

Do People Feel Healthier in the Countryside?

Understanding Public Attitudes and Beliefs Concerning the Relationship between Health and the Environment

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Chapter 1. Introduction

1.1 Environment, Health and Lifestyle

The positive relationship between exposure to nature and greenspace within the environment and an individual's health is continuously being evidenced. Research has demonstrated that contact with nature and living things has a tendency to make most people feel good (Kellert & Wilson, 1993; Maller *et al.*, 2002). The quality of nature in the surrounding environment affects a person's mental health, whether at home, at work or at places visited. This concept is not unfamiliar, but it has yet to significantly influence the planning of urban and rural environments or public health priorities (Lindheim & Syme, 1983; Frumkin *et al.*, 2004).

The Health Council of the Netherlands recently completed an extensive review of the scientific evidence linking nature and health. They identified five intermediary mechanisms whereby nature was influencing actions or mechanisms which subsequently affected health. These included recovery from stress and attention fatigue; encouragement of exercise; facilitating social contact; stimulation of development in children and stimulation of personal development and a sense of purpose (Health Council of the Netherlands and RMNO, 2004). Therefore, there are many diverse ways in which nature benefits health which are not mutually independent but interact to improve well-being. However, this proposal that contact with nature derives extensive emotional and physical health benefits has received little attention. Our desire to conserve the natural environment transpires due to the widespread threats it is constantly facing. It is generally accepted that the environment should be conserved for predominantly ethical (Leopold, 1949; Eckerley, 1999) or economic (Costanza *et al.*, 1997; Sandifer *et al.*, 2004) reasons but not necessarily due to the emotional argument.

Nature is often perceived as a place to relax, escape and unwind from the daily stresses of modern life. The opportunity for relaxation and recreation has a positive influence on our emotional and physical wellbeing. In today's world where sufferers of stress and mental ill-health are more commonplace, nature can act as a vital health resource. Stress is a strong predictor of mortality and is currently a very serious problem for many people living in modern societies. With the resulting costs incurred due to lost outputs, increased expenditure in the provision of care and the inestimable cost to the individual, the importance of access to nature is paramount. In addition, depression and depression-related illness is estimated to become the most pronounced source of ill-health by 2020 (WHO, 2001). This has its own worrying implications because it is also known to be a risk factor for a range of chronic physical illnesses, such as diabetes, stroke, heart disease, asthma and arthritis (Hippersley-Fox *et al.*, 1998; Ostir *et al.*, 2001). This is principally due to the unhealthy associated behaviours, such as smoking, over-eating and increased alcohol consumption, which also have serious consequences of their own.

Mental ill-health is already problematic in the UK with at least one in six individuals suffering at any one time. In the UK, depression and mixed anxiety are commonplace with instances rising from 7.8% in 1993 to 9.2% in 2000. The associated public health costs are growing with £3.8 billion of the NHS annual expenditure used in the treatment of mental illness and a further £0.68 billion used for personal social services expenditure.

Throughout the 20th and 21st centuries the number of people living in an entirely urban setting has increased. It is predicted that within the next decade the number of urban dwellers will exceed those residing in rural environments for the first time. However, by definition urban areas possess less nature and greenspace than rural environments. This lack of nature will potentially diminish our psychological and physical well-being and there will be less opportunity for us to recover from any mental stresses or

physical tensions (Pretty *et al.*, 2004). Natural green environments are constantly under pressure from economic development, so we should fight to protect this credible health resource to allow us to cope with these daily pressures and tensions.

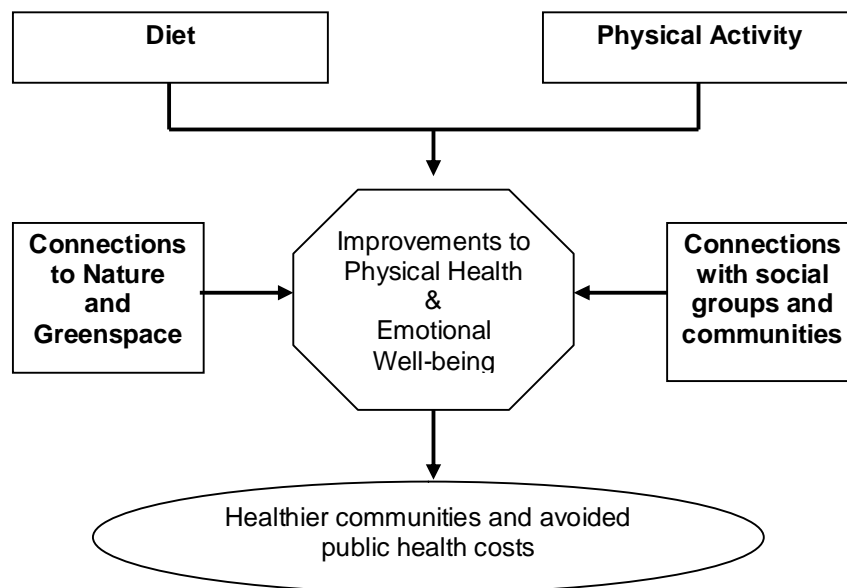
So, if research strongly indicates that exposure to nature and greenspace positively effects our physical health and mental well-being, do we fully understand why? A series of questions need to be addressed to enhance our understanding. What are peoples motivations for engaging with nature? With a multitude of choices available, why do so many people still seek out green places (both rural and urban) on a regular basis? What motivates them to take the trouble to be in the presence of green nature and living things, when they could easily stay at home and watch it on the television? As hominids were hunter-gatherers for over 300,000 generations, having daily contact with nature and the land, are the reasons co-evolutionary? In comparison the increasingly urbanised and industrialised environment we currently reside in has only emerged in the past six to ten generations.

Equally, we may question what consitutes a green experience? Do artificial plastic trees and plants have the same effect as rainforest trees or hay meadows in the spring? In what way does nature affect us emotionally as opposed to intellectually – is the experience different if you are aware the nature is simulated? What difference does spending five minutes a day in contact with nature make to two weeks in the wild? How does individuals own personal history affect their experience (is there a contrast between urban and rural dwellers, or someone visiting their own local environment compared to someone coming from another culture?) Does the culture of origin affect the experience, or is the desire to connect with nature the same irrespective of cultural context? These thought-provoking questions need to be answered so that we can begin to shape our reasons for engaging with nature and greenspace.

Chapter 2. Health Framework – Influences of Diet, Physical Activity, Nature and Social Capital on Health

The health framework in Figure 1 draws attention to a range of environmental factors which combine and interact to influence an individual’s health and well-being. It illustrates the widely acknowledged primary roles played by diet and physical activity in emotional and physical well-being and highlights the less familiar secondary roles played by connections to nature and greenspace and social communities. Combining a balanced diet with appropriate levels of physical activity leads to substantial increases in life expectancy (CDC , 1996; Ferro-Luzzi and James, 2000; DCMS, 2002; DoH, 2004). Ironically, just as food shortages have been largely conquered in industrilised countries, ill-health arising from over-consumption of certain constituents of diets is now a major public health cost (Pretty, 2002; Wanless, 2002; Lang and Heasman, 2004). At the same time the nature of work has changed and many people have adopted increasingly sedentary lifestyles, which have further contributed to ill-health. Both these trends are extremely costly, both to individuals and to the public health budget.

Figure 1: Framework describing interactions between diet, physical activity, connections to nature and social groups and the effects on physical health and emotional well-being



Well-being is further enhanced through close connections to both nature and communities. These connections involve direct interaction but are also made indirectly through consumption of food, membership of environmental organisations, and by contact with others through social institutions and cultural mechanisms (Jacobs, 1961; Freeman, 1984; Coleman, 1988; Kellert and Wilson, 1993; Pretty, 2002). Furthermore, connections with the environment potentially have direct and indirect effects on the level of quality of physical activity. Connectedness to social groups is known to have a positive effect on health (Pevalin and Rose, 2003) and such connectedness is now often called social capital – a resource of trust, reciprocity and obligations that people can draw upon to provide personal health benefits (Coleman, 1988; Putnam, 1993; Pretty *et al.*, 2003).

In most health care systems, the predominant focus for both treatment and expenditure concerns people who have become ill. The same is also true for our environments – we tend only to become concerned

when something important is harmed. Yet the best approach, and the cheapest, is to focus efforts upstream, and try to create healthy environments in which people can flourish rather than flounder. Thus we should be equally concerned with not just preventing mental and physical ill-health, but with creating social and natural contexts that deliver well-being for all social groups

2.1 Diet

The diets of most people in industrialised countries, and of an increasing number of those in developing countries, have undergone enormous changes within the last two generations (Popkin, 1998, 1999; Pretty, 2002). Barry Popkin (1998, 1999) coined the phrase the “*nutrition transition*” to describe how modern and urbanised societies have adopted different types and amounts of foods with severe health consequences. On average, people now consume more food calories than they burn, and increasingly they consume types of food, such as those containing simple sugars and an excess of salt, that are making them ill. We have seen a shift from consuming traditional and local foods with mixed diets high in fruit and vegetables, to refined cereals and sugars, more fats, processed foods and fewer vegetables. Of particular concern for public health is the 34% fall in vegetable consumption over the last 50 years and the 59% decline in fish consumption.

Gross energy intake in the home increased to a peak in the 1970s, but paradoxically, since then it has fallen during a period in which obesity has substantially increased. This emerging obesity epidemic is currently endangering the health of the UK population and acts as a contributing risk factor for a number of other conditions. The warning signs were apparent in 2002 when it was established that around 22% of adults and 16% of children in England were classed as clinically obese. If current trends persist it is estimated that one third of all adults will be obese by 2010. Recent estimations concerning the costs of obesity suggest that it contributes to 18 million days of sickness per year. A 5% decline in the number of inactive people could save £300 million annually (DoH, 2004). It appears that increases in energy intake outside the home have played a critical role, particularly the consumption of fast food, soft drinks and alcohol. At the same time as diets and eating habits have shifted, physical activity has declined and this has a substantial impact on energy balance.

As a result of these broad changes in diet, diet-related illness now has severe and costly public health consequences (Ferro-Luzzi and James, 2000; Eurodiet, 2001). According to the comprehensive Eurodiet study, “*most of Europe has seen a very substantial increase in a number of chronic diseases in adult life*”. This is primarily due to diet and inactivity and diseases include “*coronary heart disease, strokes, obesity, maturity onset diabetes mellitus, gall-stones, osteoporosis and several cancers*”. Worse still, the Eurodiet (2001) study concludes that “*disabilities associated with high intakes of saturated fat and inadequate intakes of vegetable and fruit, together with a sedentary lifestyle, exceed the cost of tobacco use*”.

2.2 Physical Activity

Along with diet, physical activity has been evidenced to be an important determinant of health and well-being. Moderate regular exercise reduces morbidity rates by 30-50% and has a particularly protective effect against maturity onset Type II diabetes, coronary heart disease, strokes and colon cancer. In addition, it helps to reduce blood pressure and improve blood lipid and glucose profiles. It enhances mental health, fosters healthy muscles and bones and aids maintenance of health and independence in older adults (Paffenbarger *et al.*, 1994; CDC, 1996; Scully *et al.*, 1998; Parks *et al.*, 2003). An active lifestyle can also enhance psychosocial well-being and a multitude of psychological benefits are inferred (Berger, 1996). Organised, regular planned physical activity is linked with favourable psychological outcomes, which can be categorised into four augmented areas: “*enhanced mood, stress reduction, a more positive self-concept, and higher quality of life*” (Berger, 1996). Specific groups including clinically

depressed or anxious individuals, coronary heart disease patients, elderly etc may experience even more marked and distinct psychological benefits.

Echoing Popkin's phrase, we believe that modern societies have also gone through an "*activity transition*" in the past 2-3 generations, which has very significant public health consequences for whole populations. As yet, these changes have not been widely discussed or accepted, until very recently (DCMS, 2002). The recent Eurodiet (2001) study states "*the importance of physical activity has been underestimated for many years by both doctors and policy-makers*". People in both industrialised countries and urban settlements in developing countries have become increasingly sedentary in all aspects of daily life, including during leisure time, in travelling to and from work, and during work itself (Table 1). Home life has also become more sedentary and although gym and fitness club membership has risen (though many have a low adherence rate) in the past 20 years, there are indications that people are becoming less likely to engage in organised sports and leisure activities.

Table 1: Prevalence of activity and inactivity among adults, by sex and age, England, 1998

	Achieving at least 30 mins of moderate intensity physical activity on 5 or more days of the week (%)		Achieving less than 30 mins moderate intensity activity per week (%)	
All men and women aged 16 +	31		38	
Male	37		35	
Female	25		41	
Age (years)	Men	Women	Men	Women
16 - 24	58	32	16	33
25 - 34	48	31	22	28
35 - 44	43	32	28	29
45 - 54	36	30	33	34
55 - 64	32	21	44	42
65 - 74	17	12	52	61
75 +	7	4	72	82

Source: Health Survey for England 1998 in DoH 2004

During the past fifty years the UK has witnessed a dramatic reduction in levels of daily physical activity. On average, adults aged 20-60 years, expend 2MJ (500kcal) less energy per day in comparison to their ancestors fifty years ago (Eurodiet, 2001). This is primarily due to jobs becoming less physical, people opting to use the lift instead of the stairs and choosing to drive to work or school rather than walk or cycle. When comparing the percentage of children aged 5-10 years who walked to school, during 1985-86 (67%) to figures collated in 1999-2000 (54%) it is evident that the proportion decreased by 13%. In addition, the percentage of primary school children travelling by car increased from 22% to 39% during the equivalent period (DOT National Travel Survey, 2001; DoH, 2004). In the UK, the distance walked per year by each individual has fallen from 410 km.yr⁻¹, in 1975-76 to 298 km.yr⁻¹ in 1998-2000.

