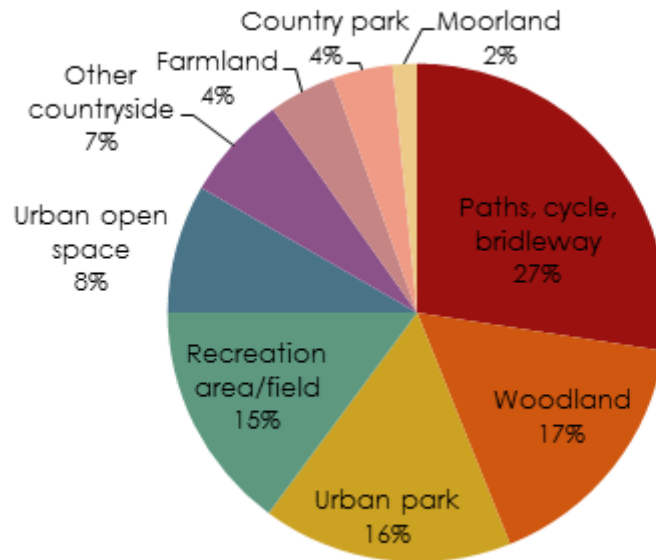


Figure 3. Percentage of participants' visitations in the past 7 days (weighted data). MENE Survey 2015/16 Hampshire

9 VISITING GREEN SPACE

Surveys suggest there are on average 1.23 billion visits per year to natural environments in England (White, Elliott et al. 2016).

9.1 REASONS FOR VISITING GREEN SPACE

Qualitative surveys suggest that individuals visiting green space are motivated by its green related qualities, feelings of improved wellbeing, recreational walking and for child activities (Dallimer, Davies et al. 2014, Irvine, Warber et al. 2013). In Scotland, green spaces were valued for their nature-based activities, relaxation and wildlife observation (Schmidt, Walz et al. 2016). The frequency of green space visits was associated with individual attraction and identity with natural environments in addition to their perceived quality (Flowers, Freeman et al. 2016).

In an interactive online survey from Finland, the most popular qualities of green space cited were its aesthetic attractiveness followed by ease of walking/cycling, the presence of nature and calmness. The most cited negative qualities were of the opposite nature - unattractive aesthetics, feelings of busyness and feeling socially insecure (Kyttä, Broberg et al. 2013).

Swedish research found eight dimensions important to the restorative nature of green spaces (Grahn, Stigsdotter 2010). Whilst the first items are especially important for stressed individuals, items further down the list are valued by those who are maintaining health. See Box 2.

Box 2 Features of green space associated with restoration (Grahn, Stigsdotter 2010).

1. Safety – Ability to relax and let children play without fear.
2. Peaceful – Feeling undisturbed by urban interruptions such as traffic or incivilities.
3. Natural – As though formed in nature.
4. Place – Feeling like a distinct area separate from everyday life.
5. Diversity – Rich in different species of plant and animal life.
6. Historical – A sense of place in tune with culture.
7. Purpose – A reason to visit for green views and sense of community.
8. Social – A place to gather for recreational and social activities.

9.2 BALANCING ACCESS AND QUALITY

Several studies in this report have suggested that simple objective measures of size or distance to the participant's home are related to health outcomes even without confirming if such individuals utilise these green spaces. However, the issue of utilisation likely contributes to the mixed findings found for physical activity and mental health. The use of green spaces relates to numerous factors including individual and community contexts, features of the green space and climate (Figure 4).

