Physical activity and the environment

Review Three:

Natural Environment

NICE guideline PH8 (published January 2008) has been updated and replaced by NG90.

New recommendations have been added on strategies, policies and plans to increase physical activity in the local environment (1.1.1 to 1.1.3); active travel (1.2.1 to 1.2.4 and 1.2.6 to 1.2.9); public open spaces (1.3.1 to 1.3.3). NICE has deleted some recommendations from the 2008 guideline because the evidence has been reviewed and the recommendations have been updated.

This evidence review is relevant to the updated guideline.

See the guideline for more details.

NICE Public Health Collaborating Centre – Physical activity
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Executive Summary

This report examines the evidence for the effectiveness of interventions to the natural environment in increasing physical activity.

The natural environment includes urban and country greenways and parks, water and wetlands, beaches, woodlands, remnant/vacant land, green belts, green corridors, canals, riverbanks, linear green space, tree belts/forests, scenic and historic sites, cliff tops and coast-lines.

Studies were included in the review if they assessed the effect of an intervention that involved a physical modification to the natural environment. This included studies that aimed to change an individual aspect or a set of characteristics of the natural environment, either by landscaping, scenic beautification, renovation, preservation or conservation and/or provision of specific facilities for physical activity (e.g. path, trail, green space, park) within a natural area.

Only intervention study designs were included, studies that examined the association (correlations) between physical activity and the natural environment were excluded.

The outcome of the intervention had to include a measure of physical activity behaviour or use (including walking/ cycling/ pedestrian counts). However, in the absence of any studies with physical activity as an outcome measure visitor numbers were accepted as a proxy outcome measure. It is recognised that this is a weak measure of the primary outcome of interest.

No intervention studies meeting the inclusion criteria were found from the electronic search strategy, however two post-only studies were identified through an extensive search of grey literature and relevant websites.

These studies covered two main areas:

1. Woodland

There is insufficient evidence to draw any conclusions on the effect of interventions involving changes to the physical environment and design features of woodland areas on physical activity outcomes. There is, however, evidence from one (3-) quality post-only study (Cannock Chase Council et al., 2005) to suggest that building creative features along a woodland trail may increase visitor numbers.

2. Coastal

There is insufficient evidence to draw any conclusions on the effect of interventions involving changes to the physical environment and design features of coastal areas on physical activity outcomes. There is, however, evidence from one (3-) quality post-only study (Peacock et al., 2006) to suggest that improving a coastal path may increase frequency and duration of visits.

Included case studies

Cannock Chase Council, Forestry Commission and Cannock Chase Primary Care Trust. (2005) Route to Health. Birches Valley Forest Centre, Cannock Chase.

Peacock, J., Hine, R. and Pretty, J. (2006) The health benefits of environmental improvements to a circular route at Easington Coastal Path. Short summary of the key findings for the Environment Agency and Durham Heritage Coast. Centre for Environment and Society, University of Essex.

1. Introduction

1.1. Background to this review

The National Institute for Health and Clinical Excellence ('NICE' or 'the Institute') has been asked by the Department of Health (DH) to develop guidance on a public health programme aimed at improving the environmental factors that promote physical activity.

This guidance is in response to a number of developments in the fields of physical activity and public health in recent years, including:

- A growing recognition of the influence of the environment as a determinant of the behaviour of individuals and communities;
- A corresponding increase in published research on the environment and physical activity;
- A desire by public health professionals to work in partnership with local authorities and other key agencies on public health programmes;
- A need to complement interventions targeted at individuals with programmes that have the potential to have a larger population impact.

1.2. The need for guidance

1.2.1. Physical activity and ill health

Increasing activity levels will contribute to the prevention and management of over 20 conditions and diseases including coronary heart disease, diabetes, cancer, and weight management; and can help to improve mental health.

In 2004 the DH estimated the cost of inactivity in England to be £8.2 billion annually – including the rising costs of treating chronic diseases such as coronary heart disease and diabetes. The contribution of inactivity to obesity is estimated to cost a further £2.5 billion each year.

Around 35% of men and 24% of women (aged 16 plus) are physically active enough to meet the current national recommendations (achieving at least 30 minutes of at least moderate activity on 5 or more days a week). Seventy per cent of boys and sixty-one percent of girls aged 2-15 years achieve the recommended physical activity levels (at least 60 minutes of at least moderate intensity physical activity each day). Physical activity varies according to age, gender, class and ethnicity (Department of Health, 2006).

1.2.2. Trends in physical activity

Trends between Health Surveys for England in 1997, 1998, 2003 and 2004 found small increases in physical activity levels between 1997 and 2004 (Department of Health 2006). Other data from national travel surveys show that the distance people walk and cycle has declined significantly in the last three decades while travel by car has increased (Department for Transport, 1995; Department for Transport, 2005). Although there are limitations with these estimates, including the absence of published confidence intervals, the use of different questionnaire items and potential misclassification, there is concern about the generally low levels of physical activity undertaken by the population as a whole, and particular concern regarding the prevalence of participation amongst specific sub population groups (women, older adults, lower socio-economic class, minority ethnic groups).

1.2.3. Physical activity and the environment

The environment can influence people's ability to be active (Department of Health, 2004). For example, access to parks, the countryside, scenic and historic sites and other green space, can encourage and discourage access on foot or by bike, while the design and layout of woodland trails, coastal paths, country parks as well as specific features of green space, can help people to be more active.

Many components of the natural environment can be modified by public sector agencies through changes to policy and practice. Action can be taken in partnership with individuals, local community groups or other key organisations.

1.3. The nature of evidence on the environment

The idea of an environmental approach to public health is not new. Many successful public health initiatives have involved environmental and/or policy change for example, sanitation and road safety. In response to the shifting focus within the field of public health and physical activity, a large body of evidence has accumulated exploring which features of the environment are associated with different types of physical activity. This evidence has predominantly focused on the built urban environment. In addition it should be noted that much of this research has focused on the correlates of physical activity rather than on interventions examining the effectiveness of changes to the environment on physical activity.

More recently, however interest in the natural environment has developed as organisations from the conservation and natural environment sector, such as the Forestry Commission, Natural England (formerly Countryside Agency), British Trust for Conservation Volunteers, CABE etc have expanded their horizons, recognising the role their sector can play in improving public health. There is a developing literature which suggests that both passive and active exposure and access to natural open spaces and well-designed greenspaces can have a wide range of social, economic, environmental and health benefits (Morris, 2003). More specifically, the natural environment can provide many opportunities for increasing levels of physical activity, a priority for improving the nation's public health (Henwood, 2001).

Early research on the natural environment focused on understanding and measuring relationships, such as biophylia and the restorative benefits of exposure to nature (Kaplan and Kaplan, 1987; White and Heerwagen, 1998). This subsequently led to an interest in the role the natural environment can have on other dimensions of human health, particularly physical health. Increased physical activity is recognised as one of the best ways to improve people's physical and mental health (Morris, 1994), thus interest in the relationship

between the natural environment and physical activity evolved. Research on physical activity and the natural environment initially focused on exploring the direction and magnitude of relationships between characteristics of the natural environment and physical activity, for example between the presence of and perceptions of safety in parks, access and proximity to parks, and size of parks (Humpel, Owen & Leslie, 2002). In addition, there has been a focus on new aspects of measuring these micro and macro characteristics such as proximity, attractiveness, size and design and their relationship to physical activity (Giles-Corti, 2005). Much of this research has been conducted with adults and only in some studies, children. Thus because this is a new field of investigation, it remains largely unknown what specific attributes of the natural environment are associated with increased levels of physical activity.

