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The health benefits of walking in greenspaces of high natural and heritage value

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Lifestyles are increasingly characterised by sedentary behaviour, obesity problems, stress, mental ill-health and disconnection from nature. However, contact with nature has been shown to improve psychological health by reducing stress, enhancing mood and replenishing mental fatigue. In addition to providing a range of environmental services, greenspaces provide opportunities and incentives for 'green exercise' such as walking, cycling or horse riding. Visitor numbers indicate that many people already benefit from spending time in greenspaces, but little is known about the immediate impact of an acute exposure on their health and wellbeing. This study focuses on evaluating changes in self-esteem and mood after walking in four different National Trust sites of natural and heritage value in the East of England. The standardised measures of both self-esteem and mood were administered immediately pre- and post-activity. Self-esteem scores for visitors leaving the sites were significantly higher than those just arriving and overall mood also significantly improved. Feelings of anger, depression, tension and confusion all significantly reduced and vigour increased. Thus, the environment plays an important role in facilitating physical activities and helping to address sedentary behaviours. Walking, in particular, can serve many purposes including exercise, recreation, travel, companionship, relaxation and restoration. However, walking in greenspaces may offer a more sustainable option, as the primary reward is enhanced emotional wellbeing through both exposure to nature and participation in exercise.

Keywords: greenspaces; natural environments; self-esteem; mood; walking; physical activity

1. Introduction

Lifestyles are becoming increasingly characterised by sedentary behaviours, obese statures, stressed states, mental ill-health and a growing disconnection from nature. The health status of the UK population has become a pressing governmental concern, and promoting increased participation in physical activities is now a public health priority. Participation in regular physical activity imparts physical, social and mental health benefits (Sport England 2002). It reduces the risk of several chronic diseases such as cardiovascular disease, type II diabetes, cancer, hypertension,

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obesity, osteoporosis and depression, the most prevalent mental illness in the UK (Willis and Liesl 2005; Warburton et al. 2006).

Physical activity levels have dropped with less than 40% of men and 28% of women in England (NHS Information Centre 2008) not meeting UK Government guidelines of 30 min or more of moderate or vigorous activity on at least 5 days per week (DH 2004). Jobs themselves have become less physical, people are more likely to take the lift than walk the stairs, and adults and children are more likely to travel to work or school by car than to walk or bicycle. These low levels of walking are a major contributor to the increase in physical inactivity. When comparing the percentage of children aged 5–10 years who walked to school, during 1985–1986 (67%) to figures collated in 2006 (52%) it is evident that the proportion decreased by 15%. In addition, the percentage of primary school children travelling by car increased from 22 to 41% during the equivalent period (Department for Transport 2006). In the UK, the distance walked per year by each individual has fallen from 410 km year⁻¹ in 1975–76 to 323 km year⁻¹ in 2006 (Department for Transport 2006).

Walking is the most preferred outdoor recreational activity for reaching recommended physical activity targets (Morris and Hardman 1997; Ball et al. 2001; Office for National Statistics 2003). It is a natural activity, which is inexpensive and requires no special skills or equipment. It is also convenient, can be routinely incorporated into daily lifestyles and is self-regulating in terms of intensity, frequency and duration (Ball et al., 2001). There are many health benefits associated with walking which are apparent in both the short-term (acute effects of exercise) and long-term (chronic effects) from cumulative adaptations following habitual activity over a period of weeks or months. Walking increases aerobic performance and trunk muscle endurance (Parkkari et al. 2000). It also improves body composition and increases serum high-density lipoprotein (HDL) cholesterol levels (Parkkari et al. 2000). It increases flexibility and stability of joints (Ball et al. 2001), helps prevent cardiovascular disease (Albright and Thompson 2006), obesity, type II diabetes (Smith et al. 2007), osteoporosis, metabolic disorders (Boardley et al. 2007), hypertension (Kokkinos et al. 2001) and mental ill-health (Larun et al. 2006).

There is also increasing evidence to show that regular contact with nature and greenspace positively affects physical health and mental well-being (Frumkin 2003; St Leger 2003; Pretty 2004; Maas et al. 2006; Pretty et al. 2006; Van den Berg et al. 2007). This includes exposure to all types of greenspaces, from deep wilderness, open countryside, forests, woodlands, national or country parks, nature or wildlife reserves, urban parks, grasslands, hills and valleys to domestic gardens and allotments. Three key theories [Biophilia hypothesis, (Wilson 1984); Attention restoration theory (ART) (Kaplan and Kaplan 1989) and Psycho-evolutionary stress reduction theory (PET) (Ulrich 1981)] are proposed to offer explanations concerning the human relationship with nature, which all focus on the restorative effects of the natural environment. The 'biophilia hypothesis' suggests an innate evolutionary basis to the relationship and recognises the basic human dependence and preference to affiliate with nature (Wilson 1984; Kellert and Wilson 1993; White and Heerwagen 1998). ART (Kaplan and Kaplan 1989) focuses on the cognitive changes associated with restoration, while PET argues that restoration is derived from reduction of stress, and acknowledges affective or emotional changes (Ulrich 1981). However, all theories agree that nature contributes to enhanced well-being, mental development and personal fulfillment.

An increasing number of studies report that contact with greenspace improves psychological health by reducing stress, enhancing mood and offering a restorative environment which enables people to escape from the stresses of urban life (Ulrich 1981; Kaplan and Kaplan 1989; Hartig et al. 1991, 2003; Ulrich et al. 1991; Van den Berg et al. 2003; Louv 2005; Priest, 2007; Van den Berg et al. 2007). In today's modern societies, where mental ill-health is more commonplace (WHO 2001; Gilbody 2004) and costly to society (The Sainsbury Centre for Mental Health 2003; Mind 2007), nature could act as a vital health resource.

Nature and greenspaces contribute to health in the UK by also providing opportunities and incentives for exercise and recreation. With industrialised countries currently facing serious health challenges such as obesity, type II diabetes, hypertension and coronary heart disease, (CDC 1996; DCMS 2002; DH 2004), introducing sustainable activity initiatives is, therefore, at the forefront of the government agenda. Thus, participating in physical activities in outdoor greenspaces, often referred to as 'green exercise', (walking, running, cycling, gardening, horse riding, etc.) (Pretty et al., 2003, 2006) could help to address these emerging health challenges.