The level of weekly physical activity required to achieve general health benefits has led to the development of an universal recommendation. It advises that individuals should participate in "*at least 30 minutes a day, of at least a moderate intensity on 5 or more days of the week*" (DoH, 2004). Only 31% of adults presently accomplish this recommendation and only 44% of pupils achieve their recommended 2 hours of physical activity within the curriculum. The major leading type of activity that is commonly used to reach this target is walking, as reported in the UK 2000 Time Use Survey. Other preferred activities include gardening, cycling, DIY and ball games, as well as more formal structured sports and leisure activities.

The major problem is the misconception that current physical activity levels are sufficient to avoid ill-health. 80% of individuals are aware that regular exercise is beneficial for their health, but most

inaccurately believe that they participate in enough exercise to reap these rewards. For these targets to be met, a dramatic modification is necessary and perceptions need to be revolutionised. Research has shown that there are a number of barriers to participation relating not only to the costs of participating both in terms of time and expense, but also from feeling that the individual does not belong in a particular environment. For example, gyms and fitness centres usually appear to be full of fit people, which can decrease the likelihood of overweight or unfit people also participating.

The annual costs of physical inactivity in England are reported to be approximately £8.2 billion (DoH, 2004). This figure excludes individuals who are obese due to inactivity, which contributes an extra £2.5 billion annual cost to the economy. These figures incorporate both costs to the NHS and costs associated to the economy (e.g. work absenteeism).

It is clear that the fall in physical activity levels together with transitions towards calorie-rich diets, obesity and hypertension have presented serious challenges to the health of residents of industrialised countries.

2.3 Connections to Nature and Social Groups

There is an abundance of persuasive evidence which connects regular contact with the natural environment and greenspace to enhanced physical health and mental well-being. A cross section of disciplines have comprehensively researched this area of work, including fields of psychology, environmental health, ecology, horticulture, landscape planning, leisure and recreation, public health, policy and medicine (Burgess *et al.*, 1988; Rohde and Kendle, 1994; Harrison *et al.*, 1995; Carney, 2001; Frumkin, 2001; 2002a; 2002b; 2003; Henwood, 2001; 2003; Maller *et al.*, 2002; Seymour, 2003; Morris, 2003; Jackson, 2003; Pretty *et al.*, 2003, 2005a; 2005b St Leger, 2003; Tabbush and O'Brien, 2003; Elson, 2004; Pretty, 2004).

The concept originates from a prolific theory referred to as the “Biophilia Hypothesis” (Wilson, 1984; Kellert and Wilson, 1993; White and Heerwagen, 1998), which believes that humans have an “*innate tendency to focus on life and life-like processes.*” This yearning for ‘contact with nature’ is a natural inherited instinct which forms part of our genetic make-up and contributes to enhancing our well-being, mental development and personal fulfilment. It also explains our human ethic of care and growing concern in conserving the natural environment.

In addition, the psychological value of open green space has been widely documented (Jackson, 1979; Taylor, 1979; Altman and Zube, 1989; Rubenstein, 1997). Kaplan and colleagues indicate that such natural settings need not be remote wildlands, and emphasise the value of “*the everyday, often unspectacular natural environment that is, or ideally would be, nearby*” – parks and open spaces, street trees, vacant lots and backyard gardens, as well as fields and forests (Kaplan *et al.*, 1998). Many studies have demonstrated the “*power of the urban park to reduce stress, act as a social facilitator and encourage community cohesion*” (Rubenstein, 1997). Residents of urban communities typically encounter environments with less vegetation and greenspace. Therefore, access to a green urban park will significantly enhance their lives, build social capital and provide an opportunity and incentive for exercise (Brill, 1989; Ward-Thompson, 2002).

Urban environments with access to green amenities are perceived to be more attractive than urban areas lacking green environments (Hull and Harvey, 1989; Sheets and Manzer, 1991; Orland *et al.*, 1992; Kuo *et al.*, 1998). The built environment can therefore affect the likelihood of taking non-leisure based physical activity such as cycling and walking (Ross, 2000; Berrigan and Troiano, 2002; Craig *et al.*, 2002; Handy *et al.*, 2002; Parks *et al.*, 2003). Parks *et al.* (2003) have demonstrated a dose-response between the number of places to exercise within a neighbourhood and the probability of meeting physical

activity recommendations. Bedimo-Rung *et al.* (2005) propose a conceptual model to describe the relationships between park characteristics, such as the number of visits and physical activity levels within the park, park use and overall benefits, including physical and psychological health, social, economic and environmental.

Analysing the use of urban open green spaces and users resultant health status has also been used to aid landscape and planning. Grahn and Stigsdotter (2003) reported a significant relationship between the proximity of urban open green spaces, visiting frequency, duration of stay and the level of self-reported stress experienced. Having access to a public or privately owned garden adjacent to their place of residence was another principle factor. People who lived 50m or less from the nearest open green urban area visited it 3-4 times per week. In comparison, if this distance was increased to 300m, the number of visits reduced to an average of 2-7 times per week, and a distance of 1000m reduced the number of visits further to only once a week. Residents of communities lacking greenery in their local area do not compensate for this by visiting public parks or urban forests more frequently.

Open space is also important for children (Kaplan and Kaplan, 1989; Kahn, 1999; Kahn and Kellert, 2002; Bingley and Milligan, 2004). The opportunities for children residing in urban and rural neighbourhoods to join in safe play are gradually diminishing due to rising crime rates, parental fear of crime and increasing road traffic. Bingley and Milligan (2004) assessed how recalled childhood play experiences influenced their current mental well-being, along with childhood memories, imaginings and personified sensory experiences (recalled from ages 7-11 years). Scandinavian research demonstrates that factors such as children's social play, concentration and motor ability are all positively influenced following playing in nature (Fjortoft, 1999; Jorgensen, 2001). This was particularly apparent in Taylor *et al.*'s (2001) study involving children with Attention Deficit Disorder. Children worked better and their concentration improved after participating in activities in green surroundings.

Although open green space is valuable for psychological well-being, the quantity of available greenspace is also correlated with longevity and a reduced risk of mental ill-health in Japan, Scandinavia and the Netherlands (Takano *et al.*, 2002; De Vries *et al.*, 2003; Grahn and Stigsdotter, 2003). De Vries's (2003) large-scale epidemiological study reported that residents of neighbourhoods with access to copious amounts of greenspace tend to enjoy better general health. Takano *et al.*'s (2002) longitudinal study compared data relating to access to walkable greenspaces and mortality rates in elderly residents of Tokyo over a period of 5 years. They found that residing in a neighbourhood with relatively abundant greenspace correlated with a lower mortality rate.

The design of the built and natural environment thus matters for mental health (Newman, 1980; Freeman, 1984, 1998; Halpern, 1995; Kaplan *et al.*, 1998; Pretty and Ward, 2001). Researchers have attempted to establish whether there is a link between the urban environment and individual's mental health (Lewis and Booth, 1994; Watt *et al.*, 1994; Dalgard and Tambs, 1997; White and Heerwagen, 1998; Judd *et al.*, 2002; De Vries *et al.*, 2003). Initial findings indicate that the prevalence of psychiatric morbidity is prominent in built-up urban areas and less incessant in rural domains (after adjusting for confounding variables). Access to gardens or open spaces, however, reduces the frequency and furthermore, social connectivity also influences health in both rural and urban areas (Dalgard and Tambs, 1997; Taylor *et al.*, 1997; Judd *et al.*, 2002). A dysfunctional built environment can often be a source of stress and a malign influence over social networks and support mechanisms (Frumkin *et al.*, 2004).

Public health has also been compromised during the development of 'urban sprawl' (Frumkin *et al.*, 2004). Cities have rapidly been diffusing into previously defined rural areas and the typical traits of sprawl "low density land use, heavy reliance on automobiles for transportation, segregation of land uses, and loss of opportunity for some groups, especially those in inner cities" are rife and well known (Frumkin, 2002a). An ecologic study reports that urban sprawl is potentially associated with participating

in less walking for leisure, obesity and a greater prevalence of hypertension (Ewing *et al.*, 2003). Other key health issues affected by urban sprawl include air pollution, heat, alteration in physical activity patterns, number of motor vehicle crashes, pedestrian injuries and fatalities, water quality and quantity, mental health and social capital. This leads to significant health consequences which need to be acknowledged and resolved, especially for those people principally affected.

Greenspace in the form of parks, streets, squares and allotments can be especially valuable in urban areas for facilitating social contact and helping to bring people together (Ward Thompson, 2002). Activities in green places often occur in social groups, or indeed people undertake activities in order to interact with other people. Social capital is thus a component, whereby relations of trust and reciprocity tied together by social norms and institutions can help people engage in activities, link to particular places, and be mentally and physically healthy. Social capital is also closely tied to capacity for collective environmental management.

Three key studies researching the link between nature and social contact were undertaken in a poor neighbourhood in Chicago, whereby the only variation in public domains were the presence or absence of green common spaces with trees or grass (Coley *et al.*, 1997; Kuo *et al.*, 1998; Kwoen *et al.*, 1998). Coley *et al.* (1997) concluded that the presence of trees significantly increased the utilisation of the public green space. Kuo *et al.* (1998) hypothesised that “*greener neighbourhood common spaces give rise to stronger neighbourhood social ties (NST’s)*”, and found a difference in the level of NSTs and the amount of vegetation in the common space, with the strongest ties occurring in areas rich in green matter. These residents had “*more social activities and more visitors, knew more of their neighbours, reported their neighbours were more concerned with helping and supporting one another and had stronger feelings of belonging*”. The third study involved elderly residents and looked at an additional independent variable which looked at the time people spent in green common spaces. The study reported a positive link between the social integration of the elderly residents in the community and exposure to green common spaces. The studies reinforce the notion that regular contact with nature is indispensable, as residents prefer areas with trees and grass and negatively respond to areas devoid of vegetation. The mere presence of trees encourages more frequent use of the outdoor space and experiencing nature reduces mental fatigue, diminishes sensations of stress and has emphatic effects on mood (Kuo *et al.*, 1998; De Vries *et al.*, 2003).

Some of the most obvious effects on health can be observed when environments are transformed. For example, after slum clearances, people gain from improvements in physical assets and services, but lose out when social networks deteriorate and distinct cultures break down. As Hugh Freeman (1998) puts it, such clearances often involved “*the demolition of a neighbourhood and not just the destruction of buildings, but also that of a functioning social system, with a characteristic culture of its own and important social networks that could never be reproduced artificially*”. One study of social change amongst the residents in 1920s Dagenham found that there were wide variations in sociability according to the make up of the streets. People living in small, narrow streets and cul-de-sacs had more social connections and reciprocal arrangements than those in wider, busy streets, where fewer people got to know their neighbours or described them as friendly. When large modern estates replaced the existing layout, the social support networks based on geographic proximity broke down, leading to an atomised community.

Another study of a 43 block project in Minnesota, built in the mid-1950s found that although residents had a similar number of friends as non-project dwellers, these “*bore little or no relation to the physical proximity of families to each other*”. Neighbours had become much more hostile, and the quality of life had fallen, even though individuals were generally satisfied with their own apartments. The problem was that the project offered no natural or defensible space as Oscar Newman later came to call it, or common facilities around which neighbourly relationships could develop. The space between the blocks was soon

called 'wasted space' by residents. By 1972, only 18 years after the project had been opened, all the blocks were demolished after years of vacancy rates exceeding 70%. Ironically, the design won architectural praise, but only before the people had to live in it (Newman, 1972; Halpern, 1995).

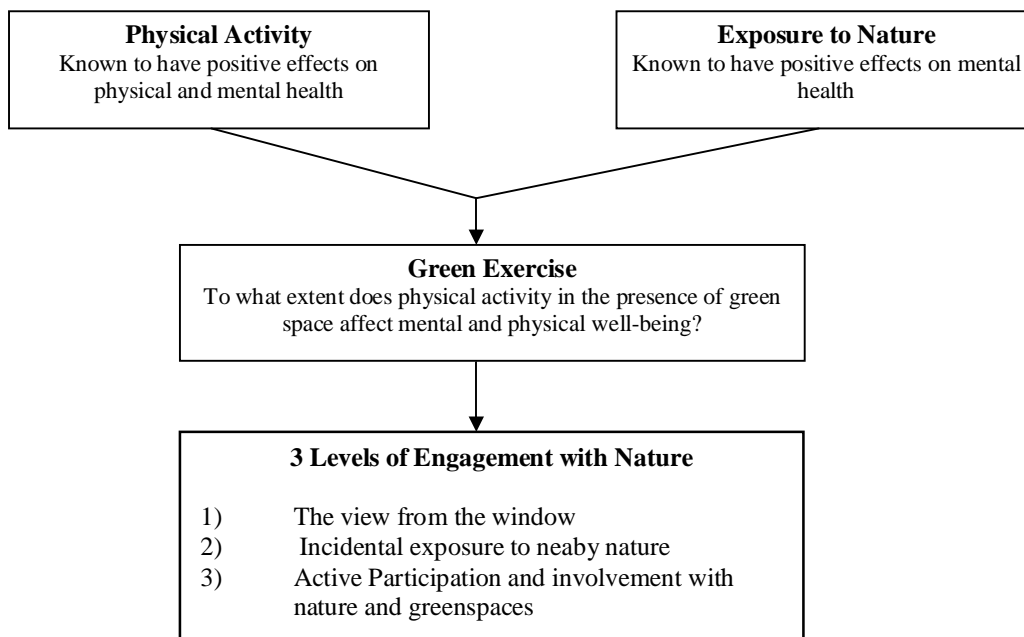
Problems arising from physical features of the built environment include sick building syndrome (caused by materials used in some buildings and ill-designed air conditioning systems), long distance commutes to work, and suburban communities with self-contained homes that encourage little contact with neighbours. However, contrasting positive social features include access to an immediate family environment or extended networks of friends and neighbours, as well as presence of green spaces, meeting places, and opportunities for interactions, all of which lead to improvements in mental and spiritual well-being (Newman, 1980; Garreau, 1992; Pretty and Ward, 2001).