One of the limitations of the available literature is that it is restricted to observational studies of use of natural and semi-natural environments, such as urban and country parks, woodlands, beaches and coast-lines and other public open space. Little research has focused on how aspects of the natural environment can be modified to promote and/or change levels of physical activity. One related area of development has been the testing of interventions using the natural environment as a setting itself for physical activity, for example 'green exercise' and woodland walks. The latter projects usually involve behaviourally-focused programmes such as referral to group walks in set woodland locations. These intervention studies do not, however, involve an actual change to the natural environment. In contrast 'Green Gyms' is a concept whereby groups are involved in physical activity through undertaking projects set in the natural environment and involving a modification or improvement / development of the location (BTCV, 2006). Examples include building or repairing stonewalls or hedgerows, clearing of areas or new planting. In these interventions the modification of the environment is actually the outcome of the project and few or no such studies include a focus on assessing the impact of the modification on future usage of the area.

The natural environment and physical activity is predominantly a new research area, (CABE, 2004) and while there is a growing interest in how improving the facilities and amenities of the natural environment might increase levels of physical activity this remains largely unexplored. It is worth noting a number of significant challenges associated with undertaking a review of the evidence on natural environmental interventions. The evidence hierarchy practised within public health is not reflected within the natural environment research. For example, use of controlled research designs are rare, and issues such as data capture, contamination and bias make some public health study designs inappropriate, with causality being very difficult to demonstrate. To date, no other process has endeavoured to capture the literature on interventions in the natural environment in a systematic fashion.

It was anticipated that the search strategy needed to be broad enough to capture studies from non-traditional sources including sources and journals not indexed in electronic or public health databases. Much of the work may be in the 'grey' literature (such as government reports or case studies). Furthermore, few studies report levels of physical activity, walking or cycling as a study outcomes, or present unvalidated measures that are difficult to equate to established measures of physical activity. Finally, a wider range of study types tends to be used with more of a focus on case studies, post only measures or uncontrolled pre and post studies, increasing the risk of bias.

1.4. Scope of the reviews

1.4.1. Aspects of the environment that will be covered

NICE guidance will be based on the findings from five reviews on specific aspects of the environment:

- Transport
- Urban planning and design
- The natural environment (urban and rural)

- Building design
- National, regional or local policy influencing physical activity through the environment.

This report presents the findings from the natural environment review. The natural environment includes urban and country greenways and parks, water and wetlands, beaches, woodlands, remnant/vacant land, green belts, green corridors, canals, riverbanks, linear green space, tree belts/forests, scenic and historic sites, cliff tops and coast-lines. The scope includes interventions that involved a physical modification to the structure, composition or design of the natural environment, for example landscaping or scenic beautification of a natural area to increase access to, or opportunities for recreation, leisure or physical activity; improvements or modifications to natural/scenic or historic easements, sites or routes; renovation, preservation or conservation of a natural environment (for instance restoration of wetlands, woodlands, greenways, canal towpaths, cliff-top walks, coastal paths, woodland trails); studies assessing recreational paths and trails when they are located alongside natural sites (green corridors, canals, riverbanks, coastal areas, etc).

1.4.2. Population groups that will be covered

This review includes the general population, including both children and adults. The guidance will investigate the effectiveness of interventions across the broad social gradient, including those in the poorest circumstances and those in the poorest health.

1.4.3. Areas that will not be covered

The influence of national fiscal policy on physical activity levels is not addressed in this review.

Studies which used the natural environment as a setting for physical activity, for example Green Gyms, were excluded from this review because they were not evaluating the effects of physically modifying the natural environment on physical

activity. Green exercise refers to a range of schemes which provide an alternative to traditional facility based physical activity programmes, they encourage individuals to be active whilst being directly exposed to nature, such as gardening, farming, conservation activities, trekking, cross-country running or horse-riding. These schemes aim to change participants' physical activity; they may or may not change some aspect of the natural environment as part of the physical activity intervention.

Studies which aimed to modify the natural environment for the primary purpose of changing the transportation system (for example, traffic-free walking and cycling trails along green corridors) were excluded from this review as these interventions were the focus of the transport review undertaken as part of this set of reviews for NICE (NICE, 2006a). Readers interested in the evidence on these approaches are referred to the transport review (NICE, 2006a). Similarly, interventions undertaken within urban parks were excluded from this review as these interventions were included in the scope of the urban planning and design review also undertaken as part of this set of reviews for NICE (NICE 2006b). It is recognised there is some conceptual overlap in relation to the scopes within this set of reviews and some interventions, such as rail-trails, could be included within more than one review because many trails are often built around a wooded or natural area, and / or may be implemented in or in close proximity to urban areas. To avoid duplication transport related interventions and those in urban environments were excluded. Readers interested in the evidence on these approaches are referred to the other draft review papers (NICE, 2006a; NICE, 2006b).

1.4.4. Outcomes

The primary aim is to recommend environmental interventions that are likely to increase physical activity levels in the general population by: incorporating physical activity into every day life; increasing formal or informal recreational activity (including active play); increasing active travel (cycling and walking). In addition, secondary outcomes were reviewed and those relevant or potentially

related to physical activity were summarised in both the evidence tables and in summary text.

1.4.5. Review team

This review has been carried out by a team from the Public Health Collaborating Centre (CC) for Physical Activity. The Collaborating Centre is an alliance between the British Heart Foundation Health Promotion Research Group (University of Oxford) and the British Heart Foundation National Centre for Physical Activity and Health (Loughborough University).

2. Methodology

2.1. Literature Search

Literature searches were conducted using the terms and databases listed below. References were downloaded into a Reference Manager database and de-duplicated resulting in 21,690 references. An additional 1417 citations were obtained from the UrbaDoc databases: Acompline (1024), Archinet (35), Orlis (74), Urbamet (282), Urbaterr (2), and 389 citations retrieved from British Architectural Library online - these citations could not be imported into Reference Manager. This produced a total of 23,496 hits altogether.

Five references were identified by other search strategies; 1 from the NICE Transport search strategy and 4 from the NICE Urban Planning and Design search strategy.

2.1.1. Search terms

All search strategies were designed by the CC and NICE. Tailored search terms appropriate for each particular database were used. Search terms followed the same order (1) natural environment terms and (2) physical activity terms. Typical search terms included:

Natural, rural, green, park, wood, woodland, forest, trees, tree-belt, rivers, beach, lake, canal, waterway, playing field, open space, conservation, ground, outdoors, outside, conservation of natural resources AND landscape, renewal, regeneration, pedestrianised, structure, layout, facility, feature, surrounding, amenity, location, planning, space, environment, development, design, sprawl, landuse, aesthetic or esthetic, pavement, sidewalk, sign, path, footpath, trail, recreation, area, access, public facilities, environment design AND physical activity, exercise, sport, walk, running, jogging, bike or biking, rollerblading, rollerskating, skating, recreation, play.

A full search strategy for MEDLINE is presented in Appendix A. All searches were performed from January 1990 to the most recently published version of the database (July 2006).

2.1.2. Databases searched

Medline; Embase; Cinahl; PsycInfo; SportDISCUS; Global Health; Geobase; SIGLE; Cochrane Library; PAIS; ISI Science Citation Index and Social Science Citation Index; Cambridge Scientific Abstracts (CSA) Physical Education Index; CSA ERIC; CSA DAAI (Design and Applied Arts Index), Urbadoc, British Architectural Library online.