There is an increasing recognition that greenspaces (both rural and urban) can provide many different environmental services simultaneously and so, therefore, are multifunctional. These services include wildlife biodiversity, landscape and aesthetic features, recreation and amenity opportunities, water services (accumulation, supply, storm protection and flood control), climate change mitigation (the filtration of air pollution and carbon sequestration) and also more recently, health services (Dobbs and Pretty 2004; Millennium Ecosystem Assessment 2005; Hine et al. 2007). Although the argument for greenspaces contributing to the nation's health is gathering momentum once more it is still not always taken seriously by planners or public health agencies. Herzog et al. (2002) concluded that "the restorative potential of natural settings is probably underappreciated", as many decision-makers do not appreciate the full potential outcomes of such settings, particularly in the face of competition for multiple other leisure and entertainment opportunities of modern life (Rossman and Uehla 1977; Williams and Harvey 2001; Herzog et al. 2002).

A number of health initiatives and studies have reviewed the positive health benefits of organised facilitated walks in greenspaces (e.g. WHI, Paths to Health) (Ashley et al. 1997, 1999). A national evaluation of WHI health walk schemes reported that 65% of attendees were achieving the weekly recommended levels of moderate physical activity (Dawson et al. 2006). Many participants believed that the scheme had encouraged them to do more independent walking, especially for shorter journeys which they now walked instead of using the car. Reasons for participation were fairly diverse, including enjoyment of the countryside, feeling healthier and more alive, experiencing increased confidence and becoming part of a social group.

The first randomised control trial of the health walks programme analysed change in activity and fitness levels, overall quality of life, motivators to exercise and change in cardiovascular risk factors (Lamb et al. 2002). Some 36% of the participants in the health walk group introduced activity into their lifestyles and remained active compared with only 23% in the group solely receiving advice, although no differences were reported in cardiovascular risk factors. This control group were obviously seeking out alternative activity options leading to the 'natural' increase for 23% of this population. Findings, to date, seem to imply that although health reasons may be the primary drivers for joining walking schemes, it is the

contact with nature and social networking that sustain motivation (Pretty et al. 2007). Thus, activities which result in exercise becoming secondary to environmental or social benefits have a higher adherence rate than activities in which exercise remains the sole driver.

There are a great variety of natural and heritage green sites within the UK which attract millions of day visitors each year. These environments are often protected and preserved by national bodies for public benefit and are officially recognised for their importance (e.g. as National Parks, Areas of Outstanding Natural Beauty, Sites of Special Scientific Interest, National and Local nature reserves, Sites of Importance for Nature Conservation, Environmentally Sensitive Areas). Despite the growing daily disconnections between a predominantly urbanised population and nature (Louv 2005; Pretty 2007), and the increase in sedentary lifestyles, people still express their preferences for nature through visits to the countryside and membership of environmental and wildlife organisations. Each year, some 0.77 billion leisure visits are made to the UK countryside and seaside (Natural England et al. 2006) and a substantial proportion of these visits involve green exercise. Table 1 reports the number of days per annum spent hiking and walking (276 million), participating in outdoor sport and leisure (52 million), cycling and mountain biking (36 million) and swimming (8 million). The total value of the countryside in terms of expenditure on leisure trips in 2005 was £11.4 billion (Natural England et al. 2006).

Table 1. Green exercise leisure activities in English rural areas (2005–2006).

	Countryside		Seaside/Coast	
Number of day visits (millions)	700		72	
Proportion of day visits on each activity (%) and number of days per year (million) on each activity				
Main Activity	(%)	Days per year (million)	(%)	Days per year (million)
Walk, hill-walk, ramble	36	252	33	24
Cycling, mountain biking	5	35	2	1
Swimming	1	7	2	1
Visit beach	0	0	23	17
Sports, active pursuits indoor, outdoor, field, water	7	49	4	3
Hobby or special interest	11	77	4	3
Visit leisure attraction	3	21	3	2
Visit park or garden	3	21	1	1
Informal sports, games, relaxation and wellbeing	2	14	2	1
Other	32	224	25	18
Other characteristics of leisure visits				
Average round trip (km)	28		50	
Total duration of trip including travel time (min)	174		216	
Time spent at destination (min)	126		138	
Main form of transport (%)				
Car	58		63	
On foot	13		23	

Source: England Leisure Visits Survey (2005).

Visitor numbers indicate that many people already benefit from spending time in greenspaces of natural and heritage value, but too little is known about the immediate impact on their health and wellbeing. Existing research mainly focuses on the physiological health benefits of walking and few studies analyse any acute psychological changes using quantitative measures. The role of the environment is often not acknowledged, yet walking in greenspaces is thought to be more beneficial in comparison to city streets. Exercising while viewing green rural pictures reduced blood pressure further than when viewing urban streets. In addition, mood and self-esteem improved after 20 min of viewing rural and urban green scenes (Pretty et al. 2005). However, limited studies have compared these effects to green exercise activities in the field to explore whether the magnitude of change is greater (Pretty et al. 2007) than simulated green exercise in a laboratory.

Very few evidence-based assessments of UK green exercise activities evaluate the health benefits in an objective, controlled way, using standardised instruments. The majority rely predominantly on anecdotal or qualitative data and outcomes are complicated to quantify because of the lack of standardised measures of health. Therefore, this between-subjects study assesses changes in psychological health parameters, using standardised internationally recognised scales, following a single visit to a greenspace of natural and heritage value. It focuses on evaluating the changes in self-esteem and mood after walking in a range of National Trust sites in the East of England, including forests, fens, lowland heaths and coastal areas.

2. Methodology

2.1. Study site selection

To represent greenspaces of natural and heritage value in the East of England, four different National Trust sites were chosen. The National Trust cares for 250,000 hectares of countryside, provides public access to 820 km² of land and manages and protects 1125 km of coastline in England, Wales and Northern Ireland (National Trust 2004). A two-stage cluster sampling technique was used, which initially limited the sampling population to the East of England region only. Once the counties were identified, one site was chosen from each of the larger counties within the region. The four selected sites incorporated a variety of habitats and landscapes which are important for differing historical, cultural, biodiversity and tourist reasons and provided a geographical spread. The four National Trust sites chosen were (i) Dunwich Heath, Suffolk (a coastal lowland heath); (ii) Flatford Mill, Suffolk (situated within Dedham Vale AONB, a picturesque river valley along the Essex/Suffolk border); (iii) Hatfield Forest, Essex (an ancient medieval hunting forest, mixing pasture and woodland) and (iv) Wicken Fen, Cambridgeshire (a fragment of the original fen landscape) (Table 2).

2.2. Participants

Visitors at all four National Trust sites were accessed using a convenience sampling technique, which is a form of opportunity sampling commonly employed in field research. All users at every site were approached to participate in the research. This ensured that the findings were representative of the visiting population for that day and were all-inclusive. A total of 137 visitors were approached (males = 60; females = 72) and of these 132 completed the composite questionnaire (representing

Table 2. Key features of the four National Trust sites studied.