Chapter 3. Emergence of Green Exercise

Physical activity positively transforms both physical and psychological well-being (Scully *et al.*, 1998) and regular contact with nature and greenspace enhances mental well-being. Therefore, we have hypothesised that there may be a synergistic benefit in engaging in physical activities whilst simultaneously being directly exposed to nature (Hayashi *et al.*, 1999). We have called this “green exercise” (Pretty *et al.*, 2003). The natural and built features of an environment can influence behaviour, interpersonal relationships and actual mental states (Tuan, 1977; Freeman, 1984; Kellert and Wilson, 1993; Tall, 1996; Frumkin, 2001). Therefore, the environment can be either therapeutic or pathogenic (Burgess, 1988; Gesler, 1992; Lewis and Booth, 1994). Despite the continual urbanisation of modern societies, why, then, does nature still seem to have a positive effect on individuals?

Current evidence implies that contact with nature positively contributes to our overall health status by aiding recovery from pre-existing stresses or problems, having an ‘immunising’ effect by protecting us from future stresses, and improving concentration. Consequently, we have discerned 3 distinct levels of engagement with nature highlighted in Figure 2 (Pretty *et al.*, 2004; Pretty, 2004; Pretty *et al.*, 2005a; 2005b).

Figure 2: The Concept of Green Exercise and its 3 Levels of Engagement



What is interesting about this evidence is that most of it relates to the USA, Scandinavia and Japan. There have been very few empirical studies to investigate the effect of nature and green space on health in the UK (for example, see Reynolds, 1999; 2002; Countryside Agency, 2003; Willis, 2004; Pretty *et al.*, 2005a; 2005b). In addition, very little research has investigated the separate effects of nature on social capital and collective well-being (see Burgess, 1988; Coley *et al.*, 1997; Fredrickson and Anderson, 1999; Ulrich, 1999; Ward Thompson, 2002).

3.1 The View from the Window

The evidence demonstrating the health benefits of viewing nature through a window or in a painting has been collated at hospitals, the workplace and home and whilst travelling to work (Verderber and Reuman, 1987; Tennessen and Cimprich, 1995; Leather *et al.*, 1998; Parsons *et al.*, 1998; Kaplan, 2001; Laumann *et al.*, 2003). Two classic studies from the 1980s (Moore, 1981; Ulrich, 1984) suggest that greenspaces and nearby nature should be seen as a fundamental health resource (Frumkin, 2001; Maller *et al.*, 2002). The first found that prisoners in Michigan whose cells overlooked farmland and trees reported 24% less sick cell visits compared to those in cells facing the prison yard. The second was a ten year comparative study of post-operative patients in Pennsylvania whose rooms either overlooked trees or a brick wall. The hospital stay for those patients with tree views was significantly less, they also required fewer painkillers and used less strong or moderate medication and nursing staff reported fewer negative evaluation comments in the medical records.

At home, the view is equally important. Kuo and colleagues have demonstrated that small amounts of green in the barren urban environment of Chicago make a large difference to people's well-being (Kuo *et al.*, 1998; Taylor *et al.*, 1998, 2001; Kuo and Sullivan, 2001). Green views from home, plus nearby nature in which to play, have a positive effect on the cognitive functioning of children and their capacity to think. Residents of two of the ten poorest neighbourhoods in the USA positively responded to trees and grass near their blocks, and they indicated the greener the better. Buildings with more vegetation also had 52% fewer property and violent crimes than those with none, and these residents also reported lower levels of fear and less generalised aggressive behaviour in the local neighbourhood. Interestingly, there was a greater difference between non-green and moderately green buildings than between moderately and very green, suggesting more of a benefit would accrue from a light-greening of all urban spaces rather than a dark-greening of just a few. Indeed, well-maintained vegetation may be a cue to care, as it suggests that local people care for their environment and so are more vigilant (Kuo and Sullivan, 2001).

Windows present in the workplace have also shown to buffer the stresses of work. Over longer periods those workers with windows have reported fewer illnesses, felt less frustrated and more patient and relaxed and have expressed a greater enthusiasm for work (Kaplan, 1993). Those in windowless workplaces have compensated by displaying pictures of landscapes or keeping indoor plants (Heerwagen and Orians, 1993). The introduction of interior plants reduces stress, by lowering systolic blood pressure (Lohr *et al.*, 1996), increases productivity and attention (Kotter, 1999; Shibata and Suzuki, 2002). Fjeld *et al.* (1998) also imply a link exists between workers health and the presence of plants within the workplace (Fjeld *et al.*, 1998; Fjeld and Bonnevie, 2002). Without this form of compensation workers appear to be more stressed and aggressive.

The view during the commute to work can also influence levels of stress. When people are exposed to different types of roadside corridors, it was reported that those on the urban drive which was dominated by human artefacts were most stressed compared to those driving through nature prevalent scenes of forests or golf courses. In addition, the nature drive appeared to have a protective effect against future stresses that might arise during the day (Parsons *et al.*, 1998).

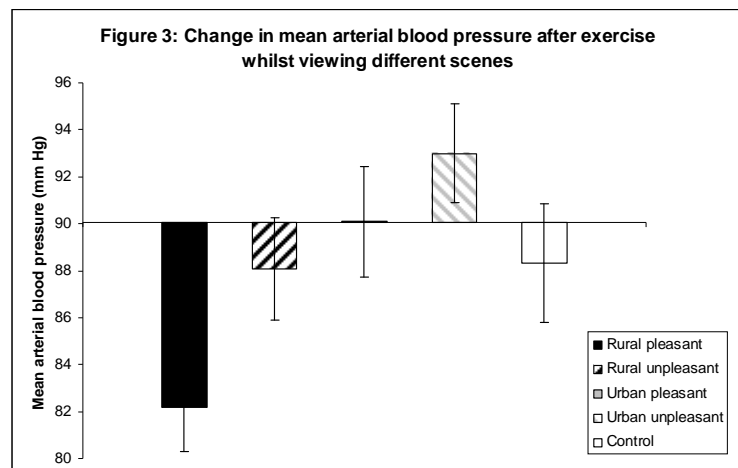
The value of the view from a window is also reflected in monetary terms as various studies have demonstrated increased economic value for hotels and housing (Peiser and Schwann, 1993). The presence of greenspace affects room pricing policy in hotels in Zurich (Lange and Schaeffer, 2001) and increases the value of homes with gardens overlooking lakes and paths in the Netherlands by 25% (Luttik, 2000). Street trees in Berlin increase real estate value by 17% (Luther and Gruehn, 2001) and the value of housing near to water is greater in Merseyside (Wood and Handley, 1999).

The effect of viewing nature in pictures has also been demonstrated (Ulrich, 1993; Van den berg *et al.*, 2002; Diette *et al.*, 2003; Pretty *et al.*, 2005a). An initial study in a Swedish psychiatric hospital reported the amount of damage to paintings on walls over a 15 year period. Damage was only ever inflicted on abstract paintings and there were no recorded attacks on paintings depicting nature and landscapes. In a more recent study of hospital patients, Diette *et al.* (2003) demonstrated the clear value of a landscape picture accompanied by the sounds of nature. Prior to their operation, a group of bronchoscopy patients overlooked a large landscape picture present at their bedside whilst listening to sounds of birdsong and a babbling brook. This group's level of good or excellent pain control was 50% higher in comparison to those without access to the picture or sounds. This simple intervention has financial implications if it suggests that less money can be spent on pain killing drugs for patients (Diette *et al.*, 2003).

Van den berg *et al.*, (2002) asked patients to view a frightening movie followed by either a video of a natural or built environment. Greater improvements in mood and concentration were reported after viewing natural settings compared to viewing built environments and the natural scenes were perceived as more beautiful. Laumann *et al.* (2003) and Ulrich *et al.* (1991) also used videos of natural and urban environments to analyse changes in heart rate, selective attention and stress recovery. Participants heart rate recordings in the nature group dropped during the video compared to baseline values, whereas participants viewing the urban environments did not report any change. Recovery was also faster when exposed to natural environments, which supports the theory that nature exposures of short duration are important in urbanised societies.

Many studies have used photographs to investigate the effects of different scenes on cognition and emotions (Coughlin and Goldstien 1970; Shafer and Richards 1974; Zube *et al.* 1975; Sorte 1975; Russell and Mehrabian 1976). Most studies of this type have used still photos, mainly comparing urban and rural scenes (Honeyman, 1992; Schroeder 1995; Hartig *et al.*, 1996; Purcell and Lamb 1998; Staats and Hartig 2004), and all have consistently demonstrated reduced stress and improved mental well-being in the presence of nature scenes. Few studies have investigated the effects of exposure to different scenes on physiological measures such as heart rate and blood pressure (Ulrich *et al.*, 1991; Hartig, 1991; 2003; Laumann *et al.*, 2003) but Pretty *et al.*, (2005a) was the first to analyse the potential synergistic effects of physical activity and nature. The aim of this study was to determine the physiological and psychological effects of exercise conducted on a treadmill whilst being exposed to a series of rural or urban photographic scenes. Each of these was sub-divided into pleasant and unpleasant categories in order to explore the effect of rural scenes compromised with pollutants or other visual impediments and also the effect of clearly urban scenes enhanced by the presence of nearby nature in the form of greenspace. Therefore, five categories of scenes were tested: rural pleasant, rural unpleasant, urban pleasant, urban unpleasant and control (exercising without exposure to images).

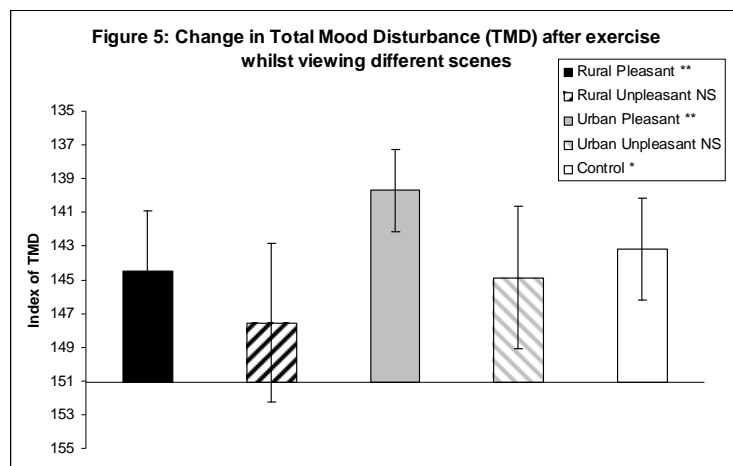
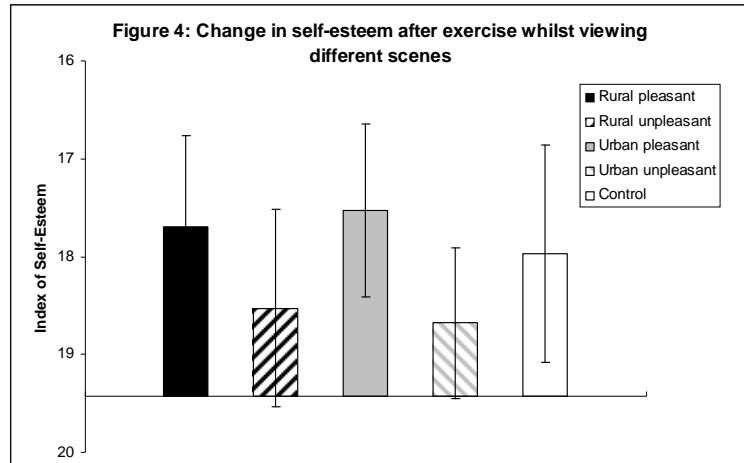
Blood pressure and two psychological measures (self-esteem and mood) were measured before and after the intervention. Figure 3 highlights the changes in mean arterial blood pressure normalised to the starting average for all five groups. Only those subjects viewing rural pleasant scenes experienced significant decreases in blood pressure and interesting those viewing urban unpleasant pictures witnessed a slight increase. As control subjects experienced a slight decrease in blood pressure it is clear that both pleasant and unpleasant urban scenes increase blood



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pressure relative to the control. The urban scenes therefore appear effectively to negate the marginal but potentially beneficial impact of exercise on blood pressure.