2.1.3. Selection of studies for inclusion

The agreed search strategy resulted in 23,496 titles – these were screened for potential relevance by one person, resulting in 1999 titles. 15% of the total hits (23,496) were also screened by a second person to check the sensitivity of relevance screening.

The 1999 titles and abstracts were then assessed in more detail, for relevance to both natural environment interventions and studies assessing physical activity outcomes. The titles and abstracts were double sifted to avoid bias and a third reviewer resolved any differences. From the 1999 screened titles, 87 potential titles were identified and the full papers were downloaded from the internet, obtained from library sites, ordered via inter-library loan, or obtained from personal sources. The 5 additional references identified through the NICE Transport and the Urban Planning and Design search strategies, were added to the 87 potentially relevant titles from the Natural search strategy giving a total of 92 potentially relevant titles and abstracts.

Of the 92 potentially relevant titles, 60 papers were retrieved and checked against the in-out criteria (Appendix B) by two people. Where any uncertainty existed, a third reviewer assessed the full paper independently. Due to the obscurity of the journal, book or conference proceedings, 32 studies could not be obtained within the timeframe of this review (Appendix C).

None of the 60 studies were accepted for full data extraction because they did not meet the inclusion criteria for this review. The main reason for exclusion of studies was that they did not involve a change to the natural environment, they did not include a measure of physical activity as an outcome, the focus was on correlations or the paper was purely a description of the area or an opinion piece. A full list of the excluded studies and the reason for exclusion can be found in Appendix D.

2.1.4. Publicly available research, case studies, project reports and documents

The initial literature search did not yield any studies or reviews which met the inclusion criteria for the natural environment review. As a result, the reviewers then conducted a comprehensive search for other categories of evidence: unpublished, but publicly available research; case studies; project reports and documents; academic theses; research completed, but not yet published and ongoing research with interim results. The search for other categories of evidence was undertaken by systematic searching of key websites relevant to the natural environment (Appendix E) and by contacting relevant organisations and professionals. The Physical Activity Collaborating Centre requested information via e-mail from a number of people including key international and national researchers and experts, and lead organisations from the natural environment sector. In addition, members of the Programme Development Group (PDG) were contacted for potential sources of published, unpublished and/or 'grey' literature not indexed in electronic databases.

In total, 93 publicly available case studies, project reports and documents were obtained through this process. These documents were all subjected to the same in/out screening process as the original literature. Two studies met the inclusion criteria and were accepted for full data extraction (Appendix F). Of the 91 remaining case studies, project reports or documents, 82 did not meet the inclusion criteria and 9 could not be assessed within the timeframe of this review. Although there was a lot of publicly available research, case studies, project

reports and documents available, few of these case studies, project reports or documents had any baseline or post intervention follow–up data or any project evaluations; consequently these were excluded as the effectiveness and wider application of the results beyond the project are not reliable. A full list of the excluded case studies, project reports or documents and the reason for exclusion can be found in Appendix G.

Table 1. Summary of review process

SEARCHES		
	Literature Search	**Publicly available research, case studies, project reports and documents**
No. Hits	23496	93
No. following initial screening	2004*	-
Potentially relevant titles		
Total number of studies identified	92	93
Processed against in/out criteria		
Number of studies assessed	60	82
Unable to assess	32	9
Data extraction and quality appraisal		
Number of studies included in the review	0	2

The outcome of the intervention had to include a measure of physical activity behaviour (including total physical activity/ walking / cycling/ pedestrian counts)

* 1999 + 5 from other NICE search strategies (Transport & Urban Planning & Design reviews)

however in the absence of physical activity outcome measures other 'proxy' measures such as usage were accepted. Counts of visitor numbers can be used as a useful outcome measure in the natural environment literature and this was accepted as a proxy measure of activity. However, it is noted that visitor numbers do not provide a summary measure of physical activity behaviour and as such is a weak measure of the primary outcome of interest in this review, namely population level change in physical activity.

Only intervention (experimental or quasi-experimental) study designs were included. Studies that examined the association (or correlation) between physical activity and characteristics of the natural environment were excluded. Furthermore, studies that only described patterns of usage of existing facilities (e.g. trails, greenways, sports facilities) and studies where no intent to modify or improve a physical feature of the natural environment was evident were excluded as these do not provide evidence on the effectiveness of changes to the natural environment on physical activity. For studies to be included the intervention had to include some form of physical modification to the natural environment (the independent variable) and the dependent variable was the physical activity outcome. On this basis green exercise schemes were excluded as the intervention (independent variable) was physical activity and the dependent variable was the environment.

Where possible, effectiveness was examined over the following timescales:

- In the short term (up to and including one year)
- In the longer term (over one year)

2.2. *Study Type and Quality Appraisal*

Each study was categorised by study type (categorised as type 1-4) and graded for quality using a code '++', '+' or '-', based on the extent to which the potential sources of bias had been minimised (NICE, 2006b, p27.). The studies were categorised into the following study types:

Type 1	Systematic reviews, meta-analyses of RCTs (randomised controlled trials), or RCTs
Type 2	Systematic reviews of, or individual, non-randomised controlled trials, case-control studies, cohort studies, controlled before-and-after (CBA) studies, interrupted time series (ITS) studies, correlation studies.
Type 3	Non-analytic studies (for example, case reports, case series studies, after only studies)
Type 4	Expert opinion, formal consensus.

Studies were quality appraised against NICE quality criteria (NICE, 2006b) appropriate for study types, and subsequently classified into one of three categories (++, + or -). The included studies were quality assessed independently by two reviewers and any discrepancies were resolved through discussion.

NICE Quality Criteria

Does the study describe its methods and results?
Where was the study published?
Who published the study?
Was the study peer reviewed?
Who funded the study?
Were the study samples shown to be representative of the study population in baseline and follow-up (where applicable)?
Was the method/instrument used to assess physical activity or travel mode appropriate to the research question(s) of the study? (*i.e. capable of measuring the outcome under consideration*)
Did the study provide details of the measures used?
Did the study take into account any potential confounders?

++	**All or most** of the data are adequately described and the conclusions of the study are thought very unlikely to alter (low risk of bias).
+	**Some** of the data are adequately described and the conclusions of the study are thought unlikely to alter (risk of bias)
-	**Few or no** data are adequately described and the conclusions of the study are thought likely to alter (high risk of bias)

This review did not identify any ***type 1*** (systematic reviews, meta-analyses of RCTs or RCTs) or ***type 2*** (systematic reviews of, or individual, non-randomised controlled trials, case-control studies, cohort studies, CBA or ITS studies or correlation studies) *studies*. Two ***type 3*** studies were found which were graded as (-) quality. The reasons for these two studies being graded as (-) quality were poorly described methods and/or results, use of inappropriate measures to assess the outcome under consideration, a low quality measure of physical activity (for example, reporting visitor numbers) and failure to take potential confounders into account.

Table 2. Study type and quality

Study type and quality	Authors
3 -	Cannock Chase Council et al., (2005); Peacock et al., (2006).

2.3. Study categorisation

2.3.1. Description of studies

Two studies with post only data met the inclusion criteria (Cannock Chase Council et al., 2005: Peacock et al., 2006). These studies tested 2 different environmental interventions relating to the natural and semi-natural environment and these were categorised as: Woodlands; and Coastal (see section 3-4 for descriptions of the categories).

Both interventions included some form of change or physical modification to the natural environment, for example, improvements to a footpath and/or changes to the amenities within the natural environment. In addition, both interventions included some element of promotional activity e.g. leaflets and posters.