Site	County	Size of National Trust site (ha)	Population within 20 km radius of site	Type of habitat	Annual visitor numbers (2005–2006)
Wicken Fen	Cambridgeshire	600	266,000	Fenland	36,135
Hatfield Forest	Essex	424	402,000	Ancient woodland	250,000
Dunwich Heath	Suffolk	119	28,700	Coastal lowland heath	143,694
Flatford, Dedham Vale	Suffolk	178	464,500	River valley	68,273 ^a

^aBased on number of till transactions at the riverside café rather than vehicle numbers as the car park at Flatford Mill is privately owned. These figures therefore do not include number of people who visit and do not buy coffee.

a response rate of 96%). An equal proportion of users were questioned when they arrived at the sites (49.2%, $n = 65$) compared with those leaving (50.8%, $n = 67$). Most participants in the sample were either aged between 51 and 70 years (57.6%) or between 31 and 50 years (25.0%). A further 14.4% of users were over the age of 71, and 2.3% were aged between 19 and 30 years. All participants were members of the general public who were choosing to visit the sites.

2.3. Measures

2.3.1. Rosenberg Self-Esteem Scale

Self-esteem is commonly accepted as a key indicator of emotional stability and is thus a contributor to mental well-being, quality of life and survival (Huppert and Whittington 2003). There are strong positive correlations between self-esteem, self-efficacy and optimism, and these constructs are significantly related to health (Bernard et al. 1996). The relationship between self-esteem and psychological well-being (e.g. depression, social anxiety, loneliness, alienation) is also well documented (Blascovich and Tomaka 1991).

An individual's level of self-esteem has implications for health behaviours, motivations and lifestyle choices. High levels of self-esteem are associated with healthy behaviours, such as healthy eating, participating in physical activities, not smoking and a lower suicide risk (Torres and Fernandez 1995). High self-esteem is also associated with positive qualities, such as independence, adaptability, leadership, stress resilience, life satisfaction, social adjustment and greater academic and work achievements (Fox 2000). By contrast, low self-esteem is closely linked to mental illness and the absence of psychological well-being. Symptoms of low self-esteem include depression, trait anxiety, unhappiness, gloom, neuroses, suicidal ideation, a sense of hopelessness and a lack of assertiveness (Fox 2000).

Visitors' self-esteem was assessed using the Rosenberg Self-Esteem Scale (RSE) (Rosenberg 1989). This is a standardised tool widely used in health psychology. It has been extensively used in numerous studies analysing the relationship between self-esteem and exercise because it is a fairly conservative measure and its validity is widely acknowledged (Fox 2000). At all the sites, self-esteem was measured immediately pre- and post-activity using the one-page 10-item RSE scale.

2.3.2. Profile of mood states (short form)

Mood is an integral component of daily life and has a strong influence on feelings of happiness, being able to appreciate the moment, being willing to help others, coping with stressful situations and general quality of life (Berger et al. 2002). Mood states are known to influence long-term health by both direct (immune system) and secondary (lifestyle choices) pathways. Acute changes in mood are generally maintained for 2–4 h post-exercise (Raglin and Morgan 1987; Thayer 1996). However, this relatively short duration of enhanced mood has a positive influence on quality of life including more social interaction, improved productivity and better behavioural choices (Berger et al. 2002). Engaging in regular exercise over the long-term can contribute to more sustained chronic changes in mood.

Mood change was measured pre- and post-activity using the standardised, short form one-page version of the Profile of Mood States test (POMS)

(McNair et al. 1971), which has a background of successful use for mood change post-exercise. The POMS is the dominant instrument for measuring mood in studies examining the relationship between mood and exercise (Grove and Prapavessis 1992; Biddle 2000) due to its sensitivity to mood changes in a wide variety of settings. The POMS subscales measured were anger–hostility, confusion–bewilderment, depression–dejection, fatigue–inertia, tension–anxiety and vigour–activity.

2.3.3. Demographic questionnaire

Composite questionnaires were developed to provide general demographic information, such as gender, age and occupation. The composite questionnaire also included open-ended questions to allow users to express their views of the perceived value and/or insignificance of the sites.

2.3.4. Behavioural change measures

A series of questions were incorporated to assess current visitation patterns. These included average duration of stay, frequency of visits, mode of transport, travel time to the site and reasons for visits.

2.4. Procedure

Surveying techniques were used to collect empirical data involving pre-printed composite questionnaires. The researchers visited each site for one full day during the summer of 2006 and positioned themselves at a central point (e.g. entrance/exit, central car park or café/information centre) in order to access all visitors arriving and leaving the sites. The composite questionnaires were designed for self-completion, however, assistance was provided if the participant requested it. The questionnaire format was not suitable for completion by children or those with learning difficulties and prior informed consent would have been needed to approach young people under 18 who were not with a parent or guardian. Therefore, these sub-groups were not represented in the findings.

All users were informed of the purpose of the research and their decision to complete the questionnaire was entirely voluntary, as participation was not compulsory. Participants were advised that all information provided would be treated as anonymous and not passed on to a third party. The study was a between subjects design, in which the independent variable had two levels. Visitors who had just arrived at the sites were sampled as the ‘before’ cohort and visitors who were just leaving the sites were sampled as the ‘after’ cohort, allowing pre- and post-data analysis for the evaluation of the health services component. A multivariate data set of dependent variables was collated.

2.5. Statistical analysis

A database was created using SPSS 14.0 to assist in manipulating data, detecting inconsistencies and statistically analysing the results. All data measures were tested for normality (Kolmogorov–Smirnov test) and homogeneity of variance. Descriptive statistics were obtained for each measure and mean differences between before and after visit scores were recorded along with the 95% confidence interval for the

estimated population mean difference. In all cases, exact probability (p) values were reported along with estimated effect sizes (η^2). Statistical significance was set at $p < 0.05$.

A series of parametric statistical analyses were conducted including one-way between subjects analysis of variances (ANOVA) with *posthoc* Tukey comparisons, independent samples *t*-tests, one-way between subjects multivariate analysis of variances (MANOVA) and Pearson's product moment correlations.

3. Results

3.1. General user profile

The majority of users (88.6%) travelled to the sites by car, 8.3% had walked and 1.5% had cycled. The remaining 1.5% listed other methods of transportation, such as by boat ($n = 159$).