Figure 4 shows the change in self-esteem with starting self-esteem averaged for all groups. Self-esteem was significantly increased in all groups but the control treatment produced a greater improvement in self-esteem than the two unpleasant treatments (rural and urban), implying that the latter have a depressive effect on self-esteem relative to exercise alone. Both pleasant treatments, however, produced the greatest increase in self-esteem. A similar pattern emerged when analysing changes in total mood disturbance (TMD) (Figure 5). Again, a significant improvement in TMD is seen in all five groups but the biggest improvements are seen in the rural and urban pleasant conditions, which are greater than the control group. The two unpleasant conditions are once again causing a depressive effect in comparison to exercise alone. This shows the synergistic effect of exposure to both rural and urban pleasant green environments, when combined with exercise.



3.2 Incidental Exposure to Nearby Nature

The second category of engagement with nature involves being in the presence of nearby nature which is incidental to some other activity, which you are primarily engaged in. Examples include walking or cycling to work, reading on a garden seat, or talking to friends in a park (Hayashi *et al.*, 1999; Ulrich, 1999). It also incorporates nearby nature in neighbourhoods or in the grounds of hospitals and care homes, along with healing gardens (Verderber and Reuman, 1987; Cooper-Marcus and Barnes, 1995, 1999; Wells, 2000; Whitehouse *et al.*, 2001; Ulrich, 2002; Wells and Evans, 2003).

A recent report by Ulrich (2002) provides detailed information addressing the health benefits of nature and especially gardens in hospitals. Nakamura and Fujii (1990, 1992) compared brain wave activity in unstressed participants when viewing either plants or human made objects. Viewing plants with flowers significantly influenced subjects' relaxation state in comparison to pots without plants. In addition, electroencephalograms (EEG) were monitored whilst subjects were situated in a real outdoor setting viewing either a green hedge, concrete fence of similar proportion or a concoction of them both. Again greenery induced relaxation whilst the concrete eluded stressful experiences.

Traditionally hospitals have been renowned for their surrounding beautiful gardens and array of plants (Nightingale, 1860). Similarly, monasteries often designed intricate gardens to offer a pleasant relaxing environment for the ill to visit for a respite (Gerlach-Spriggs *et al.*, 1998). Sadly, over time, hospital funding has become more concerned with reducing the risk of infection and focusing on efficiency and this has been reflected in design and lack of greenery. Consequently, they have evolved into stressful establishments which do not fulfil the emotional needs of patients, their families and staff (Lindheim and Syme, 1983; Ulrich, 1991; Horsburgh, 1995). This problematic transformation needs to be addressed as research implies that gardens and nature in hospitals enhance mood, reduce stress and improve the overall appreciation of the health care provider and quality of care.

Healing gardens are designed to aid recovery from stress and are often present in hospitals and care homes, whereby stressful experiences are encountered by patients, visitors and staff. Sempkirk *et al.* (2003) comprehensively reviews studies that analyse positive effects of these types of gardens. In addition, Cooper-Marcus and Barnes (1999) extensively review research into the positive impact of healing gardens on the patient's health and well-being. Whitehouse *et al.* (2001) found that a healing garden in a children's hospital in California had numerous positive effects on users. 54% stated that they felt more relaxed and less stressed, 24% refreshed and rejuvenated, 18% more positive and able to cope and only 10% had experienced no difference in mood. Nearly half of all observed visitors spent less than 5 minutes per visit in the garden, so even very short visits were beneficial. Visitors to the garden want to "*escape the stresses of the hospital and enjoy the relaxing and restorative elements of nature*".

Outdoor natural settings are also sometimes seen as therapeutic 'healing places' (Olds, 1989). In this study participants were asked to mentally recall an occasion whereby they were experiencing feelings of helplessness, pain or distress and envisage the ideal environment whereby immediate healing could occur. Outdoor scenes featuring trees, grass, water, rocks, flowers and birds were evident in over 75% of the drawings. Even the interior settings that represented less than 25% of the pictures still contained elements that are typical of outdoor settings. This emphasises how significant an environment embracing nature can be during the healing process.

Special healing gardens are often designed for patients with Alzheimer's disease and a study by Mooney and Nicell (1992) compared patients with this disease who had access to a garden to those who did not. Those who had access to a garden showed significantly lower levels of aggression and violence than those who did not have this facility.

Such principles are applied in the Eden Alternative nursing home in Texas, where healing gardens, greenhouses, atriums and plants have been deployed. After conversion, there were 57% fewer bedsores, an 18% reduction in the number of patients restrained, a 60% decrease in behavioural incidents and a 48% reduction in staff absenteeism. The costs of such nature based treatments are expected to be much less than expenditure for drugs and surgery, to achieve the same outcomes (Eden Alternative, 2002).

The design of landscape grounds is also of great importance to elderly residents in retirement communities. When natural elements were incorporated within the setting, residents psychological, social and physical well-being were all enhanced (Browne, 1992).

Research analysing the link between nearby nature in neighbourhoods and health in children found that children in families moving to houses with more nearby nature had higher levels of cognitive functioning (Wells, 2000). These findings should be treated with caution because it could be argued that these types of families were able to select these types of preferred homes. Therefore, cause and effect can be difficult to disentangle and decipher. Wells and Evans, (2003) also reported that those 8-10 year old children living in five New York communities exposed to both indoor and outdoor vegetation were less stressed and recovered from stressful events more successfully than those in greenless homes and backyards.

These findings supported earlier work involving younger children who had better attention capacity and more co-ordination when they were regularly exposed to outdoor nature.

A lot of research has analysed the positive effect of plants in offices (Lewis, 1992; Randall *et al.*, 1992; Ulrich and Parsons, 1992; Larsen *et al.*, 1998). One particular study removed all office plants for a period of three months and then questionnaires were administered to all employees. One office floor was then professionally landscaped and to ensure consistency of environmental change the floor with no plants displayed artwork on the walls. A second questionnaire was administered six months later which revealed the enjoyment workers got out of looking after the plants themselves. Nearly half of the employees situated on the plantless floor visited the other floor purposely to view the plants (Randall *et al.*, 1992).

Another study measured the effect of indoor plants on participant's productivity, attitude towards the workplace and overall mood in the office environment (Larsen *et al.*, 1998). Offices were randomly transformed to incorporate no plants, a moderate number of plants or a high number of plants. Participants completed a timed productivity assignment and self-reported assessment, which produced conflicting findings. Statistical analysis implied that productivity was poorer in the office with more plants present but participant's assessment of performance increased relative to the number of plants in the office. When plants were present, participants perceived the office to be more attractive and described an elevated level of mood.

Instances of ecological restoration can also lead to improvements in health and well-being for members of the local community. A recent study evaluated the physical and mental health benefits of environmental improvements at two green sites in the UK (Peacock *et al.*, 2005). Environmental enhancements to an urban park and a canal regeneration scheme resulted in more users visiting the site per month (33% increase), more frequently (34% increase in the number of visits per month) and spending longer engaging with nature per visit (39.73 mins instead of 30.26 mins). Prior to the restorations people were using the sites as a thoroughfare to work or school, or because it happened to be the nearest open space they could walk their dog. After the improvements, they were choosing to directly engage with the environment instead of being incidentally exposed and their reasons for visiting now included "health-fresh air", "scenery" and "wildlife". Before the environmental improvements their reasons for accessing the sites were predominantly for "exercise" and "walking the dog". It was also found that the longer individuals spent within the green environment the more their self-esteem improved, which can lead to an abundance of health benefits. Therefore, continual improvements to provisions, access and the quality of the greenspace rich in biodiversity will provide an ideal opportunity for outdoor recreation and act as a valuable resource for its users.

3.3 Active Participation and Involvement with Nature and Green Spaces

The third category of engagement with nature implies a positive decision to visit places where there is green nature and directly participate in an activity, such as gardening, trekking, walking, mountaineering, running, camping, cycling, water based activities etc. It includes exposure to nearby nature, such as in gardens or nature reserves, as well as distant eco-systems, such as national parks and wildernesses.

The behaviour of many groups of people seems to suggest that they already appreciate the benefits of protecting the environment, undertaking physical activity and combining the two. Their values are expressed in a variety of direct and indirect ways, through membership of environmental and wildlife organisations, visits to the countryside and membership of sports and outdoor organisations. In the UK, people in industrialised societies spend a great deal of time trying to engage with nature in different ways. Each year there are 1.5 billion day visits to the countryside and seaside involving substantial amounts of physical activity. Each year, people participate in 158 million days of outdoor sport and leisure, 457

million days of walking and hiking, 21 million days of swimming and 53 million days of cycling and mountain biking (Table 2).

Table 2: Green Exercise in Great Britain countryside and days spent on each activity (2002-03)

	Countryside		Seaside / Coast		Wood / Forest		Water with boats		Water without boats	
Volume (millions)	1262		267		252		119		134	
Value (£bn)	10.9		3.1		1.2		1.4		1.1	
Proportion of day visits on each activity (%) and number of days per year (million) on each activity										
Main Activity	(%)	Days per yr (million)	(%)	Days per yr (million)	(%)	Days per yr (million)	(%)	Days per yr (million)	(%)	Days per yr (million)
Walk, hill-walk, ramble	32	404	20	53	62	156	34	40	54	72
Cycling, mountain biking	4	50	1	3	8	20	7	8	2	3
Swimming	1	13	3	8	1	3	3	4	0	0
Visit beach	0	0	21	56	0	0	1	1	0	0
Sports, active pursuits indoor, outdoor, field, water	11	139	7	19	4	10	8	10	9	12
Hobby or special interest	8	101	6	16	4	10	5	6	4	5
Visit leisure attraction	5	63	4	11	3	8	6	7	5	7
Visit park or garden	3	38	1	3	7	18	4	5	9	12
Informal sports, games, relaxation and wellbeing	3	38	2	5	1	3	0	0	1	1
Other	33	416	36	96	9	23	31	37	16	21

Source: Countryside Agency (2004)

In addition, 5 billion visits are made annually to urban parks, 5million people are regular anglers and many millions garden regularly (15 million gardens in the UK), 60% of households have a pet, and many millions of other are birdwatchers, wild-fowlers, dog walkers, nature watchers, horse riders and game shooters. Membership of environmental and heritage organisations also increases access to outdoor facilities and greenspace. For example, National Trust has 3 million members, RSPB has 1 million, the Wildlife Trust has 500,000 and Ramblers Association has 170,000. Some of these activities and memberships already have a green exercise component, such as walking in the countryside, fell-running and orienteering, mountaineering and work days on nature reserves, which are all classed as informal recreation.

Greater participation by the public in green exercise has increased due to new initiatives, such as Walking the Way to Health Initiative, which has encouraged 1 million people to walk more. This successful initiative set up by the Countryside Agency and British Heart Foundation encourages group walking in green surroundings providing them with new social networks and confidence to access areas they would not explore alone until familiarity had been established. Other successful projects such as the “Green Gym” initiative set up by the British Trust of Conservation Volunteers encourages participation in local nature conservation activities to improve health and well-being. The gyms encourage social networks and projects vary, including creating community gardens, managing local woodlands, tree-planting and maintenance of public footpaths.

When comparing these innovative outdoor voluntary activities to indoor sports, the adherence rates are a lot more successful in the long term. Nearly half of the participants of indoor sports drop out within the first six months. Walking seems to be the most preferred form of exercise to maintain adherence (Hilldsdon and Thorogood, 1996), but research analysing joggers also reported that running in a stimulating green environment detracted the mind from the physical discomfort of exertion and fatigue. This enabled participants to continue jogging for longer periods of time (Pennebaker and Lightner, 1980).

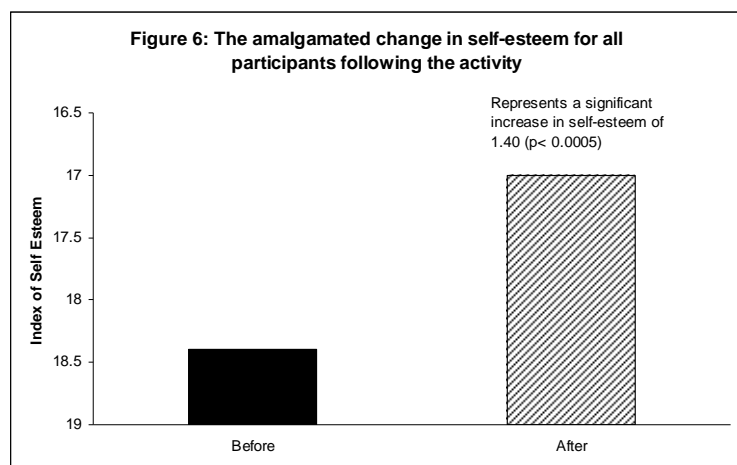
It is often argued that the underlying reasons for nature's ability to help people recover from stress and mental fatigue is due to its restorative powers. The two prevailing theories incorporating this notion are Kaplan and Kaplan's Attention Restoration Theory and Ulrich's psycho-evolutionary model, which both assume the restorative effects of nature are due to an innate evolutionary basis (Kaplan and Kaplan, 1989; Ulrich, 1983; Kaplan, 1995). Hartig and colleagues have further developed the idea that nature can restore deficits in attention arising from overwork or over-concentration, making people both feel and think better (Hartig *et al.*, 1991, 2003). They found that sitting in a room with tree views promoted more rapid blood pressure decline compared to sitting in a windowless room. In addition, walking in a nature reserve reduced blood pressure more than walking along an urban, non-green street. In both contexts, the green room and green walk, people recovered more rapidly from attention-demanding tasks. The benefits of the nature walk continued for 30 minutes before the difference converged. This is probably because the benefits of the exercise (the walk itself) started to surpass any unpleasantness of the urban street.