2.3.2 Country of studies

Both studies were conducted in the UK.

2.3.3 Length of outcome measures

One study (Cannock Chase Council et al., 2005) measured short-term outcomes (up to 12 months follow up) only. The other study (Peacock et al., 2006) did not report the time to follow up.

The focus of this review meant that the sources of evidence came from natural environment disciplines and the reporting of physical activity as a study outcome is a rare occurrence compared with those studies conducted within a public health paradigm. The best available outcome data on physical activity were proxy measures such as visitor numbers and frequency and duration of visits. Other non physical activity outcomes were also reported in both studies and included health knowledge, perceived health and mood states.

2.4. Assessing applicability

Each study was assessed on its external validity: that is, whether or not it was directly applicable to the target population(s) and setting(s) in the scope. This assessment took into account whether the study was conducted in the UK, any barriers identified by studies or the review team, with references as appropriate, to implementing each intervention in the UK, (NICE, 2006b).

2.5. Synthesis

It was not appropriate to use meta-analysis to synthesise the outcome data as interventions, methods and outcomes were heterogeneous. This review is restricted to a narrative overview of all studies that met the inclusion criteria and contained sufficient data for data extraction and quality assessment. The effects of studies were examined within the categories of the type of natural environment intervention, stratified by study quality. The evidence statements were developed using NICE criteria (NICE, 2006b, p37), outlined below.

- The best available evidence of the effect of an intervention

- The strength (quality and quantity) of supporting evidence and its applicability to the populations and settings in question

- The consistency and direction of the evidence base

It is noted that for the two categories of interventions contained within this review, only one study met the inclusion criteria. Evidence statements were drafted for these sections, but caution should be taken in generalising due to this limitation. This review did not produce any evidence statements based upon any cost-effectiveness data, where relevant studies with economic data were found these were highlighted for consideration in the economic review.

3. Findings - Woodlands

This category termed ‘woodlands’ relates to interventions involving changes to the physical environment and design features of woodland areas. For example, this could include studies which have aimed to modify the size and density of the woodland area, change access routes, landscape or beautify the woodland area, provide specific facilities for physical activity (e.g. path or trail, climbing or play facilities), and/or build, upgrade features within the woodland (e.g. picnic benches, rest stops). There are approximately 2.8 million hectares of woodland in the UK which can be found in both urban and rural areas. Woodlands are used for a range of leisure and recreational activities, including walking, cycling, playing, tai chi, orienteering and picnicking.

One (3-) study with post only data (Cannock Chase Council et al., 2005) was identified, which reported data on the effects of building creative features along a woodland trail on visitor numbers.

Cannock Chase Council and partners (2005) aimed to assess the impact of woodland trail modifications on health knowledge and visitor numbers of community members. A one-mile woodland trail within Birches Valley Forest in the West Midlands, United Kingdom, was modified to include a range of sculptures and statues. Local community members and/or groups designed and created a piece of artwork inspired by a pertinent health issue. The artwork, for example creative rest stops and benches, was sited along the trail and amongst the trees to encourage people to use the trail.

The Council and partners (2005) used infrared counters to monitor visitor numbers on a monthly basis over a one year period. Although it could be assumed that visitors were physically active along the trail, this study did not provide any information about mode of activity during the visit. It should also be re-emphasised here that visitor numbers are a weak proxy measure of physical activity. In addition, a cross-sectional survey was undertaken at the launch of the

'route-to-health' trail. One hundred and eighty-nine males and females of all ages completed a self-report questionnaire about trail use, current physical activity patterns, the impact of the trail on health knowledge and the quality of the trail.

Evidence of efficacy

One (3-) quality post-only study met the inclusion criteria, proving details of an intervention designed to modify the features of a woodland trail. Cannock Chase Council et al., (2005) reported the number of visitors using the route-to-health trail had increased ten-fold to 50,000 visitors over the year, compared to the number of visitors using the same trail before the project started. There is insufficient evidence available to draw any conclusions on the content of the intervention, its delivery, the setting, intensity or any socio-demographic or cultural factors.

Based on one (3-) quality post-only study there is insufficient evidence to draw any conclusions on the effect of interventions involving changes to the physical environment and design features of woodland areas. It is therefore not possible to identify any features potentially related to effectiveness in terms of the intervention content, delivery, setting or intensity, nor can any statements be made about any potential differential impact for specific socio-demographic groups or cultural factors. No conclusions can be made regarding the applicability or implementability of this type of intervention.

Woodland – summary evidence statement:

There is insufficient evidence to draw any conclusions on the effect of interventions involving changes to the physical environment and design features of woodland areas on physical activity outcomes. There is, however, evidence from one (3-) quality post-only study (Cannock Chase Council et al., 2005) to suggest that building creative features along a woodland trail may increase visitor numbers.

4. Findings - Coastal

This category termed ‘coastal’ groups interventions involving changes to the physical environment and natural features of coastal water areas. This includes studies that aimed to change an individual aspect or a set of characteristics of the coastal area, either by landscaping, scenic beautification, renovation, preservation or conservation and/or provision of specific facilities for physical activity (e.g. path, trail).

One (3-) post-only study was identified (Peacock et al., 2006) which involved development, restoration and scenic beautification of a coastal path in the United Kingdom.

Peacock and colleagues (2006) aimed to examine the health benefits of a new circular coastal path for members of the local community, in particular the path users. A new circular route was developed which linked the village and the existing linear coastal path. Park benches and locally designed artwork were also sited along the route to encourage more people to use the area. Following the development of the new circular route, Peacock et al., (2006) conducted a post-only study which examined the number of occasions on-site and off-site participants visited the coastal path before and after the environmental improvements, the average duration of the visits before and after enhancements and the main reason for visiting. On-site participants were respondents who were questioned whilst using the coastal path whereas off-site participants were members of local groups and schools who were questioned in the community. The time of the study following the path enhancements was not reported; therefore any seasonal effects cannot be taken into consideration when examining the results.

One-hundred and nineteen males and females of all ages completed a self-report questionnaire about their current health and mood state, total weekly physical activity and patterns of path use before and after enhancements. Changes in the

number of occasions visiting the path, and average duration of visits before and after enhancements and the main reasons for visiting were calculated for on-site and off-site users using non-parametric tests.

Evidence of efficacy

One (3-) quality study met the inclusion criteria, providing details of an intervention designed to modify features of a coastal area. Peacock et al., (2006) reported the number of visits per person per month for on-site and off-site participants' pre and post enhancements. For on-site participants the number of visits per person per month increased from 13.14 visits to 14.83 visits following the improvements, representing a 12.9% increase. For off-site participants this changed from 8.96 visits to 9.77 visits following enhancements representing a 9% increase in the number of visits per person per month. For the off-site participants there was a significant difference between the number of visits prior to the improvements and the number of visits reported after enhancements ($p<0.05$).

In addition, Peacock and colleagues (2006) reported the average duration of visits per person for on-site and off-site participants' pre and post enhancements. For on-site participants the total time spent in the park per person per month increased from 761.86 minutes to 941.11 minutes, representing a 25% increase post enhancements. For off-site participants the total time spent in the park per person per month increased from 413.5 minutes to 482.83 minutes, representing a 16.8% increase in time spent in the park post enhancements.

The main reasons on-site and off-site participants visited the coastal path before and after the environmental improvements were also reported. A higher percentage of on-site participants started visiting the path for health, scenery and wildlife reasons following the improvements; however a smaller proportion of on-site participants were visiting it to get some exercise and to walk the dog following improvements. A higher percentage of off-site participants visited the

path for exercise, walking the dog, health, scenery and wildlife after the improvements had taken place compared to prior to the improvements.