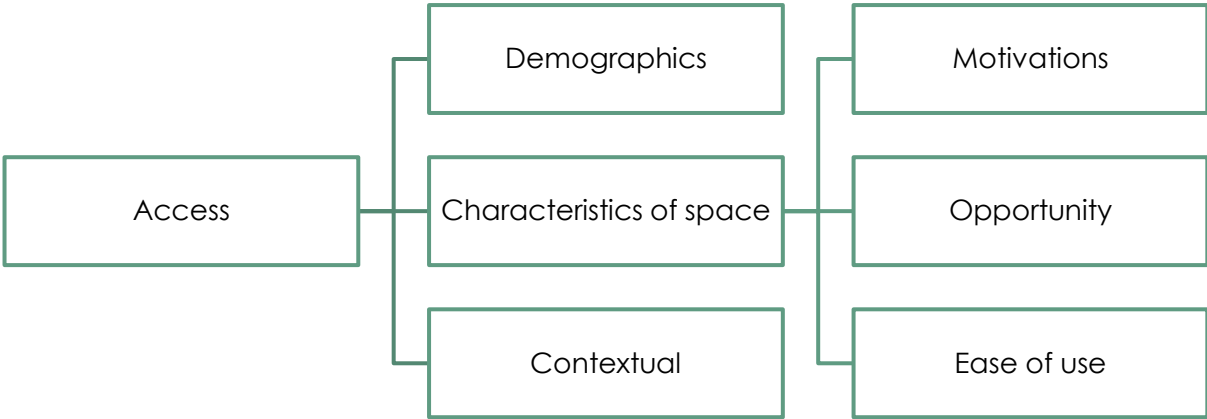


Figure 4 Theoretical moderating factors in relation to utilising green spaces

Adapted from: (Lachowycz, Jones 2013). Access refers to distance to and quantity of greenspace in the neighbourhood. Demographics refer to individual factors such as age, gender ethnicity, income. Contextual factors include weather, cultural norms, social cohesion, neighbourhood connectivity. Green space characteristics include facilities, quality, safety. Motivations include awareness of green space and purpose (dog walking, active transport, play, socialising). Opportunity includes time use, personal mobility, access to transport. Ease of use includes safety of equipment, maintenance of paths and overgrowth.

Perceived quality and safety of green spaces appear to be particularly important even when green space is within walking distance (Ekkel, de Vries 2017). In Sheffield, the use of green space was associated with closer distance, but a reduced frequency of visits was associated with the perceived level of neglect (Barbosa, Tratalos et al. 2007). Similar results were found in Bristol where perceived lower access, safety and greater distance was associated with less frequent visits to green spaces (Jones, Hillsdon et al. 2009).

In a qualitative study in Glasgow, walkability of urban green spaces was related to perceived social cohesion and risk of anti-social behaviour (Seaman, Jones et al. 2010). In an American study, high road traffic speeds and poor connectivity to parks were found to be related to reduced physical activity in adults (Kaczynski, Koohsari et al. 2014).

9.3 INEQUALITIES IN ACCESS

The percentage of green space in a British cohort was found to be lower in deprived neighbourhoods as assessed by the Carstairs Index (Chaparro, Benzeval et al. 2018). Localised analyses of Leicester and Bradford also found that low income and ethnic minorities had lower access to green space (Ferguson, Roberts et al. 2018, Comber, Brunsdon et al. 2008).

A recent study of the MENE survey found that infrequent contact with green space was associated with higher area deprivation. (Boyd, White et al. 2018). Low users (<1 visit per month) were more likely to be low SES individuals, in poorer health and ethnic minorities. Deprived individuals were found to have less interest in visiting green space (Roe, Aspinall et al. 2016).

Yet individuals of low SES often receive the most health benefits from green space visits due to their inequitable levels of chronic health issues (Marmot, Allen 2014). For example, sufficient green space in a deprived neighbourhood may reduce cardiovascular mortality inequalities to the same level as a non-deprived (Mitchell, Popham 2008). This report previously noted how green space may reduce stress in deprived communities (Roe, Thompson et al. 2013).

9.4 PROMOTING GREEN SPACE ACCESS

A systematic review found that increased use of and physical activity in urban green spaces were associated with physical renovations, particularly when combined with a physical activity media promotion (Hunter, Christian et al. 2015). Providing walking groups may reduce perceived safety fears that restrict lone walkers (Dawson, Hillsdon et al. 2007).

9.4.1 Promoting Green Space in Stoke-on-Trent (ProGreSS)

ProGreSS was an 18-month project to regenerate green space in a deprived urban area of Stoke-on-Trent. Prior to intervention, residents were intimidated by potential antisocial behaviour and inadequate facilities. Intervention included a series of onsite community activities, improvement in sight-lines, development of a natural play area. After improvements, perceptions of anti-social behaviour reduced and objective quality increased. However there were no direct observational increases in use, possibly due to a focus on younger people.

9.5 WOODLANDS

Woodlands may be seen as inaccessible for those concerned with safety, particularly lone women, ethnic minorities and young people (Thompson, Aspinall et al. 2008). The most important predictor of woodland use as adults may be exposure

in childhood. Organised activities to encourage exploration of local woodlands have been shown to increase confidence in accessing woodlands (O'Brien 2005).