The research demonstrates that short or occasional exposures to nature are potentially highly beneficial. However, we are yet to establish whether cumulative short exposures, such as viewing nature out of a window or taking a short walk equate to longer, less frequent exposures to nature, such as a weekend trekking in the hills (Hartig *et al.*, 2003). Secondly, the findings do not explore enhanced or different effects of exposure to specific places for certain people because they hold memories and stories which are associated with them. It could be hypothesised that some environments may be green and beneficial, but anonymous, whereas others may evoke pleasant memories which affect the experience (Tuan, 1977; Gallagher, 1994). Bodin and Hartig (2001) continued to assess the ability of the environment to source attentional and emotional restoration by comparing different outdoor environments commonly accessed during a run. A run through a nature reserve dominated by greenery, water and pleasant views was compared to an urban route through sidewalks and streets with varying traffic volumes and many buildings. Findings were consistent with the proposed hypothesis that running in a nature reserve promoted restoration more effectively than exercising in the urban environment. Runners also stated their preference for the nature reserve as they perceived it to be more psychologically restorative.

Butryn and Furst (2003) also examined the effects of park and urban settings on mood and cognitive strategies of non-elite female runners. Mood and feeling states significantly improved following the run, irrespective of setting, but the natural vegetated park setting was overwhelmingly preferred (93%) by the runners.

The research so far has primarily focused on either the physiological, psychological, restorative or social health benefits of outdoor recreation but not necessarily the combined effect of all components. Very few studies have quantified the improved health and psychological well-being effects that participation in green exercise activities derives.

Therefore, Pretty *et al.* (2005b) undertook research involving 263 participants which measured the effects of ten green exercise activities (including walking, cycling, horse riding, fishing, canal boating and conservation activities) in four countries of the UK. The case studies incorporated a range of activities, occurring in diverse contexts (woodlands, water-based, open countryside etc) with varying durations and intensities. Group and individual activities were included

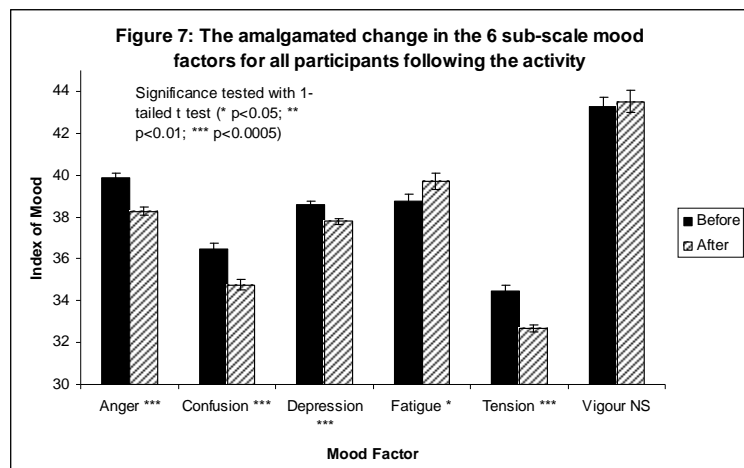


along with organised and informal sessions. The composite questionnaire was administered pre- and post-activity which measured physical and mental health as well as incorporating questions which captured qualitative narratives. Standardised psychological tools were used to measure changes in self-esteem and mood. Even though these participants were generally an active and healthy group, we found that green exercise led to a significant improvement in self-esteem and total mood disturbance (TMD). Figure 6 highlights the significant improvement in self-esteem when all ten case studies were amalgamated.

Figure 7 reports the significant reduction in the subscale mood factors of anger-hostility, confusion-bewilderment, depression-dejection and tension-anxiety. Although participants felt significantly more fatigued (due to the intensity of the exercise) after the activities they still felt more vigorous and alive. Improvements in self-esteem and mood were found not to be affected by the type, intensity or duration of the green exercise as results were comparable for all ten case studies.

The qualitative narrative also highlighted the value of creating

social networks and the enjoyment participants derived from meeting new people and becoming part of a social group. Thus, all these activities generated mental and social health benefits, indicating the potential for a wider health and well-being dividend from green exercise.



Alternative examples of active participation include access to private and community gardens, which provide an important direct link to nature for many people. These are particularly valuable in urban settings and it is reported that the average family spends 3 ½ hours per week gardening. There are over 300,000 occupied allotments in the UK, yielding some 215,000 tonnes of fresh food annually, but more importantly, providing the opportunity for regular contact with nature and greenspace. There are several hundred city farms or community gardens in the UK (Pretty, 1998) providing food, especially fruit and vegetables for poorer urban groups and a range of other natural products, such as wood, flowers and herbs. Derelict or vacant land is often transformed into desirable areas for local people to visit and enjoy, resulting in the creation of quiet, tranquil environments for the community that attracts more wildlife. They also provide an opportunity for unemployed people to use their time productively in their own community and for mental health patients to engage in work that builds self-esteem and confidence.

The term “care farming”, which is gaining strength in continental Europe, is used to describe an agricultural holding which offers day care or a supervised workplace within a natural environment. It predominantly attracts people who are unable to gain employment in the mainstream job market due to a number of varied reasons. The utilisation of these care farms promotes physical and mental health and well-being, social contact and sensory stimulation. On such farms, animals, plants, gardens, fields and woodlands are used to provide recreational and/or work-related activities for psychiatric patients, people with learning disabilities, people with a history of drug abuse, disaffected youth, elderly people and social service clients (Hassink, 2003). By 2004, there were 500 green care farms in Norway, 430 in the Netherlands, 300 in Italy, 300 in Germany, 250 in Austria, 140 in Belgium and 15 in Slovenia. Such green care farms are formally tied to local social services and hospitals and provide an important component of “care in the community”. There are several Care Farms in the UK (although these are as yet

not directly supported by health or social care providers) and growing interest to encourage further development in this area.

Based on these experiences of the value of gardening for mental health, a tradition of horticultural therapy has also emerged in recent years (Lewis, 1992; Ulrich, 1999; Sheffield Healthy City Team, 2001; Sempkirk *et al.*, 2002). Therapeutic horticulture is defined as “*the process by which individuals may develop well-being using plants and horticulture. This is achieved by active or passive involvement*” (Growth Point, 1999). Sempkirk *et al.* (2002) explored the utilisation of social and therapeutic horticulture (STH) for groups of patients recovering from major illness or injury, those with physical or learning disabilities, mental ill-health, the elderly, offenders and drug or alcohol abusers. An array of health benefits were experienced including improved self-esteem, self-confidence and independence, and increased sense of general well-being and the social opportunities the projects offered. The STH projects also increased their clients’ access to “*growing things*”, “*nature*”, “*being outside*” and the “*peace of the natural environment*”, along with opportunities for self-reflection, relaxation and restoration (Sempkirk *et al.*, 2005). Inclusion in STH programmes has also led to employment opportunities and helped the individual in their training or education progression. Like many other areas, where nature has been used as a form of therapy, hard evidence of effectiveness is surprisingly scarce (Frumkin, 2001).

Another field of research relating to the health benefits of active participation in the natural environment concerns wilderness experiences. The benefits of wilderness experiences date back to the testimony of 19th century writers such as John Muir and Henry David Thoreau. Muir’s writing on the Sierra Nevada, and the importance of such wild areas for well-being was instrumental in the establishment of the world’s first national park at Yellowstone in 1872 (Muir, 1911, 1992; Thoreau, 1837-53, 1902; Pretty, 2002). A number of studies have shown that people both seek and derive a variety of values when they visit wildernesses, in particular a desire for tranquillity and natural beauty, escape from the stresses of urban life, and the potential for dramatic ‘peak experiences’ (Scott, 1974) or transcendent moments. Herzog and colleagues conclude that “*the restorative potential of natural settings is probably underappreciated*”, as many people do not appreciate the full benefits of such settings – particularly in the face of competition for multiple other leisure and entertainment opportunities of modern life (Rossman and Ulehla, 1977; Williams and Harvey, 2001; Herzog *et al.*, 2002).

Fredrickson and Anderson (1999) explored the effects of a wilderness experience on two groups of women in two areas of Minnesota and Arizona. Participants enjoyed both the individual contact with nature and being part of a social group, who shared the experience together. Personal testimonies revealed that the experience left a lasting impression on most participants, especially as the experiences differed so dramatically from everyday life. Participants spoke of renewed hope, a reawakening of emotions and a new sense of identity.

Studies have also analysed the effects of nature on sense of purpose and personal growth and the positive effects on self-confidence, self-image and mood in various groups of people, including young criminals, people with depression and abused women (Kaplan and Talbot, 1983; Kaplan, 1984; Hazelworth and Wilson, 1990; Stringer and McAvoy, 1992).

Recreational wilderness experiences incite personal development by initiating feelings of competence and autonomy (Coleman and Iso-Ahola, 1993; Coleman, 1993). Hartig and Evans (1993) explain that the reason these feelings are experienced is not solely due to the interaction with nature but also due to the absence of any social pressure and meeting the expectation of others. Following these findings Fox (1999) developed a model referred to as the “*Spiritual Experience Process Funnel*”. It proposes that during a wilderness experience an individual starts to relax and feel autonomous and competent, they begin to become receptive to the beauty and symbolic importance of nature, which stimulates reflection and sense of purpose. The symbolic effect of nature describes natural elements and places such as trees, water,

special locations, which act as symbols which relate to deeper meanings and values. Therefore, a “sense of place” manifests itself which refers to an emotional bonding and identification with a particular place or area (Health Council of the Netherlands and RMNO, 2004). The symbolic effect of nature and place attachment is evident in urban environments as well as in the wilderness (e.g. trees, allotments, areas of scrubland, water etc) (Chenoweth and Gobster, 1990). Thus we are partly shaped by the environment, by our attachments developed during specific experiences and interactions. The personal benefits include psychological well-being, self-image, and self-esteem, and the social ones include family stability, community pride and cultural identity (Pretty, 2002). So, is contact with nature and place a fundamental part of the way we establish self-identity? Identity is a relationship in which something is shared, and linkage with nature and communities partially helps to do this (Fox, 1995; Milton, 2002). To a certain extent, who and what we are is constructed through relationships with people and with nature. Thus, if we lack these relationships and connections, we must lose a sense of personal identity and self-esteem.

Fredrickson and Anderson’s (1999) study also found that person-person interactions were equally as important as person-place connections. The study found that person-person interactions were just as important as person-place connections: “*the affective appeal of a particular place setting has as much to do with the social interactions that occur there, as with the overall visual appeal of the landscape itself*”. Similar experiences were noted in the forests of Australia, where so-called ‘transcendent’ experiences were found to provoke a sense of harmony, freedom and well-being that were sufficiently long-lasting to change long-term attitudes to the environment. Several other studies have noted the value of natural and wilderness experiences and their therapeutic potential, and the additional role that physical hardship can play in triggering more profound experiences (Mitchell, 1983; Kaplan, 1995; Fredrickson and Anderson, 1999; Williams and Harvey, 2001; Herzog *et al.*, 2002).

Adventure therapy has been utilised for a wide variety of people, particularly in the USA (Kaplan and Talbot, 1983; Martin, 1996; Richards and Smith, 2003) for many years. Experiences have involved deep immersion in natural and wild areas far from urban development, with participants camping and taking part in a range of physical activities, such as rock climbing, swimming, canoeing and hiking. The effects of such therapeutic camping have been assessed for bereaved children (Moyer, 1988), mental health patients (Jerstad and Stelzer, 1973; Berman and Anton, 1988; Davis-Berman and Berman, 1989), children with renal disease (Warady, 1994), emotionally-disturbed adolescents (Hobbs and Shelton, 1972), addiction recoverers (Bennett *et al.*, 1998; Kennedy, 1993), children with learning difficulties (Michalski *et al.*, 2003), and urban adults (Fredrickson and Anderson, 1999; Williams and Harvey, 2001). Such programmes gave rise to the Outward Bound movement (Kaplan and Talbot, 1993; Hyer *et al.*, 1996; Stys, 2001). Some studies have emphasised the spiritual benefits of wildernesses (e.g. Hayashi, 2002; Johnson, 2002), and how activities in nature can change worldviews and behaviour (e.g. Martin, 1996). Pryor *et al.*, (2005) also examine the use of outdoor education and bush adventure therapy as a basis for a cross-sectoral approach to health by recognising that a healthy and sustainable environment is dependent on healthy human relationships with nature.

It is evident that the lives of the individuals participating in these diverse programmes are significantly enhanced. Research generally indicates that the effects of wilderness experiences are positive, but once again there is surprisingly little quantitative data, although there is an array of qualitative and observation research. An important unanswered question for those concerned for sustainability is to what extent do the benefits of such wilderness experiences continue off-site? Do they provoke long-term changes in thinking, which could lead to deep social and political transformations? It is also true that people with positive environmental values may be predisposed towards the restorative potential of nature, and that these values help to shape environmental attitudes (Kaiser *et al.*, 1999; Kals *et al.* 1999; Schultz and Zelezny, 1999).