Based on one (3-) quality post-only study there is insufficient evidence to draw any conclusions on the effect of changes to the design of coastal areas. It is also not possible to identify any features potentially related to effectiveness in terms of the intervention content, delivery, setting or intensity; nor can any statements be made about any potential differential impact for specific socio-demographic groups or cultural factors. No conclusions can be made regarding the applicability or implementability of this type of intervention.

Coastal - summary evidence statement:

There is insufficient evidence to draw any conclusions on the effect of interventions involving changes to the physical environment and design features of coastal areas on physical activity outcomes. There is, however, evidence from one (3-) quality post-only study (Peacock et al., 2006) to suggest that improving a coastal path may increase frequency and duration of visits.

Evidence Tables

Category	Author and Date	Study design and research type/ quality	Research question	Study population, setting, country, sample size	Description of intervention	Length of follow-up	Physical activity outcome variables (inc measures)	Short term findings (<1 year)	Long term findings (>1 year)	Non physical activity outcomes	Confounders/ potential sources of bias	Applicable to the UK
Woodland	Cannock Chase Council et al (2005)	Post-only study (3-)	To assess the impact of woodland trail modifications on health knowledge and visitor numbers	Community members of all ages. Community Forest in the West Midlands, England, UK. The cross-sectional survey included 189 visitors ranging from under 5 to over 65 years of age.	Route to Health is a one-mile, access friendly, community arts trail sited at Birches Valley Forest. Local community members and/or groups design and create a piece of artwork inspired by a health issue of importance to both themselves and Cannock Chase PCT. The artwork, for example creative rest stops and benches, is placed along the trail and amongst the trees to encourage people to use the trail.	1 year	a) Infrared counters measuring monthly visitor numbers. b) Cross-sectional survey assessing trail use, physical activity patterns, health knowledge and information about the quality of the trail.	a) Infrared observations were taken on a monthly basis, in the first year visitor counters have recorded over 50,000 visits, a ten-fold increase on the number of visits using the same trail before the project started. b) Findings from the survey indicated that: 46% of respondents had never walked the Route to Health before; 45% of respondents were taking part in 4 or more sessions of moderate physical activity per week (n=82).	Not reported	*Knowledge of health issues:* Findings from the cross-sectional survey reported that the route to health had taught: 52% of respondents a little new information about their health and 17% of respondents a lot of new things about their health (n=122).	Post only data reported. Poorly reported results. Cross-sectional survey - possible selection bias	Yes
Water and Wetlands	Peacock et al (2006)	Post-only study (3 -)	To assess whether a new circular coastal path provides health benefits to members of the local community	Community members of a coastal village in the North East, England, UK. Cross-sectional survey of 119 males and females of all ages either on-or off-the coastal path at the point of data collection.	A new circular route was developed linking the village and the existing linear coastal path. The new route also provided park benches, local artwork.	Not reported	Self-reported questionnaire measuring: - *the number of occasions on-site and off-site participants visited the path before and after the environmental improvements;* - Average duration of each visit. Total hours of weekly physical activity.	*This is a post-only study undertaken after the path enhancement; however time to follow-up is not reported.* **FREQUENCY OF VISITS:** **Onsite Participants** Following the enhancement the percentage of participants visiting the site at least once per day increased from 31% to 37.9%. There was also a decrease in the number of participants who reported visiting the site once per fortnight or less prior to the enhancements from 10.3% to 3.4% (p=0.016).		Self-reported current health and mood state	Possible selection bias. Poorly reported results. Cross-sectional survey not representative of residents in Easington	Yes

								The number of visits per person per month increased from 13.14 visits (n=28) to 14.83 (n=29) following the improvements, representing a 12.9% increase. **Offsite Participants** Following the enhancements the percentage of participants who visited the path: - at least twice a day increased by 4.5% - everyday increased by 2.2% - twice a week increased by 2.2% - once per week increased by 2.3% & - less frequently (once per month, occasionally, or never) decreased by 2.3%. There was a significant difference between the number of visits prior to the improvements and the number of visits reported after enhancements (p=0.046). The number of visits per person per month increased from 8.96 visits (n=26) to 9.77 visits (n=29) following the enhancements, representing a 9% increase in the number of visits per person per month. ***DURATION OF VISITS*** ***Onsite participants (n=26)*** The proportion of users who spent at least 45 minutes on the path increased from 84.6% to 88.5% following the enhancements. The total time spent in the park per person per month increased from 761.86 mins to 941.11 mins, representing a 25% increase. ***Offsite participants (n=39)*** 56.4% of users spent at least 45 minutes on the path prior to modifications, this increased to 61.5% post enhancements. The total time spent in the park per person per month increased from 413.5 min to 482.83 min, representing a 16.8% increase. **WEEKLY PHYSICAL ACTIVITY DATA** Overall, 76.5% (onsite) and 81.5% (off-site) of participants engaged in more than the 2.5h of weekly physical activity.			

Appendix A – Example search strategy

OVID Medline

Natural environment terms

1. landscap$.tw.
2. renewal.tw.
3. regeneration.tw.
4. (pedestrianis$ or pedestrianiz$).tw.
5. structur$.tw.
6. layout$.tw.
7. facilit$.tw.
8. feature$.tw.
9. surrounding$.tw.
10. amenit$.tw.
11. location$.tw.
12. planning.tw.
13. space$1.tw.
14. environment$.tw.
15. development$.tw.
16. design$.tw.
17. sprawl.tw.
18. land us$.tw.
19. (aesthetic$ or esthetic$).tw.
20. (pavement$ or sidewalk$).tw.
21. (sign or signs or signpost$ or signage).tw.
22. path$.tw.
23. trail$.tw.
24. footpath$.tw.
25. recreation$.tw.
26. area$1.tw.
27. access$.tw.

28. Public Facilities/
29. exp Environment Design/
30. Esthetics/
31. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30
32. natural.tw.
33. rural.tw.
34. green$.tw.
35. (park or parks or parkland or parklands).tw.
36. (wood or wood$1 or woodland$).tw.
37. forest$.tw.
38. tree$.tw.
39. river$.tw.
40. beach$.tw.
41. lake$.tw.
42. canal$.tw.
43. waterway$.tw.
44. playing field$.tw.
45. open space$.tw.
46. conservation$.tw.
47. ground$.tw.
48. outdoor$.tw.
49. outside.tw.
50. Conservation of Natural Resources/
51. 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50
52. 31 and 51

Physical activity terms

1. (physical adj5 (fit$4 or train$3 or activ$3 or endur$4)).tw.
2. (exercis$3 adj5 (fit$4 or train$3 or activ$3 or endur$4)).tw.

3. (leisure adj5 (centre$1 or center$1 or facilit$)).tw.
4. (fitness adj5 (centre$1 or center$1 or facilit$)).tw.
5. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj5 gym$).tw.
6. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj5 physical activit$).tw.
7. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj5 (circuits or aqua$)).tw.
8. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj5 exercis$).tw.
9. ((promot$ or uptak$ or encourag$ or increas$ or start$ or adher$) adj5 (keep fit or fitness class$ or yoga)).tw.
10. ((decreas$ or reduc$ or discourag$) adj5 (sedentary or deskbound)).tw.
11. sport$3.tw.
12. walk$3.tw.
13. running.tw.
14. jogging.tw.
15. bicycl$3.tw.
16. (bike$1 or biking).tw.
17. (exercis$3 adj5 aerobic$1).tw.
18. rollerblading.tw.
19. rollerskating.tw.
20. skating.tw.
21. exertion$1.tw.
22. recreation$1.tw.
23. stair$.tw.
24. exp Exertion/
25. Physical Fitness/
26. exp "Physical Education and Training"/
27. exp Dancing/
28. exp Sports/
29. exp Yoga/

30. pilates.tw.
31. Exercise Therapy/
32. exp Fitness Centers/
33. Recreation/
34. "Play and Playthings"/
35. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34

Combine 52 (natural) AND 35 (physical activity)

Appendix B – In/ Out Form

Author and year ..... Today's date .....
Study ID Number ..... Reviewer .....