9.5.1 Active England Woodlands

Active England Woodlands was a restoration project of five forests in Kent, Devon, Derbyshire, Nottinghamshire and Wiltshire aimed at increasing physical activity particularly in disadvantaged and minority groups (Morris, O'Brien 2011). Three of the sites had improvements in pathways and facilities with all sites involved in the promotion of their use and organised activities. It was found that all projects encouraged an increased number of visitors including women, young people and ethnic minorities but less so from low-income groups. Users reported improved fitness and wellbeing particularly from the interaction of other people from organised activities.

9.5.2 Woods In and Around Town (WIAT) programme, Glasgow

The WIAT programme was an intervention to make local woods feel safer and more accessible to deprived communities in Glasgow (Ward Thompson, Roe et al. 2013). This involved removing litter and signs of vandalism whilst improving pathways and signage. Promotional activities were used to increase awareness of these changes. Over time, residents felt their quality of life had improved with significant increases in woodland use and perceptions of its safety (Figure 5).

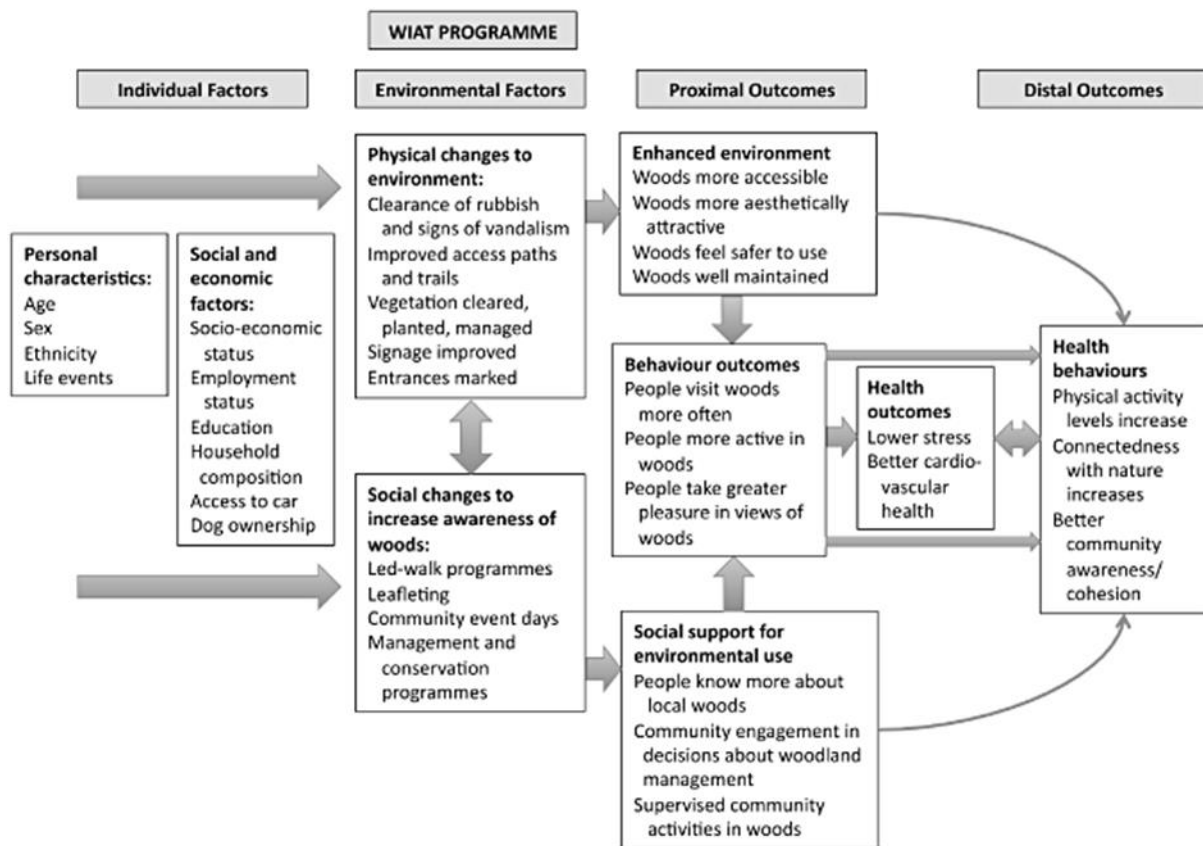


Figure 5 Theoretical framework for the impact of WIAT

Source: (Ward Thompson, Aspinall 2011)

10 GREEN SPACE PLANNING

Currently, there is limited guidance for local authorities in the UK on how to best modify and implement green spaces for health (Pinto, Bird et al. 2017). Using the evidence collected in this review, a summary of recommendations has been produced in Table 6.