Forest Schools are another example of active participation in the countryside. This concept originated in Scandinavia in the 1950s as a way of teaching children of all ages about the natural world and providing

hands on learning in a woodland environment. By the 1980s it had become an integral part of the Danish primary education syllabus. In the UK, the Forest Education Initiative is responsible for Forest Schools and it is now a GB wide initiative involving 8 partners¹. There are currently several schools set up in England and Wales with the main aim of providing contact with woodlands on a regular basis and over an extended period of time for young people. Participation in the forest school improves children's confidence, well-being and self-esteem, motivates them to learn and encourages pride and ownership of their local environment (Bishops Wood Centre 2005).

¹ Forest Education Initiative partners are: BTCV, Field Studies Council, Forestry Commission, Forest Industries Development Council, Groundwork, Timber Trade Federation, The Tree Council and the Woodland Trust. More information can be found at: http://www.foresteducation.org/about_fei.php

Chapter 4. Research Implications

It can be inferred that green exercise and regular contact with nature and greenspace has important implications for public and environmental health. A fitter and emotionally more content population would clearly cost the economy less, as well as reducing individual human suffering. Obesity already imposes a significant economic burden in public health terms and will supersede smoking as Britain's biggest killer in 10-15 years if current trends persist. If this trend continues other diet and physical inactivity related diseases will also increase, inflicting further cost to the economy. The potential economic impact of emotional benefits and improved mental well-being has not been fully quantified but would be additional to any physical health benefits, and might indeed outweigh them.

A recent report commissioned by the Forestry Commission and English Nature initiated research into estimating the economic benefits of increased outdoor exercise in green environments. Although they were able to estimate that savings from a 1% reduction in mortality and morbidity associated with reducing sedentary behaviour could be as high as £1.44 billion, there was insufficient evidence to estimate a monetary value for the psychological benefits without further research being undertaken. If, however, these benefits are achieved through "green" activities that might also provoke long term changes in attitudes to nature and the environment in both rural and urban contexts, then wider support for pro-sustainability policies is more likely to arise. Increasing support for and access to a wide range of green exercise activities for all sectors of society would produce substantial economic and public health benefits and avoided costs.

The research on the effects of green exercise and the link between health and the environment has a multitude of important policy implications for a wide range of rural and urban sectors. These range from the impact on green access and recreation providers, policy makers and agricultural managers, schools, the health sector, planners and developers, social services, environmental managers, to the sports and leisure industry. For example, the health sector needs to consider the contribution that green exercise makes to public well being and so saving money for the NHS. Primary health care practitioners should consider prescribing green exercise for those with sedentary lifestyles or weight problems. Hospital design and planning should acknowledge the value of the view from the window and the therapeutic nature of hospital gardens. Planners and developers should take account of the vital role that local green space (or nearby nature) plays for all people and regard outdoor recreational activities as part of economic regeneration strategies in both rural and urban economically depressed areas. Countryside agencies should market the countryside as a health resource, there should be better links between public and private sectors and there is a need for cross-disciplinary links across policy areas.

It is clear that a large number of people already use the countryside and urban/urban-fringe green space for leisure activities, from which they derive a health benefit. However, physical and mental health problems are on the increase. The two challenges are, therefore, to increase the number of people taking part in green exercise, including especially those social groups suffering the most ill-health through sedentary lifestyles and those currently not accessing the countryside for recreation and leisure; and to increase the rate of use by those people already participating in green exercise. These can be addressed through improved provision and access, and by wider recognition that exposure both to nature and green space and to physical activity should be a central part of the policies and strategies of a large number of organisations.

If green exercise can have such a positive effect on health, why then do not more people regularly take exercise and visit green space? Firstly, participation rates highlight that many people in the UK already engage in forms of green exercise. Therefore, there is already a health dividend being experienced. On the

other hand, health data indicates that a substantial proportion of the population is obese and too sedentary. So, it is evident that there must be barrier and accessibility issues preventing enjoyment for all. We need to identify the reasons why people are not accessing the countryside and greenspace and question how countryside managers, the NHS, Local Authorities and policymakers can reach the sedentary.

There is an extensive list of potential key physical, social and cultural constraints. For example, the distance of the green space from the home or the lack of facilities may act as a deterrent. The lack of information and knowledge about rights of way and the terrain can act as a constraint. There is still an urban myth that the countryside is populated with dangerous animals and angry farmers and public spaces are often perceived as risky. The lack of motivation to do exercise, lack of time, feeling too tired from work are powerful constraints. Often people need a purpose to exercise, such as walking the dog, so it is clear that barriers to participation affect different groups of people in different ways.

Many of these barriers, however, have been overcome in the most successful projects. Factors that make up best practice in green-exercise land-based and group-based projects include attention to good partnerships, opportunities for feedback, clearly-marked routes, good information, facilities, successful market research, good staff, a programme of events with clear dates and locations, personality of group leaders, and advertising to local people. We can learn from these good practices but there is still an immense challenge for all agencies to find ways to remove these barriers to participation.

To conclude, participation in green exercise activities and regular contact with nature and greenspace provides substantial mental, physical and social health benefits even following relatively short exposures. Health benefits will lead to avoided health costs, which will ultimately save the NHS money. Although, there are many opportunities available it is the already active, healthy, nature loving, motivated individuals that access them and we still need to do a lot more for other social groups and engaging the harder to reach sedentary 'sofa dwellers'. Therefore, we need further investments in good land- and group- based projects and a wide range of policy reform to increase the health and green-space dividend.

References

- Altman I and Zube E H. 1989. *Human Behaviour in Environment: Advances in Theory and Research. Public places and spaces*. Volume 10 New York: Plenum Press
- Bedumo A L, Mowen A J and Cohen D A. 2005. The Significance of Parks to Physical Activity and Public Health: A Conceptual Model. *American Journal of Preventive Medicine* 28(2S2): 159-168
- Bennett L, Cardone S and Jarczyk J. 1998. Effects of a therapeutic camping program on addiction recovery: the Algonquin Haymarket relapse prevention program. *Journal of Substance Abuse Treatment* 15: 469-74
- Berger B G. 1996. Psychological benefits of an active lifestyle: what we know and what we need to know. *Quest* 48: 330-53
- Berman D S and Anton M T. 1988. A wilderness therapy program as an alternative to adolescent psychiatric hospitalisation. *Residential Treatment for Children and Youth* (the official journal of the American Association of Children's Residential Centers) 5: 41-53
- Berrigan D and Troiano R P. 2002. The Association Between Urban Form and Physical Activity in US Adults. *American Journal of Preventive Medicine* 23: 74-79
- Bingley A and Milligan C. 2004. *Climbing Trees and Building Dens: Mental health and well-being in young adults and the long-term effects of childhood play experience*. Institute for Health Research, Lancaster University, Lancaster
- Bishops Wood Centre. 2005. At URL <http://www.bishopswoodcentre.org.uk/schools/forest.html>
- Bodin M and Hartig T. 2002. Does the outdoor environment matter for psychological restoration gained through running? *Psychology of Sport and Exercise* (in press)
- Brill M. 1989. Transformation, nostalgia and illusion in public life and public place. In Altman I and Zube EH. (eds). *Human behaviour and environment: Advances in theory and research. Public place and spaces*. Volume 10, pp 7-29. New York: Plenum Press
- Browne CA. 1992. The role of nature for the promotion of well-being of the elderly. In *The Role of Horticulture in Human Well-Being and Social Development: A National Symposium*, (eds). Relf D. pp 75-9. Portland: Timber Press
- BTCV Green Gym. 2005. At URL <http://www.btcv.org/greengym>
- Burgess J, Harrison C M and Limb M. 1988. People, Parks and the Urban Green: A Study of Popular Meanings and Values for Open Spaces in the City. *Urban Studies* 25: 455-73
- Butryn T M and Furst D M. 2003. The Effects of Park and Urban Settings on the Moods and Cognitive Strategies of Female Runners. *Journal of Sport Behaviour* 26(4): 335-355
- Carney C. 2001. Literature Review, Scottish Natural Heritage 2001. Ayrshire
- CDC (Centres for Disease Control and Prevention). 1996. *Physical Activity and Health*. A Report of the Surgeon General. Washington D C
- Chenoweth R E and Gobster P H. 1990. The nature and ecology of aesthetic experiences in the landscape. *Landscape Journal* 9(1): 1-8
- Coleman D. Leisure based social support, leisure dispositions and health. *Journal of Leisure Research* 25: 350-361
- Coleman D and Iso-Ahola S E. 1993. Leisure and health: The role of social support and self-determination. *Journal of Leisure Research* 25: 111-128
- Coleman J. 1988. Social Capital in the Creation of Human Capital. *The American Journal of Sociology* 94: S95-S120
- Coley R L, Kuo F E and Sullivan W C. 1997. Where does community grow? The social context created by nature in urban public housing. *Environment and Behaviour* 29: 468-494
- Cooper-Marcus C and Barnes M. 1999. *Healing Gardens: Therapeutic Benefits and Design Recommendations*. New York: John Wiley and Sons
- Cooper-Marcus C and Barnes M. 1995. *Gardens in Healthcare Facilities: Uses, Therapeutic Benefits and Design Recommendations*. Martinez CA: The Centre for Health Design
- Costanza R, d'Arge R, de Groot R, Farber S, Grasso M, Hannon B, Limburg K, Naeem S, O'Neil R V, Paruelo J, Raskin R G, Sutton P and van den Belt M. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253-260
- Coughlin R E and Goldstein K A. 1970. *The extent of agreement among observers on environmental attractiveness*. Regional Science Research Institute Discussion Paper Series, No 37. Philadelphia: Regional Science Research Institute
- Countryside Agency. 2003. *Walking for Health - The first randomised control trial*. The Countryside Agency

- Countryside Agency. 2004. Report of the 2002-03 Great Britain Day Visits
- CJC Consulting. 2005. *Economic Benefits of Accessible Green Spaces for Physical and Mental Health: Scoping Study* (on behalf of Forestry Commission and English Nature). Oxford
- Craig C L, Brownson R C, Cragg S E and Dunn A L. 2002. Exploring the effect of the environment on physical activity: A study examining walking to work. *American Journal of Preventive Medicine* 23: 36-43
- Dalgard O S and Tambs K. 1997. Urban environment and mental health: a longitudinal study. *British Journal of Psychiatry* 171: 530-6
- Davis-Berman J and Berman D S. 1989. The wilderness therapy programme: An empirical study of its effects with adolescents in an outpatient setting. *Journal of Contemporary Psychotherapy* 19: 271-81
- De Vries S, Verheij R A, Groenewegen P P and Spreeuwenberg P. 2003. Natural environments -- healthy environments? An exploratory analysis of the relationship between greenspace and health. *Environment and Planning A* 35: 1717 - 31
- Department for Culture, Media and Sport (DCMS). 2002. *Game Plan: a strategy for delivering Government's sport and physical activity objectives*. London: DCMS and Cabinet Office
- Department for Transport. *National Travel Survey; 1999-2001 Update*. London: Department for Transport, 2001.
- Diette G B, Lechtzin N, Haponil E, Devrotes A and Rubin H R. 2003. Distraction theory with nature sights and sounds reduces pain during flexible bronchoscopy. *Chest* 123: 941-948
- Eckersley R. 1999. The discourse ethic and the problem of representing nature. *Environ Politics* 8(2): 24-49
- Eden Alternative. 2002. Eden Alternative Green House Project. At URLs <http://www.edenalt.com/> and <http://thegreenhouseproject.com/>
- Ewing R, Schmid T, Killingsworth R, Zlot A and Raudenbush S. 2003. Relationship Between Urban Sprawl and Physical Activity, Obesity and Morbidity. *American Journal of Health Promotion* 18(1): 47-57
- Eurodiet. 2001. *The Eurodiet Reports and Proceedings. Public Health Nutrition Special Issue* 4: 265-436
- Ferro Luzzi A and James P. 2000. *European Diet and Public Health: The Continuing Challenge*
- Fjeld T and Bonnevie C. 2002. *The effect of plants and artificial day-light on the well-being and health of office workers, schoolchildren and health care personnel*. Hoofddorp: Plants for People Int. Hort. Exhib. Florida.
- Fjeld T, Veiersted B and Sandvik L. 1998. The effect of indoor foliage plants on health and discomfort symptoms among office workers. *Indoor and Built Environment* 7: 204-206
- Fjortoft I. 1999. The natural environment as a playground for children. The impact of outdoor play activities in pre-primary school children. In *Proceedings of OMEP's 22nd World Congress and 50th Anniversary on the child's right to care, play and education*. Copenhagen, Denmark
- Fox R J. 1999. Enhancing spiritual experience in adventure programs. In: Miles J C and Priest S (eds) *Adventure Programming*. Venture, State College, PA 455-461
- Fox W. 1995. *Toward a Transpersonal Ecology*. New York: State University of New York Press
- Fredrickson LM and Anderson DH. 1999. A qualitative exploration of the wilderness experience as a source of spiritual inspiration. *Journal of Environmental Psychology* 19: 21-39
- Freeman H. 1998. Healthy Environments. In *Encyclopaedia of Mental Health*: Academic Press
- Freeman H. 1984. (eds) *Mental Health and the Environment*. London: Churchill Livingstone
- Frumkin H. 2001. Beyond toxicity. Human health and the natural environment. *American Journal of Preventative Medicine* 20 (3): 47-53
- Frumkin H. 2002a. Urban sprawl and public health. *Public Health Reports* 117: 201-17
- Frumkin H. 2002b. *White Coats, Green Plants: Clinical Epidemiology Meets Horticulture*. Presented at XXVI Horticultural Congress in Toronto, Toronto
- Frumkin H. 2003. Healthy places: exploring the evidence. *American Journal of Public Health* 93: 1451 - 6
- Frumkin H, Frank L and Jackson R. 2004. *Urban Sprawl and Public Health*. Cambridge, MA: MIT Press
- Gallagher W. 1994. *The Power of Place*. Haper Perennial, New York
- Garreau J. 1992. *Edge City. Life on the New Frontier*. New York: Anchor Books
- Gerlach-Spriggs N, Kaufman R E and Warner S B. 1998. *Restorative Gardens: The Healing Landscape*. New Haven, CT: Yale University Press
- Gesler W M. 1992. Therapeutic landscapes: Medical issues in light of the new cultural geography. *Soc Sci Med* 34:735-746
- Grahn P and Stigsdotter U A. 2003. Landscape planning and stress. *Urban Forestry & Urban Greening* 2: 1-18
- Growth Point. 1999. Your future starts here: practitioners determine the way ahead. *Growth Point* 79 pp 4-5
- Halpern D. 1995. *Mental Health and the Built Environment - More than Bricks and Mortar*. Bristol: Taylor & Francis. pp 1-27 and 109-40