The mean time taken to travel to the National Trust sites was 53.5 min \pm 47.7 (SD), which is comparable to the 48 min reported in the English Leisure Visits Survey (ELVS) (Natural England et al. 2006). Journey times ranged considerably from 10 to 300 min ($n = 129$). The most common travel time was 30 min by car (20.2%), followed closely by 60 min by car (18.6%). Overall, 74% of users took between 30 and 90 min to travel to the site by car, thereby providing an indication of the surrounding geographical origins, which users travel from to visit the sites. As most users travelled by car, it is clear that the sites are attracting day visitors and tourists from many different areas and not just local residents.

Users were asked to indicate their main reasons for visiting the National Trust sites. They could identify as many reasons as they wished (Figure 1). All of the National Trust sites offered many reasons why users might like to visit, but three of the most popular were to watch the wildlife, enjoy the fresh air and appreciate the scenery. Figure 2 illustrates how often users usually visited the National Trust sites.

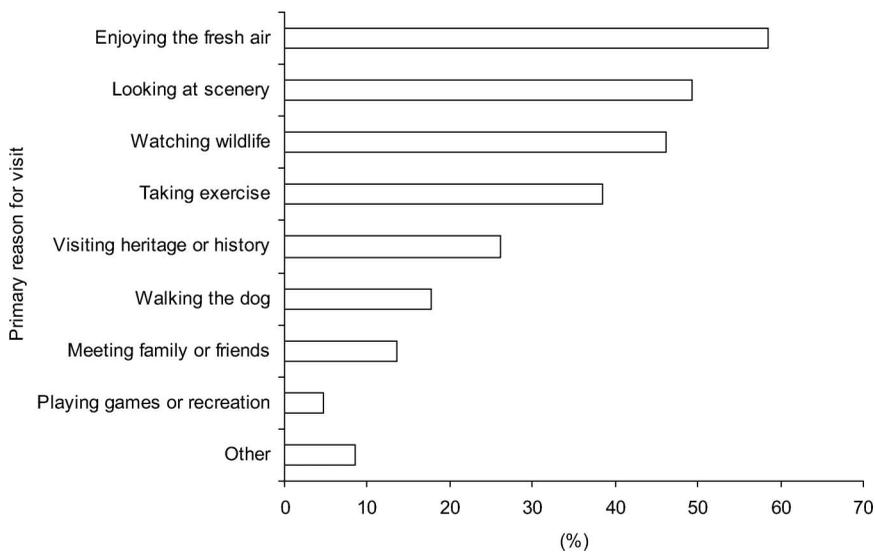


Figure 1. The main reasons why users visited the National Trust sites (%). Note: The totals add up to more than 100% as users could give many reasons for visiting sites.

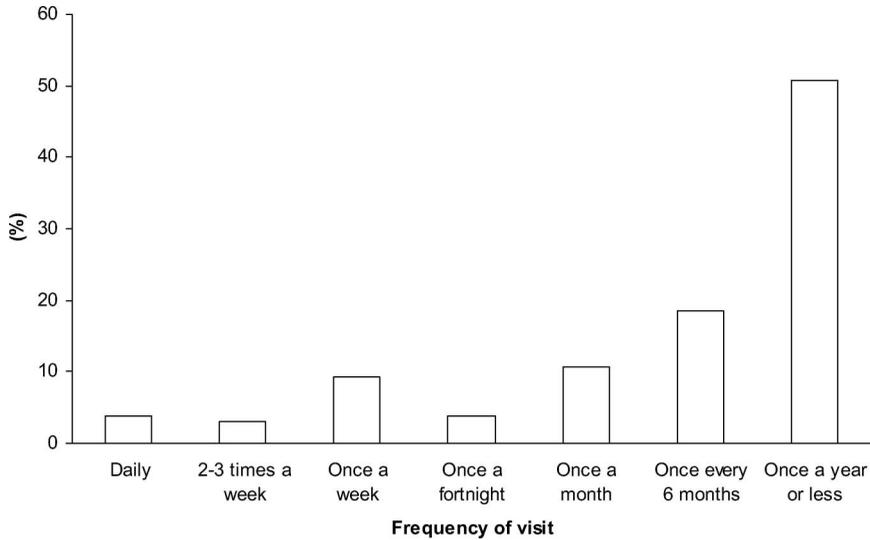


Figure 2. How often users visit the National Trust site they were visiting when questioned ($n = 130$).

The majority of users visited once a year or less (50.8%), suggesting once again that they attract a lot of visitors or tourists on annual day trips. Only 30.8% of users visited the sites once a month or more frequently ($n = 130$).

The average length of time spent at the five National Trust locations was 144.3 min \pm 72.7 min (2 h 24 min), with the most frequent duration being 120 min (36.4% of visitors) ($n = 110$). These data are comparable with the average time spent at destinations (126 min) reported in the ELVS document (Natural England et al. 2006). A further 16.4% of users explored the areas for 90 min and 11.8% stayed there for 240 min, with length of stays ranging from a minimum of 15 min to a maximum of 480 min.

3.2. Psychological health effects

Initially, a one-way between-groups ANOVA was conducted to identify any significant differences in the users' preliminary mood and self-esteem scores between the five different sites. No significant differences were found in any of the measures ($p > 0.05$; $df = 3$) indicating that all users had comparable initial psychological health states. Thus, all 132 visitors' scores were aggregated for further statistical analysis.

An independent samples *t*-test was conducted to compare the self-esteem scores of those visitors just arriving and those just departing. There was a statistically significant difference in self-esteem scores between the two groups ($t(124) = 1.86$, $p = 0.0325$, one-tailed) and the effect size was small ($\eta^2 = 0.03$). The combined average self-esteem score reported for those users who had just arrived at the sites was 18.93 (SD = 4.96), and for those just leaving the score had improved to 17.49 (SD = 3.58). (Note the lower the value, the higher the self-esteem). In addition, the arrival scores were high, representing an exceptionally good level of initial self-esteem, so there was little room for improvement arising from the visit.

The relationship between the duration of the visitors stay and the reported self-esteem scores when leaving the sites was investigated using a Pearson product-moment correlation coefficient. Preliminary analyses were conducted to ensure that there were no violations of the assumptions of normality, linearity and homoscedasticity. There was no significant correlation between the two variables ($r = -0.23$, $n = 57$, $p > 0.05$) implying that length of stay did not affect self esteem.

The combined mean scores for the six sub-scale factors of mood were analysed using a one-way between groups multivariate analysis of variance (MANOVA). This compared the mood scores of visitors just arriving at the National Trust sites with those just departing (Figure 3). The six related dependent mood variables were anger, confusion, depression, fatigue, tension and vigour. All of the mood factors represent negative moods, with the exception of vigour, which is positive. Therefore, a decrease in a negative mood variable (the first five) is a desired outcome, whereas an increase in vigour is a favourable result.