Table 6 Summary of planning recommendations for urban and semi-urban green space.

With reference to (Douglas, Lennon et al. 2017, Gidlow, van Kempen et al. 2018, Van Hecke, Ghekiere et al. 2018, Ives, Oke et al. 2017, Ekkel, de Vries 2017)

Aim	Consider	Detail	Health Basis
Contact	<ul style="list-style-type: none"> I. Size II. Proximity 	<p>All residents should be a 5 minutes network walk (400-800 meter distance) to a source of green space. This should be irrespective of socioeconomic status, ethnic group or level of rurality.</p> <p>Local green space should be on average 1 hectare. Active recreation may require larger spaces.</p> <p>Further research is needed to understand the effective size and distance of green space for health outcomes.</p>	Promotes Use
Maximise Exposure	<ul style="list-style-type: none"> I. Location II. Views of 	<p>Locate new spaces near street networks that will capture opportunistic walkers.</p> <p>Locate for optimal visibility from residents.</p> <p>Consider the impact of local noise on placement.</p>	Promotes Use Relaxation
Accessibility	<ul style="list-style-type: none"> I. Number of entry points II. Potential hazards to access 	<p>Place convenient crossing points to provide access from busy roads.</p> <p>Include multiple access points to increase equity of surrounding users.</p> <p>Provide accessible public transport stops at remote spaces. Consider sufficiency of on/off road car parking. Install bike racks.</p>	Promotes Use Removes barriers
Social Engagement	<ul style="list-style-type: none"> I. Seating II. Mixed use 	<p>Provide seating areas for socialising and rest.</p> <p>Use native plants and natural heritage aspects to encourage a sense of community cohesion.</p>	Sense of community

		Sites with a variety of uses or natural attractions are popular as social locations and incidental exercise.	
Pathway design	<ul style="list-style-type: none"> I. Quantity II. Condition III. Aesthetics 	<p>Avoid trip hazards, remove overgrown vegetation.</p> <p>Provide dual use pathways for walkers and cyclists.</p>	Physical Activity
Perceived safety	<ul style="list-style-type: none"> I. Natural Surveillance II. Signage 	<p>Plan areas to provide natural surveillance (sight-lines). Use streets as boundaries as opposed to fencing.</p> <p>Place paths away from secluded areas</p> <p>Implement signage to increase the perceived safety of more secluded areas. This includes information and directional signage where required.</p>	Removes barriers
Barriers to use	<ul style="list-style-type: none"> I. Incivilities II. Facilities III. Quality 	<p>Provide bins for litter and dog mess.</p> <p>Remove graffiti and vandalism.</p> <p>Develop maintenance programs to manage playground safety and green over growth. This also contributes to feelings of safety.</p>	<p>Removes barriers</p> <p>Improves sense of community</p>
Recreational use	<ul style="list-style-type: none"> I. Play equipment for children II. Sports for older adults III. Informal adult sport IV. Mixed use 	<p>Sites should facilitate mixed-use to support a variety of ages.</p> <p>Include areas with mixed landscaping for sources of play, exploration and nature observation.</p> <p>Provide winding pathways with different elevations to increase walking benefit and novelty.</p> <p>Toilet facilities may be required at larger sites.</p>	Physical Activity

Landscaping	<ul style="list-style-type: none"> I. Trees II. Bushes III. Aesthetics 	<p>Implement trees or suitable structures as sources of shade.</p> <p>Include mixed planting, formal planting and creative design to facilitate relaxation. Park aesthetics could include local artworks.</p> <p>Provide facilities in keeping with natural aesthetics. Attraction is important for utility.</p>	<p>Promotes use</p> <p>Relaxation</p>
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10.1 SIZE AND PROXIMITY

There are no official recommendations for distance and size requirements for green space access. Fields in Trust, a charity endorsed by Sport England, has composed its own list of guidelines for the provision of green open spaces (Table 7). However, evidence from the literature is mixed (Browning, Lee 2017). Whilst there are studies showing the importance of green space proximity, this may be moderated by its size, quality, features and user group (Foster, Hillsdon et al. 2009, Hillsdon, Panter et al. 2006). A systematic review found that the greatest physical health effects were found with buffer sizes between 500- 999 meters around the home. This suggests that green spaces in the broader neighbourhood are as important as those close to home (Browning, Lee 2017).