- Handy S L, Boarnet M G, Ewing R and Killingsworth R E. 2002. How the built environment affects physical activity: views from urban planning. *American Journal of Preventive Medicine* 23: 64-73
- Harrison C, Burgess J, Millward A and Dawe G. 1995. *Accessible natural greenspace in towns and cities: A review of appropriate size and distance criteria*. English Nature, Peterborough
- Hartig T, Evans G W, Jamner L D, Davis D S and Garling T. 2003. Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology* 23: 109-123
- Hartig T, Book A, Garvill J, Olsson T and Garling T. 1996. Environmental influences on psychological restoration. *Scandinavian Journal of Psychology* 37: 378-393
- Hartig T and Evans G W. 1993. Psychological foundations of nature experience. In: Garling T and Golledge R G (eds) *Behaviour and Environment: Psychological and geographical approaches*. Elsevier Science Publishers B V 427-457
- Hartig T, Mang M and Evans G W. 1991. Restorative effects of natural environment experiences. *Environment and Behaviour* 23: 3-26
- Hassink J. 2003. *Combining agricultural production and care for persons with disabilities: a new role of agriculture and farm animals*. Wageningen University, Netherlands. Braastad B. 2005. Green care in agriculture. COST action proposal. Norwegian University of Life Sciences, Ås, Norway
- Hayashi A. 2002. Finding the Voice of Japanese Wilderness. *International Journal of Wilderness* 8: 34-7
- Hayashi T, Tsumura K, Suematsu C, Okada K, Fujii S and Endo G. 1999. Walking to work and the risk for hypertension in men: The Osaka Health Survey. *Annals Internal Medicine* 130:21-26
- Hazelworth M S and Wilson B E. 1990. The effects of an outdoor adventure camp experience on self-concept. *Journal of Environmental Education* 21(4): 33-37
- Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment. 2004. *Nature and Health. The influence of nature on social, psychological and physical well-being*. The Hague: Health Council of the Netherlands and RMNO; publication no. 2004/09E; RMNO publication nr A02ae.
- Heerwagen J H and Orians G H. 1993. Humans, habitats and aesthetics. In *The Biophilia Hypothesis*, Kellert SR and Wilson EO, (eds). Washington DC: Island Press
- Henwood K. 2003. *Environment and Health: Is there a role for environmental and countryside agencies in promoting benefits to health*. School of Health Policy and Practice, University of East Anglia, Norwich
- Henwood K. 2001. *Exploring linkages between the environment and health: Is there a role for environmental and countryside agencies in promoting benefits to health?* School of Health Policy and Practice, University of East Anglia, Norwich
- Herzog T, Chen H C and Primeau J S. 2002. Perception of the restorative potential of natural and other settings. *Journal of Environmental Psychology* 22: 295-306
- Hillsdon M and Thorogood M. 1996. A systematic review of physical activity promotion strategies. *British Journal of Sports Medicine* 30:84-89
- Hippisley-Fox J, Fielding K and Pringle M. 1998. Depression as a risk factor for ischaemic heart disease in men: population based case control study. *British Medical Journal* 316: 1714-19
- Hobbs T R and Shelton G C. 1972. Therapeutic camping for emotionally disturbed adolescents. *Hospital & Community Psychiatry* 23: 298-301
- Honeyman M C. 1992. Vegetation and stress: a comparison study of varying amounts of vegetation in countryside and urban scenes. In *The Role of Horticulture in Human Well-Being and Social Development: A National Symposium* (eds) Relf D. pp 143-145 Portland: Timber Press
- Horsburgh C R. 1995. Healing by design. *New England Journal of Medicine* 333: 735-740
- Hull R B and Harvey A, 1989. Explaining the emotion people experience in suburban parks. *Environment and Behaviour* 24(3): 323-345
- Hyer L, Boyd S, Scurfield R, Smith D and Burke J. 1996. Effects of outward bound experience as an adjunct to inpatient PTSD treatment of war veterans. *Journal of Clinical Psychology* 52: 263-78
- Jackson C. 2003. Back to Nature. In *Mental Health Today* pp 8-9
- Jackson J B. 1979. *Urban open spaces*. Taylor L. pp 34-35 New York: Rizzoli
- Jacobs J. 1961. *The Life and Death of Great American Cities*. London: Random House
- Jerstad L and Stelzer J. 1973. Adventure Experiences as Treatment For Residential Mental Patients. *Therapeutic Recreation Journal* 7: 8-11
- Johnson B. 2002. On the Spiritual Benefits of Wilderness. *International Journal of Wilderness* 8: 28-32
- Jorgensen A. 2001. *Why is it important to encourage nature and wildlife near the home?*. Utrecht City Council: Overvecht

- Judd F K, Jackson H J, Komiti A, Murray G, Hodgins G and Fraser C. 2002. High prevalence disorders in urban and rural communities. *Australian and New Zealand Journal of Psychiatry* 36: 104-13
- Kahn P H. 1999. *The Human Relationship with Nature: Development and Culture*. Cambridge: The MIT Press
- Kahn P H and Kellert S R. 2002. *Children and Nature: Psychological, sociocultural and evolutionary investigations*. Cambridge, MA: MIT Press
- Kaiser F G, Wolfing S and Fuhrer U. 1999. Environmental attitude and ecological behaviour. *Journal of Environmental Psychology* 19: 1-19
- Kals E, Schumacher D and Montada L. 1999. Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behaviour* 31: 178-202
- Kaplan R. 2001. The nature of the view from home: psychological benefits. *Environment and Behaviour* 33: 507-542
- Kaplan S. 1995. The restorative benefits of nature toward an integral framework. *Journal of Environmental Psychology* 15:169-182
- Kaplan R. 1993. The role of nature in the context of the workplace. *Landscape and Urban Planning* 26: 193-201
- Kaplan R. 1984. Wilderness perception and psychological benefits: An analysis of a continuing program. *Leisure Science* 6: 271-290
- Kaplan S and Talbot JF. 1983. Psychological Benefits of a Wilderness Experience. In *Human Behaviour and Environment*. (eds) Altman IA and Wohlwill JF. pp 163-203. New York: Plenum
- Kaplan R and Kaplan S. 1989. *The Experience of Nature: A Psychological Perspective*. Cambridge: Cambridge University Press
- Kaplan R, Kaplan S and Ryan RL. 1998. *With People in Mind. Design and Management of Everyday Nature*. Washington D.C.: Island Press
- Kellert S R and Wilson E O. 1993. (eds) *The Biophilia Hypothesis*. Washington DC: Island Press
- Kennedy B P. 1993. The beech hill hospital/outward bound adolescent chemical dependency treatment program. *Journal of Substance Abuse Treatment* 10: 395-406
- Kotter E. 1999. *The effects of Greening Offices on Well-being, Health and Zealousness*. Symposiumverslag Plants for People
- Kuo F E and Sullivan W C. 2001. Environment and crime in the inner city: does vegetation reduce crime? *Environment and Behaviour* 33: 343-367
- Kuo F E, Bacaicoa M and Sullivan W S. 1998. Transforming inner-city landscapes: trees, sense of safety and preference. *Environment and Behaviour* 30: 28-59
- Kuo F E, Sullivan W C, Coley R L and Brunson L. 1998. Fertile Ground for Community: Inner-City Neighbourhood Common Spaces. *American Journal of Community Psychology* 26: 823-51
- Kweon B S, Sullivan W C and Wiley A. 1998. Green common spaces and the social integration of inner-city older adults. *Environment and Behaviour* 30: 823-858
- Lang T and Heasman M. 2004. *Food Wars*. London: Earthscan
- Lange E and Schaeffer P. 2001. A comment on the market value of a room with a view. *Landscape and Urban Planning* 55, 113-120
- Larsen L, Adams J, Deal B, Kweon B-S and Tyler E. 1998. Plants in the workplace: the effects of plant density on productivity, attitudes and perceptions. *Environment and Behaviour* 30: 261-82
- Laumann K, Garling T and Stormark KM. 2003. Selective attention and heart rate responses to natural and urban environments. *Journal of Environmental Psychology* 23: 125-134
- Leather P, Pyrgas M, Beale B, Kweon B and Tyler E. 1998. Plants in the workplace: the effects of plant density on productivity, attitudes and perceptions. *Environment and Behaviour* 30: 261-282
- Leopold A. 1949 *A Sand County Almanac and Sketches Here and There*. London and New York: Oxford University Press (1974 edition)
- Lewis C A. 1992. Effects of Plants and Gardening in Creating Interpersonal and Community Well-Being. In *The Role of Horticulture in Human Well-Being and Social Development: A National Symposium*. (eds) Relf D. pp 55-65. Portland: Timber Press
- Lewis G and Booth M. 1994. Are cities bad for your mental health? *Psychological Medicine* 24: 913-915
- Lindheim R and Syme S L. 1983. Environments, people and health. *Annual Review of Public Health* 4: 335-339
- Lohr V I, Pearson-Mims C H and Goodwin G K. 1996. Interior plants may improve worker productivity and reduce stress in a windowless environment. *Journal of Environmental Horticulture* 14(2): 97-100
- Luther M and Gruehn D. 2001. Putting A price on urban green spaces. *Landscape Design* 303: 23-25
- Luttik J. 2000. The value of trees, water and open space as reflected by house prices in the Netherlands. *Landscape and Urban Planning* 48: 161-167