Questions	Yes	Not Clear	No	Further information:
Is the study an **intervention study** or review of intervention studies?				State the main purpose of the study:
Is the study relevant to the **natural environment*?**				
Does the intervention include (some form of) **physical modification to the natural environment**? (might include changes to park access; park features; rail trail, forest modifications)				
Is an outcome reported on **physical activity behaviour** (including walking/cycling/step-counts, play, physical fitness, gardening)? Can include unintended consequences				State the primary measure reported: If NO, is an outcome measure related to PA? (e.g. corroborative evidence – crime, ↓BMI, ↓BP)

IF THE ANSWER TO ANY OF THE ABOVE IS NO, EXCLUDE THE STUDY (FROM THIS INITIAL SCREENING)

This study is:	**Included**	☐	**Excluded**	☐	**Not sure**	☐
Indicate if this study is relevant to another review?	Transport		☐	National Policy		☐
	Building design		☐	Economic		☐
	Natural environment		☐			
Other information:						

* Natural Environment includes: parks (urban & country, water and wetlands, beaches, woodlands, remnant/vacant land, green belts, green corridors canals, riverbanks, disused railways, linear green-space, tree belts/woodland) (Dept for Communities & Local Government, 2006).

Appendix C – Studies Unable to Review

1. Beresford R (1994). The development of recreation within the Peak National Park. s.l.; United Kingdom, Loughborough University.
2. Blandford C (2000). (London Planning Advisory Committee). Creating and enhancing open space in London.
3. Brantley H (1990). The Relationships Between The Recreational Sites And The Natural Environment. Ichper-Sd Asian Journal Vol 13; 133:63-67.
4. Cairns S (2001). Why walking and urban greenspace are good for each other. Town and Country Planning; 70(4):102-103.
5. Chernushenko D (1995). Going for green: a more sustainable future for community recreation may lie in "eco-efficiency". Recreation Canada (Gloucester, Ont); 53(1):12-14.
6. Edwards KJ (1994). A study of the recreational use of the dismantled Derby to Ilkeston railway line: a case study of the West Hallam to Stanley section. United Kingdom, University of Sheffield.
7. Fischer J (1993). Rails-to-Trails: A Valuable Resource for Outdoor Educators. Pathways: The Ontario Journal of Outdoor Education; 11.
8. Gordon PM, Zizzi S, Pauline J. (2004). Use of a community trail among new and habitual exercisers: a preliminary assessment. Preventing Chronic Disease. 1 (4): 1-11.
9. Grogan P, Timm P (2006). Engineering brownfield redevelopment. Geosynthetics; 24(1):30-33.
10. Hartman J (2000). Trails and greenways. IQ Service Report; 32(4):1-12.
11. Jordan CL (1991). Gateways and greenways to Baltimore. Parks and recreation (Alexandria, Va); 26(6):34.
12. Parish R, Funnell D (1996). Land, water and development in the High Atlas and Anti Atlas mountains of Morocco. Geography; 81(351):142-154.
13. Pendleton MR, Thompson HL, Johnsen KA, Klaas SJ, Reid S, Wheat A (2000). Outdoor recreation. Parks & Recreation (Ashburn);7-83.
14. Pirk H, Foley J (1995). Managing change and diversity in recreation and parks. Recreation Canada (Gloucester, Ont); 53(2):8-10.
15. Quinlin MP (1991). Franklin Park: something for everyone. Parks and recreation (Alexandria, Va); 26(6):54.
16. Richardson I (1998). A walk in the park? leisure manager; 16(8):19-20.
17. Richardson SL, Long PT (1990). Enhancing wellness in rural settings: a Colorado case study. Trends (Alexandria, Va); 27(1):42-46.
18. Rottle ND (2006). Factors in the landscape-based greenway: a Mountains to Sound case study. Landscape-and-Urban-Planning; 76(1-4):134-171.
19. Rounds R (1991). The population context for recreation planning in rural Western Canada. Recreation Canada (Gloucester, Ont); 49(3):11.
20. Ruff A, Maddison C (1994). Footpath management in the National parks. Landscape Research Routledge, Basingstoke, UK. 19(2):80-87.
21. Schmid S (1995). Par for the course: disc golf is a great way to revitalize vandalized and underutilized parks. Athletic business (Madison, Wis); 19(9):22.

22. Schmid S (1997). Park partners. A variety of partnerships make a Seattle-area park a true cooperative venture. Athletic business (Madison, Wis); 21(3):20.
23. Scholen G (1991). Trail partnerships: the key to the state's role in providing Minnesota greenways. Trends Park practice program (Alexandria, Va); 28(4):29-33.
24. Schutt AM (1998). Trails for economic development: a case study. Journal of applied recreation research (Waterloo, Ont); 23(2):127-145.
25. Showstack R (1990). 10 simple ways to save rivers. Canoe (Kirkland, Wash); 18(3):22.
26. Smith C (1993). The Sherwood Park Fish & Game Conservation Program - a wildlife habitat conservation program continues in Strathcona County. Recreation Alberta (Edmonton); 12(3):18-19.
27. Smith D (1995). Shaping the future of recreation, parks and leisure services in Canada - The Canadian Parks/Recreation Association. Recreation Canada (Gloucester, Ont); 53(2):4-7.
28. Wong B (1994). Active living without physical barriers: Edmonton Parks and Recreation's success story. Recreation Alberta (Edmonton); 14(2):15-17.
29. Yates D, Ruff AR (1991). Encouraging nature in urban public parks. The consequences of adopting a more ecological approach to design and maintenance. Manchester Univ. (GB). EIA Centre, Dept. of Planning and Landscape.
30. Young E. (2002). No walk in the park. RIBA Journal 109[2], 58-60.
31. Norway plans green games venue inside mountains. Building Design 1040. June 21, 6. 1991.
32. Canadian Rails to Greenways Network. Linking Canada's abondoned rail corridors. Recreation Canada (Gloucester, Ont) 1992; 50(5):7.