Table 7 Fields in Trust Guidelines

Type	Size (hectares per 1,000 population)	Distance
Amenity Green Space	0.6	480m
Parks and Gardens	0.8	710m
Natural and Semi-Natural	1.8	720m

Source: (Fields in Trust 2015)

10.2 QUALITY

Review of qualitative research agreed with evidence suggested so far that utility of an urban park was related to proximity, aesthetics, amenities, maintenance and safety (McCormack, Rock et al. 2010, Salvo, Lashewicz et al. 2018). See Box 3.

Box 3 Summary of important green space qualities (McCormack, Rock et al. 2010).

<ul style="list-style-type: none"> • Features: recreational facilities, natural trails, amenities, shade. • Condition: Maintenance, cleanliness. • Accessibility: Proximity, public transportation, near high foot traffic. • Aesthetics: Wildlife, trees, natural features, fresh air, quiet. • Safety: Undesirable users, lack of lighting, secluded paths, debris, traffic. • Social environment: Festivals, socialising, being in the community.
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10.3 PRACTICAL FEATURES

Using guidance from developed frameworks in Australia (Parks and Leisure Australia 2013), a practical example of green space recommendations is provided in Table 8. Performing a needs assessment is best practice over adhering to standards.

Table 8. An example of recommended green space features.

Minimum	+ Accessibility	+ Amenities	+ Recreation	+ Aesthetics
<ul style="list-style-type: none"> • Open area for informal activity. • Seating. 	<ul style="list-style-type: none"> • Pathways suitable for walking and cycling with 	<ul style="list-style-type: none"> • Litter bins. • Picnic tables. • Bike storage. 	<ul style="list-style-type: none"> • Playground equipment. • Natural play design. 	<ul style="list-style-type: none"> • Art installations.

<ul style="list-style-type: none"> • Shade planting. 	connective features. <ul style="list-style-type: none"> • Ability to park a car nearby. • Signage. 		<ul style="list-style-type: none"> • Ball game space. 	
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10.4 SUBGROUP NEEDS

Individuals with poor mobility such as young children, those relying on public transport and older adults are more likely to value closer access to green space than adolescents and car users (Gong, Gallacher et al. 2014, Salvo, Lashewicz et al. 2018).

Urbanisation, safety fears and indoor recreation may be reducing child contact with natural environments (Strife, Downey 2009). Children and adolescents require stimulating environments to encourage physical activity (Nordbø, Nordh et al. 2018).

Older adults value aesthetics, signs of maintenance, toilets and cafes and a lack of deterrents such as traffic, litter or signs of crime (Aspinall, Thompson et al. 2010, Sugiyama, Thompson et al. 2009). Older adults living in deprived areas may feel discouraged from using spaces that they do not perceive to be safe or accessible (Mitchell, Popham 2007).

Stressed individuals prefer using their green spaces to rest, animal or walking-related activities (Stigsdotter, Grahn 2011).

11 CONCLUSION

Research suggests that green spaces and natural areas improve our physical health and mood. With the increasing pressures of urbanisation and modernity on mental wellbeing, it is important to preserve our green spaces as welcome to all. Health impacts of green space may be particularly important for vulnerable communities that include larger amounts of low income or elderly residents. Recommendations include increasing the visibility of green space and promoting accessibility. Green spaces are judged by their quality with lower perceived safety in spaces with low maintenance. Incorporating features that encourage play in children but also support walkability in older adults encourages use in target groups. Currently, the evidence base is too limited to make comments on an effective dose of green space exposure, features and frequency of visits on health outcomes.

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13 APPENDIX

Search strategies involved the use of PubMed (MEDLINE) and Web of Science for published journal articles. CitNetExplorer was used to identify evidence linkage between published articles.

Tl=(green OR open OR nature OR park OR play OR environment OR environments OR woodland OR outdoor OR woodlands OR greenspace OR environmental OR natural OR parks OR space OR countryside OR dog OR forest OR greenness) AND TI=(health OR stressed OR older OR childhood OR activity OR values OR activities OR social OR walking OR recreation OR accessibility OR "use" OR access OR stress OR quality OR sociocultural OR accessible OR community OR wellbeing OR restorative OR proximity OR active OR inactivity OR emotional OR cognitive OR mental OR overweight OR adiposity OR obesity OR diabetes)