There was a statistically significant difference between the mood scores of those users just arriving and those just leaving on the combined dependent variables ($F(6, 114) = 4.92$, $p < 0.0005$, Wilks' $\lambda = 0.79$, $\eta^2 = 0.21$). The effect size was, therefore, large. When the results for the six dependent variables were analysed individually, statistically significant differences were found in anger ($F(1, 119) = 18.93$, $p < 0.0005$, $\eta^2 = 0.14$), depression ($F(1, 119) = 24.25$, $p < 0.0005$, $\eta^2 = 0.17$), tension ($F(1, 119) = 15.70$, $p < 0.0005$, $\eta^2 = 0.12$), confusion ($F(1, 119) = 11.59$, $p = 0.001$, $\eta^2 = 0.09$) and vigour ($F(1, 119) = 8.58$, $p = 0.004$, $\eta^2 = 0.07$), using a Bonferroni adjusted α level of 0.0083.

The mean scores showed that feelings of anger were significantly less for those users leaving the site ($M = 37.59$, $SD = 1.55$) compared with those at arrival ($M = 40.03$, $SD = 4.16$). Similarly, depression levels were lower for visitors departing the sites ($M = 37.13$, $SD = 0.46$) in comparison with those at arrival

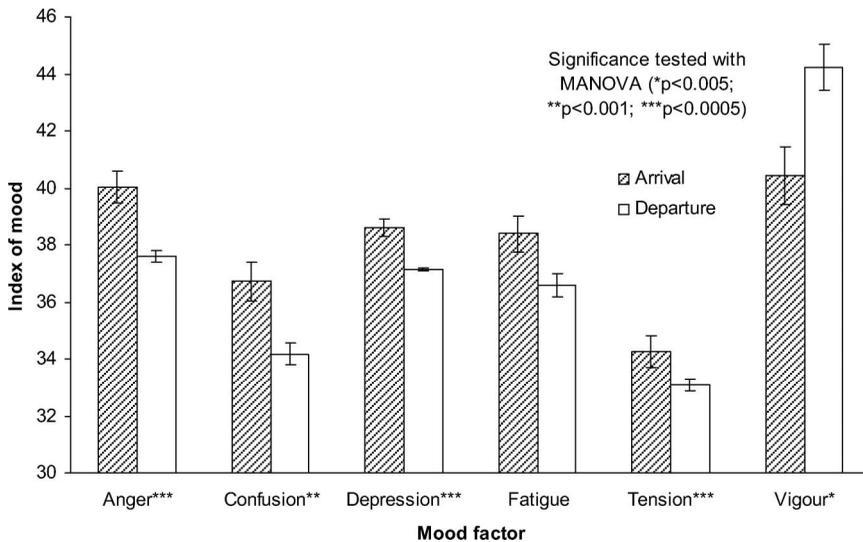


Figure 3. Sub-scale mood scores for visitors arriving ($n = 58$) and departing ($n = 63$) the green sites.

($M = 38.62$, $SD = 2.36$) and feelings of tension were considerably lower when leaving ($M = 32.02$, $SD = 1.54$) compared with arrival ($M = 34.24$, $SD = 4.16$). Levels of confusion were lower when leaving the sites ($M = 34.17$, $SD = 2.91$) compared with arriving ($M = 36.71$, $SD = 5.07$) and visitors leaving felt more vigorous ($M = 44.24$, $SD = 6.53$) in comparison with those arriving ($M = 40.45$, $SD = 7.69$), implying that their experience had instigated feelings of liveliness and energy. Feelings of fatigue were also lower in those leaving the sites ($M = 36.60$, $SD = 3.16$) compared with those at arrival ($M = 38.38$, $SD = 4.86$), even though the majority had been walking around the sites for a couple of hours.

A Total Mood Disturbance (TMD) Score was calculated to denote an overall assessment of emotional state (Figure 4). This method is used to provide an indicator of overall mood. It involves summing the POMS subscale T -scores of anger, confusion, depression, fatigue and tension and then subtracting the T -score for vigour (McNair et al. 1992, p. 6). An independent samples t -test reported a statistically significant decrease in TMD ($t(119) = 4.46$; $p < 0.0005$; one-tailed) and the effect size was moderate ($\eta^2 = 0.14$). Thus, walking in the green sites significantly improved subjects' overall mood by an index of 14.26, from ($M = 147.53$, $SD = 21.97$) to ($M = 133.27$, $SD = 10.97$). Therefore, this finding also supported the conclusion that spending time walking in the National Trust sites helped to improve visitors' mood.

The relationship between the duration of the visitors stay and the reported TMD scores when leaving the sites was also investigated using a Pearson product-moment correlation coefficient (Figure 5).

There was a negative correlation between the two variables ($r = -0.35$, $n = 57$, $p = 0.01$), with longer stays being associated with greater improvements in overall mood. However, due to the sample size it is also important to report the coefficient of determination ($r^2 = 0.12$), which implies there is a 12% shared variance.

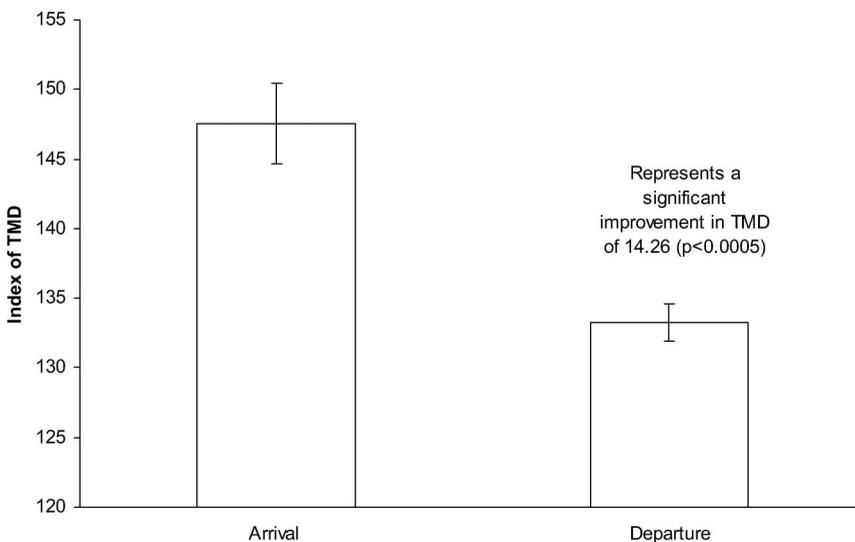


Figure 4. TMD for visitors arriving and departing the National Trust sites.