- Maller C, Townsend M, Brown P and St Leger L. 2002. *Healthy Parks Healthy People: The Health Benefits of Contact with Nature in a Park Context*. Deakin University and Parks Victoria, Melbourne, Australia
- Martin P. 1996. New Perspectives of self, nature and others. *Australian Journal of Outdoor Education* 1: 3-9
- Michalski J H, Mishna F, Worthington C and Cummings R. 2003. A multi-method impact evaluation of a therapeutic summer camp program. *Child and Adolescent Social Work Journal* 20: 53-76
- Milton K. 2002. *Loving Nature: Towards an Ecology of Emotion*. London: Routledge
- Mitchell R G J. 1983. *Mountain Experience: The Psychology and Sociology of Adventure*. Chicago: University of Chicago Press
- Mooney P and Nicell P L. 1992. *The importance of exterior environment for the Alzheimer's residents. Effective care and risk management*. Health Care Management Forum 5(2): 23-29
- Moore E O. 1981. A prison environment's effect on health care service demands. *Journal of Environmental Systems* 11: 17-34
- Morris N. 2003. *Health, Well-Being and Open Space*. OPENspace
- Moyer J A. 1988. Bannock bereavement retreat: A camping experience for surviving children. *The American Journal of Hospice Care* 5: 26-30
- Muir J. 1911. *My First Summer in the Sierra*. Houghton Mifflin, Boston (reprinted in 1988 by Canongate Classics, Edinburgh)
- Muir J. 1992. *The Eight Wilderness-Discovery Books*. London and Seattle: Diaden Books
- Nakamura R and Fujii E. 1990. Studies of the characteristics of the electroencephalogram when observing potted plants: *Pelargonium hortorum* "Sprinter Red" and *Begonia evansiana*. *Technical Bulletin of the Faculty of Horticulture of Chiba University* 43: 177-183 (In Japanese with English summary)
- Nakamura R and Fujii E. 1992. A comparative study of the characteristics of the electroencephalogram when observing a hedge and a concrete block fence. *Journal of the Japanese Institute of Landscape Architects* 55: 139-144 (In Japanese with English summary)
- Newman O. 1980. *Community of Interest*. New York: Anchor Books
- Newman O. 1972. *Defensible Space*. New York: Macmillan
- Nightingale F. 1860. 1996. *Notes on Nursing (Revised with Additions)*. London: Balliere Tindall
- Office for National Statistics. 2003. *The UK 2000 time use survey*. London: Office for National Statistics
- Olds AR. 1989. Nature as healer. *Children's Environments Quarterly* 6: 27-32
- Orland B, Vining J and Ebreo A. 1992. The effect of street trees on perceived values of residential properties. *Environment and Behaviour* 24(3): 298-325
- Ostir GV, Markides KS, Peek MK and Goodwin JS. 2001. The association between emotional well-being and the incidence of stroke in older adults. *Psychosomatic Med* 63: 210-215
- Paffenbarger R S, Lee I-M and Leung R. 1994. Physical activity and personal characteristics associated with depression and suicide in American college men. *Acta Psychiatrica Scandinavica Suppl* 377: 16-22
- Parks S E, Housemann R A and Brownson R C. 2003. Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States. *Journal of Epidemiology and Community Health* 57: 29-35
- Parsons R, Tassinary LG, Ulrich RS, Hebl RS and Grossman-Alexander M. 1998. The view from the road: implications for stress recovery and immunization. *Journal of Environmental Psychology* 18: 113-140
- Peacock J, Hine R, Willis G, Griffin M and Pretty J. 2005. *The Physical and Mental Health Benefits of Environmental Improvements at Two Sites in London and Welshpool*. Environment Agency, Bristol
- Peiser RB and Schwann GM. 1993. The private value of public open space within subdivisions. *Journal of Architectural and Planning Research* 10 (Summer): 91-104
- Pennebaker J W and Lightner J M. 1980. Competition of internal and external information in an exercise setting. *Journal of Personality and Social Psychology* 39(1): 165-174
- Pevalin D J and Rose D. 2003. *Social capital for health - Investigating the links between social capital and health using the British Household Panel Survey*. University of Essex
- Popkin B M. 1999. Urbanisation, lifestyle changes and the nutrition transition. *World Development* 27: 1905-16
- Popkin B M. 1998. The nutrition transition and its health implications in lower-income countries. *Public Health Nutrition* 1(1): 5-21
- Pretty J N. 1998. *The Living Land: Agriculture, Food and Community Regeneration in Rural Europe*. London: Earthscan
- Pretty J N. 2002. *Agri-Culture. Reconnecting People, Land and Nature*. London: Earthscan
- Pretty J N. 2004. How nature contributes to mental and physical health. *Spirituality & Health Int* 5(2): 68-78
- Pretty J N and Ward H. 2001. Social capital and the environment. *World Development* 29: 209-27

- Pretty J N, Griffin M, Sellens M and Pretty C J. 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
- Pretty J N, Griffin M and Sellens M. 2004. Is nature good for you? *Ecos* 24: 2-9
- Pretty J, Peacock J, Sellens M and Griffin M. 2005a. The mental and physical health outcomes of green exercise. *International Journal of Environmental Health Research* 15(5), 319-337
- Pretty J, Griffin M, Peacock J, Hine R, Sellens M and South N. 2005b. *A Countryside for Health and Well-Being: The Physical and Mental Health Benefits of Green Exercise*. Countryside Recreation Network, Sheffield
- Pryor A, Carpenter C and Townsend M. 2005. Outdoor education and bush adventure therapy: A socio-ecological approach to health and well-being. *Australian Journal of Outdoor Education* 9(1): 3-13
- Purcell A T and Lamb R J. 1998. Preference and naturalness: An ecological approach. *Landscape & Urban Planning* 42: 57-66
- Putnam RD. 1993. *Making democracy work*. Princeton University Press, Princeton, New Jersey
- Randall K, Shoemaker C A, Relf D and Geller S E. 1992. Effects of Plantscapes in an Office Environment on Worker Satisfaction. In *The Role of Horticulture in Human Well-Being and Social Development: A National Symposium (proceedings)*. (eds) Relf D. pp 106-9. Portland: Timber Press
- Reynolds V. 2002. *Well-being Comes Naturally: An Evaluation of the BTCV Green Gym at Portslade*, East Sussex. Rep. 17, Oxford Brookes University, School of Health Care
- Reynolds V. 1999. *The Green Gym: An Evaluation of a Pilot Project in Sonning Common, Oxfordshire*. Rep. 8, Oxford Brookes University, School of Health and Social Care
- Richards K and Smith B (eds). 2003. *Therapy Within Adventure*. Proceedings of the Second International Conference, University of Augsburg. Germany: Zeil
- Rohde C L E and Kendle A D. 1994. *Human well-being, natural landscapes and wildlife in urban areas: A review*. Rep. 22, English Nature
- Ross C E. 2000. Walking, Exercising and Smoking: Does Neighbourhood Matter? *Social Science and Medicine* 51: 265-74
- Rossmann B B and Ulehla Z J. 1977. Psychological reward values associated with wilderness use. *Environment and Behaviour* 9: 41-66
- Rubenstein N J. 1997. The Psychological Value of Open Space. In *The Benefits of Open Space*. (eds) Hamilton LW. The Great Swamp Watershed Association
- Russell J A and Mehrabian A. 1976. Some behavioural effects of the physical environment. In *Experiencing the Environment* (Wapner S, Cohen SB and Kaplan B, eds). Plenum, New York
- Sandifer PA, Holland AF, Rowles TK and Scott GI. 2004. The oceans and human health. *Environ Health Persp* 112: 454-455
- Schroeder HW. 1995. Preference and meaning of arboretum landscapes: Combining quantitative and qualitative data. In *Landscape Perception, Readings in environmental psychology* (Sinha, A. eds). Academic Press. pp 119-136
- Schultz PW and Zelezny L. 1999. Values as predictors of environmental attitudes: evidence for consistency across 14 countries. *Journal of Environmental Psychology* 19: 225-65
- Scott NR. 1974. Towards a psychology of wilderness experience. *Natural Resources Journal* 14: 231-7
- Scully D, Kremer J, Meade MM, Graham R and Dudgeon K. 1998. Physical exercise and psychological wellbeing: a critical review. *British Journal of Sports Medicine* 32: 111-120
- Sempkirk J, Aldridge J and Becker S. 2005. *Growing Together – Promoting Social Inclusion, Health and Well-being for Vulnerable Adults through the use of Horticulture and Gardening*. Loughborough University and Thrive
- Sempkirk J, Aldridge J and Becker S. 2003. *Social and Therapeutic Horticulture: Evidence and messages from research*. Loughborough: Loughborough University. At URL www.ccf.org.uk; www.growingtogether.org.uk
- Sempkirk J, Aldridge J and Becker S. 2002. *Social and Therapeutic Horticulture: Evidence and messages from research*. Rep. Evidence issue 6, Loughborough University, Thrive & ccf (Centre for child and family research)
- Seymour L. 2003. *Nature and Psychological Well-being*. Rep. 533, English Nature Research
- Shafer E L and Richards T A. 1974. *A comparison of viewer reactions to outdoor scenes and photographs of those scenes*. USDA Forest Service Research Paper NE-302. Upper Darby, PA: Northeastern Forest Experiment Station

- Sheets V L and Manzer C D. 1991. Affect, cognition and urban vegetation. Some effects of adding trees along city streets. *Environment and Behaviour* 23(3): 285-304
- Sheffield's Healthy City Team. 2001. Trees for Health. In *Sheffield Newsletter*. Sheffield
- Shibata S and Suzuki N. 2002. Effects of the foliage plant on task performance and mood. *Journal of Environmental Psychology* 22: 265-272
- Sorte G. 1975. Methods for presenting planned environment. *Man-Environment Systems* 5: 148-154
- Staats H and Hartig T. 2004. Alone or with a friend: A social context for psychological restoration and environmental preferences. *Journal of Environmental Psychology* 24: 199-211
- Stringer L A and McAvoy L H. 1992. The need for something different: spirituality and the wilderness adventure. *The Journal of Experiential Education* 15(1): 13-21
- Stys Y. 2001. *Wilderness Therapy*. University of Ottawa
- Takano T, Nakamura K and Watanabe M. 2002. Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. *Journal of Epidemiology and Community Health* 56: 913-8
- Tall D. 1996. Dwelling; making peace with space and place. In *Rooted in the Land: Essays on Community and Place* (Vitek W and Jackson W, eds). New Haven and London: Yale University Press
- Taylor A F, Kuo F E and Sullivan W C. 2001. Coping with ADD: the surprising connection to green play settings. *Environment and Behaviour* 33: 54-77
- Taylor A F, Wiley A, Kuo F E and Sullivan W C. 1998. Growing up in the inner city: green spaces as places to grow. *Environment and Behaviour* 30: 3-27
- Taylor L. 1979 *Urban open spaces*. (Eds) New York: Rizzoli
- Taylor S E, Repetti R L and Seeman T. 1997. Health psychology: what is an unhealthy environment and how does it get under the skin? *Annual Review of Psychology* 48: 411 - 47
- Tennessee C M and Cimprich B. 1995. Views to nature: effects on attention. *Journal of Environmental Psychology* 15: 77-85
- Thoreau H D. 1902. *Walden or Life in the Woods*. London, New York and Toronto: Henry Frowde, Oxford University Press
- Thoreau H D. 1837-1853. *The Writings of H D Thoreau* Volumes 1-6 (published 1981 to 2000). Princeton, NJ: Princeton University Press
- Tuan Y-F. 1977. *Sense and Place*. Minneapolis: University of Minnesota Press
- Ulrich R.S 1983. Aesthetic and affective response to natural environment. In: Altman I and Wohlwill J F(eds) *Behaviour and the natural environment*. New York; Plenum Press 85-125
- Ulrich R S. 1984. View through a window may influence recovery from surgery. *Science* 224: 420-21
- Ulrich R S. 1993. Biophilia, biophobia and natural landscapes. In *The Biophilia Hypothesis*. (eds) Kellert SR and Wilson EO. Washington DC: Island Press
- Ulrich R S. 1999. Effects of Gardens on Health Outcomes: Theory and Research. In: *Healing Gardens. Therapeutic Benefits and Design Recommendations* (Cooper Marcus C and Marni B, eds). New York: John Wiley & Sons, pp 27-86
- Ulrich R S. 2002. *Health Benefits of Gardens in Hospitals*. Presented at Plants for People - International Exhibition, Florida
- Ulrich R S and Parsons R. 1992. Influences of Passive Experiences with Plants on Individual Well-Being and Health. In *The Role of Horticulture in Human Well-Being and Social Development: A National Symposium*. (eds) Relf D. pp 93-105. Portland: Timber Press
- Ulrich R S, Simons R F, Losito B D, Fiorito E, Miles M A and Zelson M. 1991. Stress Recovery During Exposure to Natural and Urban Environments. *Journal of Environmental Psychology* 11: 201-30
- Van den Berg A E, Koole S L and van der Wulp N Y. 2002. Environmental preference and restoration (How) are they related? *Journal of Environmental Psychology* (in press)
- Verderber S and Reuman D. 1987. Windows, Views and Health Status in Hospital Therapeutic Environments. *The Journal of Architectural and Planning Research* 4: 120-33
- Walking the Way to Health Initiative. 2005. At URL <http://whi.org.uk>
- Wanless D. 2002. *Securing Our Future Health: Taking a Long-Term View*. London
- Warady BA. 1994. Therapeutic camping for children with end-stage renal disease. *Pediatric Nephrology* 8: 387-90
- Ward Thompson C. 2002. Urban open space in the 21st century. *Landscape and Urban Planning* 60: 59-72
- Watt I S, Franks A J and Sheldon T A. 1994. Health and health care of rural populations in the UK: is it better or worse? *Journal of Epidemiology and Community Health* 48: 16-21

- Wells N M and Evans G W. 2003. Nearby Nature, A Buffer of Life Stress Among Rural Children. *Environment and Behaviour* 35: 311 – 30
- Wells N. 2000. At home with nature: effects of 'greenness' on children's cognitive functioning. *Environment and Behaviour* 32, 775-795
- White R and Heerwagen J. 1998. Nature and Mental Health: Biophilia and Biophobia. In *The Environment and Mental Health: A Guide for Clinicians*. (eds) Lundberg A. pp 175-92. Mahwah, New Jersey: Lawrence Erlbaum Associates
- Whitehouse S, Varni J W, Seid M, Cooper-Marcus C, Ensberg M J, Jacobs JR and Mehlenbeck R S. 2001. Evaluating a children's hospital garden environment: utilisation and consumer satisfaction. *Journal of Environmental Psychology* 21: 301-314
- WHO. 2001. *World Health Report*. Geneva: World Health Organisation
- Willis G. 2004. *The Importance of Trees and Woodland to the Quality of Urban Life in the United Kingdom: a review and pilot study*. University of Essex
- Williams K and Harvey D. 2001. Transcendent experience in forest environments. *Journal of Environmental Psychology* 21: 249-260
- Wilson E O. 1984. *Biophilia – the human bond with other species*. Harvard University Press: Cambridge, Massachusetts.
- Wood R and Handley J. 1999. Urban waterfront regeneration in the Mersey Basin, North West England. *Journal of Environmental Planning and Management* 42(4), 565-580
- Zube E, Pitt D G and Anderson T W. 1975. Perception and prediction of scenic resource values in the Northeast. In *Landscape Assessment: Values, Perceptions and Resources*. (Zube E, Brush R and Farbos J eds). Dowden, Hutchinson & Ross