Appendix D – Excluded Studies

Study Reference	Reason for exclusion
Astle JH, Boss J (2000). Your Wetlands Are Not a Wasteland: Developing Natural Areas for Program Use. Camping Magazine;-37.	Not an intervention
Balmori D (1990). A path in the city, a path in the woods. Places; 6(4):50-67.	Not an intervention
Beamer K (1991). REI: a corporate commitment to trails. Trends Park practice program (Alexandria, Va)	Not an intervention
Bendixson T (2000). Walk this way. Surveyor; 187 (5569):14-15.	Not an intervention
Benhart JE, Davis S (2002). The effects of greenways and trails on environmental quality and property values in Pennsylvania. Pennsylvania-Geographer; 40(2):157-175.	Not an intervention
Bradley G, Wortman D, Holderness J (1995). Natural area planning: a case study in Washington State, USA. Natural-Areas-Journal;(4):-346.	Not an intervention
Brown A (1993). Community forests. Sport and leisure (London); 33(6):30.	Not an intervention
Brown H (1998). Keeping out the keep out signs: Hamish Brown looks at attitudes towards access and accountability in the Scottish hills - and finds the signs are looking good. TGO - The great outdoors (East Kilbride, Scotland); 20(8):44-49.	Excluded on title – correlates study.
Brownson, RC, Hagood, L, Lovegreen, SL, Britton, B, Caito,NM, Elliot,MB et al (2005). A multi-level ecological approach to promoting walking in rural communities. *Preventive Medicine,* 41: 837-842.	The study does not examine the effects of environmental modification on p.a. levels.
Brownson RC, Housemann RA, Brown DR, Jackson-Thompson J, King A, Malone BR et al (2000). Promoting physical activity in rural communities: walking trail access, use and effects. American Journal of Preventive Medicine; 18(3):235-241.	Included in urban planning and design review (NICE 2006b)
Chavez DJ, Tynon JF, Harding JA (1999). America's best-kept secret: the national recreation trails. Parks & recreation (Ashburn, Va); 34(3):36.	Not an intervention
Cheadle A, Gregg T, Lewis K, Schwartz S, Walwick J (2004). Taking sound steps. Parks & Recreation (Ashburn) National Recreation and Park Association, Ashburn, USA:;7-53.	Not an intervention

Clair B (2005). Recreation and tourism in areas of outstanding natural beauty: Key influences on the policymaking process. Current-Issues-in-Tourism; 8(2-3):93-113.	Not an intervention
Davison R (1997). The benefits of countryside recreation: a Scottish perspective. Countryside Recreation Network News;2-6.	Not an intervention
Dept. of Natural Resources and Environment, (2002). Sustainable practices for sport & recreation. Melbourne, Vic.; Australia	Not an intervention
Doherty S (1992). Active living and the environment. Go for Green pins big hopes on small actions. Recreation Canada (Gloucester, Ont); 50(5):12.	Not an intervention
Dolesh RJ (2004). Follow the trail toward improved health. Parks & Recreation (Ashburn) National Recreation and Park Association, Ashburn, USA:;5-46.	Not an intervention
Evenson KR, Herring AH, Huston SL (2005). Evaluating change in physical activity with the building of a multi-use trail. American Journal of Preventive Medicine; 28((2S2)):177-185.	Included in transport review (NICE 2006 a)
Gobster PH (1995). Perception and use of a metropolitan greenway system for recreation. Landscape-and-Urban-Planning; 33:401-413.	Not an intervention
Gobster PH, Westphal LM (2004). The human dimensions of urban greenways: planning for recreation and related experiences. Landscape-and-Urban-Planning; 68:147-165.	Not an intervention
Hall KB, Jr (1991). Designing fitness trails for seniors. Parks & Recreation (Arlington);8-31.	Not an intervention
Hall S, Soller C (1991). A national system of trails. Trends Park practice program (Alexandria, Va); 28(4):43-47.	Not an intervention
Jarvi CK (1997). The greening of parks and recreation. Parks & recreation (Ashburn, Va); 32(11):86-90.	Not an intervention
Jenish D (1996). The long and winding trail: old train lines offer new possibilities. Maclean's (Toronto); 109(34):46-47.	Not an intervention
Lindsey G (1999). Use of urban greenways: insights from Indianapolis. Landscape and Urban Planning; 45(2-3):145-157.	Not an intervention

Lund T, Alexander D (2005). Public Rights of Way and Planning. Town and Country Planning 74[7/8], 240-242..	Not an intervention
Maynard M (1997). A waterfront for walking. Landscape Architecture; 87(5):34-39.	No physical activity outcome data
NSW Health Dept. (2002). Walk it: active local parks: the effect of park modifications and promotion on physical activity participation: summary report. North Sydney; Australia.	More relevant to Urban planning and design review (NICE 2006b).
Nolan PVJ (2005). Healthy Trees - do woodlands really make us healthier? Countryside Recreation 13[1], 19-23.	Not an intervention
O'Shea S (1999). Public access to Louisiana beaches following publicity funded restoration projects: the reclamation of Fourchon Beach. Tulane environmental law journal (New Orleans); 13(1):95-124.	No physical activity outcome data
Park CH, Rolfe C, Sheppard L, Schwingel A, Smith D, Tanaka K (2004). Active green environments: Developing environmental green spaces to promote physical activity in seniors. Medicine and Science in Sports and Exercise; 36(5):S75.	Not an intervention
Pauwels F, Gulinck H (2000). Changing minor rural road networks in relation to landscape sustainability and farming practices in West Europe. Agriculture-Ecosystems-and-Environment; 77(1-2):95-99.	Not an intervention
Pearce F (1994). Greening the heart of England. New Scientist; 143((1944)):30-35.	Not an intervention
Pedroli B, de Blust G, van Looy K, van Rooij S (2001). Setting targets in strategies for river restoration. Landscape Ecology; 17:5-18.	Not an intervention
Plumb G, Lusk A (1993). The greening of America. Parks & recreation (Arlington, Va); 28(8):46.	Not an intervention
Pressey RL, Harris JH. Wetlands of New South Wales (1988). in: The conservation of Australian wetlands;(Surrey Beatty, Chipping Norton, NSW, with WWF Australia):-57.	Date of publication (1988) outside search criteria
Reeder RJ (2002). Rural development policy: new assistance for low-income areas and infrastructure. Rural America; 16:26-34, issue.	Not an intervention

Reynolds V (1999). The Green Gym. Evaluation of a pilot project in Sonning Common, Oxfordshire. Oxford Brookes Univ. (GB). Oxford Centre for Health Care Research and Development (OCHRAD).	Not an environmental intervention; the physical modifications to the natural environment had to be the intervention and physical activity the outcome, green gyms – use physical activity as the intervention
Rolston HI (1991). Creation and recreation: Environmental benefits and human leisure.	Not an intervention
Salwen P (2000). Urban recreation: New York City's parks are revamped and rehabilitated. What some have called a "filthy, noisy" city is home to creatively designed, functional parks for adults and children. Parks & recreation (Ashburn, Va); 35(4):68-77.	Not an intervention.
Sauripujol D, Llurdescoit JC (1995). Embellishing Nature - the Case of the Salt-Mountain Project of Cardona, Catalonia, Spain. Geoforum; 26(1):35-48.	No physical activity outcome data
Schmidt L (1996). Canada...by trail. Parks & recreation Canada. Canada (Gloucester, Ont); 53(4/5):8.	No physical activity outcome data
Schweitzer M, Gilpin L, Frampton S (2004). Healing spaces: Elements of environmental design that make an impact on health. Journal of Alternative and Complementary Medicine; 10:S71-S83.	Not an intervention
Scott Kortge C (1998). Focused steps bring compound benefits for fitness walkers. Parks & recreation (Ashburn, Va); 33(10):46-49.	Not an intervention
Scott P (1997). On the right track. An overview of the work of the Paths for all Partnership in Scotland. Leisure manager (Reading, England); 15(7):39-40.	Not an intervention
Sellin S, Myers N (1994). Current research in parks and recreation. Parks & recreation (Arlington, Va) 1994; 29(11):12.	Not an intervention
Settina N, Kauffman RB (2001). Water trails. Interest in the development of water trails has been fueled by arising popularity in recreational paddling, whether by sea kayak or canoe, over the past decade. Parks & recreation (Ashburn, Va); 36(9):94-102.	Not an intervention
Shackley M (2004). Managing the cedars of Lebanon: Botanical gardens or living forests? Current-Issues-in-Tourism; 7(4-5):417-425.	Re-assessed and excluded on title