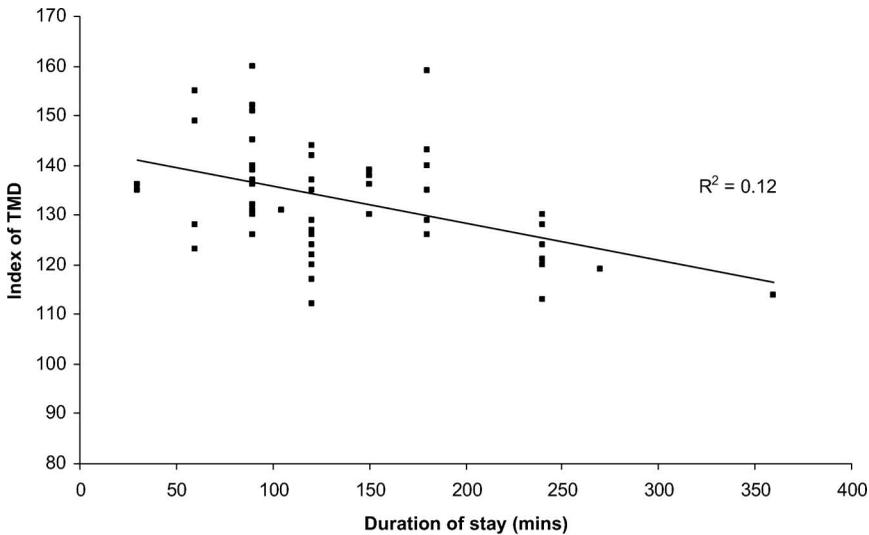


Figure 5. Relationship between duration of stay at the National Trust sites and departing TMD scores.

4. Discussion

There is much government and public concern about increasing health problems which stem from a combination of inactive lifestyles, transitions in diets and advanced technology. Ways of addressing these issues are imperative and although there is a growing recognition that greenspaces encourage physical activity, a better understanding of this relationship is urgently required. This would ensure that the potential opportunity to increase physical activity levels further is capitalised upon and an economic model for maintaining greenspace can be developed (Bird 2004).

The greenspace already available to the public as green infrastructure, including National Parks, Areas of Outstanding National Beauty (AONBs), nature reserves, country parks, urban parks, and heritage sites, constitutes a very significant resource for the UK. In the East of England, the National Trust manages a varied selection of iconic coastline and countryside sites that all afford opportunities for walking, recreation and leisure, and other green exercise activities. A good quality countryside or green space can also often enhance the value of the green exercise experience. Thus, the aim of this study was to assess any changes in psychological health parameters experienced after walking in different National Trust sites during a single visit.

With such exceptionally good initial self-esteem levels, there was little room for improvement on the scale measured. However despite this, self-esteem levels of the participants significantly improved after the visits. Longer stays were not associated with improved self-esteem implying that short exposure is just as beneficial as longer experiences. Total mood disturbance scores reported a significant improvement in overall mood when findings from the four sites were amalgamated. When the six subscale mood factors were analysed separately, visitors leaving the green sites were significantly less angry, tense, depressed and confused compared to visitors just arriving. They also felt significantly more vigorous implying that they were more energetic and active. Longer stays were associated with greater increases in overall

mood, indicating that the more time spent at the green site the better the mood. However, although visitors were spending at least 2 h on average walking in the fresh air and enjoying the green scenes, the majority of participants did not recognise this as a health service that the site was providing. Yet, the combination of walking in a green environment and having contact with nature led to significant improvements in visitor's mental health by enhancing self-esteem and mood. In addition, improvements in physical health can also be inferred from the exercise participation.

The formation of social capital and contact with nature are also key aspects in healthy communities. Most of the visitors to the National Trust areas included in this study visited the sites with their partners, families and friends rather than on their own, thus encouraging social interaction. Many comments by participants supported this notion when they were asked what they enjoyed most about the site. Examples include "It is a place where my son and I can enjoy together open space, the landscape, peace" and "I enjoy walking with friends, enjoying the beauty of the autumn countryside and the fellowship over the cup of coffee and biscuits". This has implications not only for physical and mental health benefits but also for the formation of social capital. Thus, the National Trust sites are important assets for enhancing social and physical health and psychological well-being, in addition to the fundamental part they play in helping to preserve and conserve the natural environment.

There are, nonetheless, limitations to this study. First, the study population was only representative of the visitors questioned on the days surveyed. Therefore, findings should be treated with caution when applying them to the general population. The majority of visitors reported exceptionally good levels of self-esteem and mood. With such high initial scores any potential improvements were limited. A relatively small sample size was questioned at each site and the sampling method may have led to some bias in the sample. This is because the study only included those people choosing to visit the sites and did not include the views of those who chose not to visit. Findings may also vary with seasons as the weather, temperature, amount of vegetation, or colours may all affect the experience.

What remains unclear is the proportional contributions of contact with nature and exercise to the overall improvement in self-esteem and mood. Is the combination of exercise and contact with nature more powerful than either alone? Previous research implies that it is the synergistic benefits of combining the two elements which induces the positive effects on psychological well-being (Pretty et al. 2005, 2006, 2007), indicating the potential for a wider health and well-being dividend from green exercise activities. However, future research needs to compare walking in different environments (both indoor exercise and non-green urban routes) to identify the importance of the location.

It would also be advantageous to analyse the long-term health benefits using a combination of both psychological questionnaires and physical activity monitoring (using accelerometers). These longitudinal effects could be explored by sampling the same population at specified points over a longer time period. This would provide an indication of long-term physical activity behaviour and the health implications of repeat exposures. Another key issue requiring further analysis relates to exposure time to greenspaces. Can the number of visits, time spent per visit or exposure to a particular type of green environment constitute a "dose of greenspace"? Can a variety of measurable effects be used to explore what the dose-response curve would

look like? This research study has focused primarily on rural greenspaces of natural and heritage value, but local access to safe urban greenspaces is especially valuable in increasing physical activity levels within communities. Therefore, it is important to widen the research to include urban greenspaces, such as parks, gardens, allotments and green corridors to analyse the psychological health benefits derived from participating in green exercise activities in these environments.

5. Concluding comments

It is clear that the UK is increasingly becoming a more urbanised society (Habitat 2001), with a declining understanding of the natural environment (Pilgrim et al. 2007; Pretty 2007). With increasingly sedentary lifestyles, increased consumption of processed and fast foods and growing disconnection with nature, the resultant public health problems are significant. Access to the countryside and urban greenspaces for fresh air, leisure, exercise, getting away from everyday stresses and reconnecting with the natural world, all positively impact on physical and mental health. Thus, the environment plays an important role in facilitating physical activities and helping to address sedentary behaviours.

In addition to the range of environmental services provided by greenspaces, managed and protected green sites of natural and heritage value play a valuable role in enhancing the health of the nation. Walking, in particular, can serve many purposes including exercise, recreation, travel, companionship, relaxation and restoration. However, to encourage the nation to walk more, these benefits need to be promoted along with the idea that health improving exercise does not solely equate to gym activities or vigorous exercise. Walking in greenspaces also seems to be a more sustainable option, as the primary reward is enhanced emotional well-being through both exposure to nature and participation in exercise (Bird 2004). In addition, the biodiversity and variety of colours observed in changing seasons contributes to the attractiveness of outdoor spaces and is an important motivator in sustaining exercise habits. Greenspace use is likely to be one of many strategies employed to maintain physical and mental health, but the quality and quantity of accessible green sites can significantly affect independent use and should play a key role in all rural and urban planning policies and public health and social care priorities (Lindheim and Syme, 1983; Frumkin et al. 2004). It may also play an important role in individual strategies, even when used intermittently, such as annual day visits (Willis and Liesl 2005). Failure to supply the restorative and psychological benefits of access to nature, may actually incur substantial health costs in the long-term (Ward Thompson 2002).

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References

- Albright C, Thompson D. 2006. The effectiveness of walking in preventing cardiovascular disease in women: a review of the current literature. *J Womens Health (Larchmt)*. 15:271–280.

- Ashley A, Bartlett H, Kowells K. 1997. Evaluation of the sonning common health walks scheme. Oxford: Oxford Brookes University.
- Ashley A, Bartlett H, Lamb S, Steel M. 1999. Evaluation of the Thames valley health walks scheme. Oxford: Oxford Brookes University.
- Ball K, Bauman A, Leslie E, Owen N. 2001. Perceived environmental aesthetics and convenience and company are associated with walking for exercise among Australian adults. *Prevent Med.* 33:434–440.
- Berger BG, Pargman D, Weinberg RS. 2002. *Foundations of Exercise Psychology*. Morgantown: Fitness Information Technology, Inc.
- Bernard LC, Hutchison S, Lavin A, Pennington P. 1996. Ego-strength, hardiness, self-esteem, self-efficacy, optimism, and maladjustment: health-related personality constructs and the “Big Five” model of personality. *Assessment.* 3:115–131.
- Biddle SJH. 2000. Emotion, mood and physical activity. In: Biddle SJH, Fox KR, Boutcher SH, editors. *Physical activity and psychological well-being*. London: Routledge. p. 63–87.
- Bird W. 2004. Natural fit. Can green space and biodiversity increase levels of physical activity. Sandy: RSPB.
- Blascovich J, Tomaka J. 1991. Measures of self-esteem. In: Robinson J, Shaver P, Wrightsman L, editors. *Measures of personality and social psychological attitudes*, Vol. I. San Diego, CA: Academic Press. p. 115–160.
- Boardley D, Fahlman M, Topp R, Morgan A, McNeven N. 2007. The impact of exercise training on blood lipids in older adults. *Am J Geriatric Cardiol.* 16:30–35.
- CDC. 1996. *Physical activity and health. A report of the surgeon general*. Washington DC: US Department of Health and Human Services, Centres for Disease Control and Prevention, National Centre for Chronic Disease Prevention and Health Promotion.
- Dawson J, Boller I, Foster C, Hillsdon M. 2006. Evaluation of changes to physical activity amongst people who attend the Walking the Way to Health Initiative (WHI): prospective survey. Oxford: Oxford Brookes University.
- DCMS. 2002. *Game plan: a strategy for delivering government’s sport and physical activity objectives*. London: Department of Culture, Media and Sport and Cabinet Office.
- Department for Transport. 2006. *Transport statistics bulletin: National Travel Survey 2006*. London: Department for Transport.
- DH. 2004. *At least five a week: evidence on the impact of physical activity and its relationship to health*. London: Department of Health.
- Dobbs T, Pretty J. 2004. Agri-environmental stewardship schemes and ‘multifunctionality’. *Rev Agric Econom.* 26:220–237.
- DOH. 2002. *Addressing the health agenda: A new focus for sports activity: Health*. London: Department of Health.
- Fox KR. 2000. The effects of exercise on self-perceptions and self-esteem. In: Biddle SJH, Fox KR, Boutcher SH, editors. *Physical activity and psychological well-being*. London: Routledge. p. 88–117.
- Frumkin H, Frank L, Jackson R. 2004. *Urban sprawl and public health: designing, planning and building for healthy communities*. Cambridge: MIT Press.
- Gilbody S. 2004. What is the evidence on effectiveness of capacity building of primary health care professionals in the detection, management and outcome of depression? Copenhagen: WHO Regional Office for Europe.
- Grove JR, Prapavessis H. 1992. Preliminary evidence for the reliability and validity of an abbreviated Profile of Mood States. *Int J Sport Psychol.* 23:93–109.
- Habitat. 2001. *State of the world’s cities report*. Nairobi: United Nations Centre for Human Settlements.
- Hartig T, Evans G, Jamner LD, Davis DS, Garling T. 2003. Tracking restoration in natural and urban field settings. *J Environ Psychol.* 23:109–123.
- Hartig T, Mang M, Evans GW. 1991. Restorative effects of natural environment experiences. *Environ Behav.* 23:3–26.
- Herzog TR, Chen HC, Primeau JS. 2002. Perception of the restorative potential of natural and other settings. *J Environ Psychol.* 22:295–306.
- Hine R, Peacock J, Pretty J. 2007. *Green lungs for the east of England*. Colchester: University of Essex Report for the National Trust.

- Huppert FA, Whittington JE. 2003. Evidence for the independence of positive and negative wellbeing: implications for quality of life assessment. *Br J Health Psychol.* 8:107–122.
- Kaplan R, Kaplan S. 1989. *The experience of nature: a psychological perspective.* Cambridge: Cambridge University Press.
- Kellert SR, Wilson EO. 1993. *The biophilia hypothesis.* Washington DC: Island Press.
- Kokkinos P, Narayan P, Papademetriou V. 2001. Exercise as hypertension therapy. *Clin Cardiol.* 19:507–516.
- Lamb S, Bartlett H, Ashley A, Bird W. 2002. Can lay-led walking programmes increase physical activity in middle aged adults? A randomised control trial. *J Epidemiol Community Health.* 56:246–252.
- Larun L, Nordheim L, Ekeland E, Hagen K, Heian F. 2006. Exercise in prevention and treatment of anxiety and depression among children and young people. *Cochrane Database System Rev.* 3:CD004691.
- Lindheim R, Syme SL. 1983. Environments, people and health. *Annu Rev Public Health.* 4:335–339.
- Louv R. 2005. *Last child in the woods: saving our children from nature-deficit disorder.* North Carolina: Algonquin Books.
- Maas J, Verheij RA, Groenewegen PP, De Vries S, Spreeuwenberg P. 2006. Green space, urbanity, and health: how strong is the relation? *J Epidemiol Community Health.* 60: 587–592.
- McNair DM, Lorr M, Droppleman LF. 1971. *EdITS manual for the profile of mood states.* San Diego, CA: Educational and Industrial Testing Service.
- McNair DM, Lorr M, Droppleman LF. 1992. *Revised Manual for the Profile of Mood States.* San Diego (CA): Educational and Industrial Testing Service.
- Millennium Ecosystem Assessment, editor. 2005. *Ecosystems and human well-being: current state and trends.* Washington DC: Island Press.
- Mind. 2007. *Ecotherapy: the green agenda for mental health.* London: Mind. Mind week report, May 2007.
- Morris JN, Hardman AE. 1997. Walking to health. *Sports Med.* 23:306–332.
- National Trust. 2004. *More than a pretty place.* London: National Trust.
- Natural England, Department For Environment Food And Rural Affairs, Environment Agency, Forestry Commission, The Broads Authority, Dartmoor National Park Authority, Exmoor National Park Authority, Lake District National Park Authority, North York Moors National Park Authority, Northumberland National Park Authority, Peak District National Park Authority, Yorkshire Dales National Park Authority. 2006. *England leisure visits survey, 2005.* Wetherby: Natural England Publications.
- NHS Information Centre. 2008. *The health survey for England 2007: latest trends.* London: NHS Information Centre.
- Office for National Statistics. 2003. *The UK 2000 time use survey.* London: Office for National Statistics.
- Parkkari J, Natri A, Kannus P, Mänttari A, Laukkanen R, Haapasalo H, Nenonen A, Pasanen M, Oja P, Vuori I. 2000. A controlled trial of the health benefits of regular walking on a golf course. *Am J Med.* 109:102–108.
- Pilgrim S, Smith D, Pretty J. 2007. A cross-regional assessment of the factors affecting ecoliteracy: implications for policy and practice. *Ecol Appl.* 17:1742–1751.
- Pretty J. 2007. *The earth only endures: on reconnecting with nature and our place in it.* London: Earthscan.
- Pretty J, Hine R, Peacock J. 2006. Green exercise: the benefits of activities in green places. *Biologist.* 53:143–148.
- Pretty J, Peacock J, Hine R, Sellens M, South N, Griffin M. 2007. Green exercise in the UK countryside: effects on health and psychological well-being and implications for policy and planning. *J Environ Plan Manage.* 50:211–231.
- Pretty J, Peacock J, Sellens M, Griffin M. 2005. The mental and physical health outcomes of green exercise. *Int J Environ Health Res.* 15:319–337.
- Pretty JN. 2004. How nature contributes to mental and physical health. *Spiritual Health Int.* 5:68–78.

- Pretty JN, Griffin M, Sellens MH, Pretty C. 2003. Green exercise: complementary roles of nature, exercise and diet in physical and emotional well-being and implications for public health policy. CES Occasional Paper 2003-1. Colchester: University of Essex.
- Priest P. 2007. The healing balm effect. *J Health Psychol.* 12:36–52.
- Raglin J, Morgan W. 1987. Influence of exercise and quiet rest state anxiety and blood pressure. *Med Sci Sports Exerc.* 19:456–463.
- Rosenberg M. 1989. *Society and the adolescent self-image*. Revised ed. Middletown, CT: Wesleyan University Press.
- Rossmann BB, Ulehla ZJ. 1977. Psychological reward values associated with wilderness use. *Environ Behav.* 9:41–66.
- Smith T, Wingard D, Smith B, Kritz-Silverstein D, Barrett-Connor E. 2007. Walking decreased risk of cardiovascular disease mortality in older adults with diabetes. *J Clin Epidemiol.* 60:309–317.
- St Leger L. 2003. Health and nature – new challenges for health promotion. *Health Promot Int.* 18:173–175.
- Thayer R. 1996. *The origin of everyday moods: managing energy, tension and stress*. New York: Oxford University Press.
- The Sainsbury Centre for Mental Health. 2003. *The economic and social costs of mental illness*. London: The Sainsbury Centre for Mental Health.
- Torres R, Fernandez F. 1995. Self-esteem and the value of health as determinants of adolescent behaviour. *J Adolesc Health Care.* 16:60–63.
- Ulrich RS. 1981. Natural *versus* urban scenes: some psychophysiological effects. *J Environ Behav.* 13:523–556.
- Ulrich RS, Simons RF, Losito BD, Fiorito E, Miles MA, Zelson M. 1991. Stress recovery during exposure to natural and urban environments. *J Environ Psychol.* 11:201–230.
- Van den Berg AE, Hartig T, Staats H. 2007. Preference for nature in urbanised societies: stress, restoration and the pursuit of sustainability. *J Social Issues.* 63:79–96.
- Van den Berg AE, Koole SL, Van der Wulp NY. 2003. Environmental preference and restoration: (How) are they related? *J Environ Psychol.* 23:135–146.
- Warburton DER, Nicol CW, Bredin SS. 2006. Health benefits of physical activity: the evidence. *CMAJ.* 174:801–809.
- Ward Thompson C. 2002. Urban open space in the 21st century. *Landsc Urban Plan.* 60:59–72.
- White R, Heerwagen J. 1998. Nature and mental health: biophilia and biophobia. In: Lundberg A, editor. *The environment and mental health: a guide for clinicians*. Mahwah, New Jersey: Lawrence Erlbaum Associates. p. 175–192.
- WHO. 2001. *World health report*. Geneva: World Health Organisation.
- Williams K, Harvey D. 2001. Transcendent experience in forest environments. *J Environ Psychol.* 21:249–260.
- Willis K, Liesl O. 2005. *Economic benefits of accessible green spaces for physical and mental health: scoping study*. Oxford: CJC Consulting.
- Wilson EO. 1984. *Biophilia: the human bond with other species*. Cambridge, Massachusetts: Harvard University Press.