Shoemaker CA, Messer Diehl ER, Carmen J, Carmen N, Stoneham J, Lohr VI (2002). Interaction by design: bringing people and plants together for health and well-being: an international symposium. The Sixth International People-Plant Symposium, Chicago, USA, 20-22 July, 2000. Interaction by design: bringing people and plants together for health and well-being: an international symposium The Sixth International People-Plant Symposium, Chicago, USA, 2000.	No studies relevant to the natural environment
Sievanen T (1991). Scandinavian research on multiple forest uses. Tourism recreation research (Lacknow, India); 16(2):55-59.	Not an intervention
Stocking M, Perkin S (1992). Conservation-With-Development - An Application of the Concept in the Usambara Mountains, Tanzania. Transactions of the Institute of British Geographers; 17(3):337-349.	Not an intervention
Stoneham J (2001). Making connections for accessible greenspaces. Countryside Recreation Countryside Recreation Network, University of Wales College of Cardiff, Cardiff, UK:1-16.	Not an intervention
Taylor G (1990). Forests for the community. Sport Leis; 31(4):18-19.	Not an intervention
Tennor E (1997). Signage and graphics in public recreation and park facilities. Design (Washington);8-15.	Not an intervention
Vento BF (1991). Trails: a nationwide system, a national priority. Trends Park practice program (Alexandria, Va); 28(4):7-9.	No physical activity outcome data
von H, Reich M (2006). The German way to greenways and habitat networks. Landscape-and-Urban-Planning; 76(1-4):7-22.	No physical activity outcome data
Walmsley A (1995). Greenways and the Making of Urban Form. Landscape and Urban Planning; 33(1-3):81-127.	Not an intervention
This land is your land. Sixteen National Millennium Trails, historical routes that serve to connect citizens with the land, history, and culture of America, are the product of Millenium trails, a national initiative of the White House Millennium Council in conjunction with several governmental and environmental organizations. Parks & recreation (Ashburn, Va) 2000; 35(10):84-88.	Not an intervention

East Coast Greenway inaugurated on National Trails Day: National Society for Park Resources. Parks & recreation (Ashburn, Va) 2003; 38(9):105.	Not an intervention
US senators promote completion of East Coast Greenway. Parks & recreation (Ashburn, Va) 2003; 38(3):16.	Not an intervention

Appendix E – Case Study Website Search

Organisation	Website	Checked
Active Living Research	www.activelivingresarch.org	• Abstracts • Reference lists & Links • Present research
Rails to Trails Conservancy	www.railtrails.org	• Publications- magazine articles
America On the Move		• Publications & News
National Centre for Bicycling & walking	http://www.bikewalk.org/	• Publications • Conference presentations
Active Living Resource Center	http://www.activelivingresources.org/	• No case studies
OpenSpace	www.openspace.eca.ac.uk	• Research projects • Literature review – ref list
English Nature	http://www.english-nature.org.uk/life_projects/	• Projects • Publications
Ravine Woodlife	http://www.ravinewoodlife.org.uk/project_news_detail.asp?NewsID=11	• Project list & news
Arts Council	www.artscouncil.org.uk/publications/publication_detail.php?rid=0&sid=&browse=recent&id=384 www.artscouncil.org.uk/publications/publication_detail.php?rid=0&sid=&browse=recent&id=188	• The impact of the arts publication. • Socio-economic benfits of the arts publication.
Cape-to-cape	http://www.capetocapetrack.com.au/pages.asp?code=10	• No case study detail/outcome data
Forestry Commission – Forest Research	http://www.forestry.gov.uk/research	• public access recreation tourism • case studies searched • publications
Naturally active	http://www.naturallyactive.org/article.aspx?SectionID=67&subsite=rural	• case studies
Countryside Agency & Forestry Commission's Community Forests	http://www.communityforest.org.uk/	• community forests evaluation report (2005)

		• quality of life report • Community forest review (2005)
Greenwood Community Forest	www.greenwoodforest.org.uk	• Publications
Great North Forest	http://www.greatnorthforest.co.uk	• News • Press releases – annual report
Tees Forest	http://www.teesforest.org.uk/	• Community projects
Red Rose Forest	http://www.redroseforest.co.uk	• Publications • Annual report
South Yorkshire Forest	http://www.syforest.co.uk/national.htm	• News • Business • Projects
Forest of Mercia	http://www.forestofmercia.org.uk/	• Publications
Forest of Marston Vale	http://www.marstonvale.org	• Projects • Publications – breathing spaces case studies
Thames Chase	http://www.thameschase.org.uk/sites.html	• Current work – THERAPI project
Watling Chase	http://enquire.hertscc.gov.uk/cms/wccf/default.htm	• Publications, projects
Great Western	http://www.forestweb.org.uk/gwf-index.htm	• Publications/info
Forest of Avon	http://www.forestofavon.org/	• Sport & recreation • News • About the forest
Mersey Forest	http://www.merseyforest.org.uk/pages/us.asp	• Projects • Documents
Woodland Trust	http://www.woodland-trust.org.uk	• Trees for All campaign • Publications
Transport Enhancement	www.enhancements.org/examples_search.asp	• case studies
Groundwork	http://www.groundwork.org.uk/	• community work
Scottish Natural Heritage	http://www.snh.org.uk/	• Initiatives
Greenspace Scotland	http://www.greenspacescotland.org.uk	• Project database
Keep Scotland Beautiful	http://www.groundwork.org.uk/	• Case studies
British Waterways	www.britishwaterways.co.uk	• Britishwaterways and • Waterscape

Appendix F - Included case studies

Cannock Chase Council, Forestry Commission and Cannock Chase Primary Care Trust (2005) *Route to Health*. Birches Valley Forest Centre, Cannock Chase.

Peacock, J., Hine, R. & Pretty, J. (2006) *The health benefits of environmental improvements to a circular route at Easington Coastal Path*. Short summary of the key findings for the Environment Agency and Durham Heritage Coast. Centre for Environment and Society, University of Essex.

Appendix G – Excluded Case Studies & Reports

Case Study Ref ID No	Author (Year) or Source of document	Title of Project	Reason for Exclusion
GreenSpace Projects			
1		Baxter Park Restoration Project	No physical activity outcome data
2		Beardmore Park	No physical activity outcome data
3		Bothwell Nature Walk	No physical activity outcome data
4		Burdiehouse Burn Valley Park	No physical activity outcome data
5		Burghlee Park, Loanhead, Midlothian	No physical activity outcome data
6		Burnside Community Woodland	No physical activity outcome data
7		Dalbeattie Forest Easy Access Nature Trail	No physical activity outcome data
8		Dalneigh Trailblazers	No physical activity outcome data
9		Dr Mackay's Wood –Juniper Green	No physical activity outcome data
10		Eric Hendrie Park	No physical activity outcome data
11		Ferry Glen Woodland	No physical activity outcome data
12		Foggieton Community Woodland	No physical activity outcome data
13		Forthgreen Network	No physical activity outcome data
14		Gateside Community Woodland	No physical activity outcome data
15		Greater Balgay Park	No physical activity outcome data
16		Holmhills Wood Community Park	No physical activity outcome data
17		Merklands Local Nature Reserve	No physical activity outcome data
18		Middleton Community Woodland	No physical activity outcome data
19		Muir Wood Park	No physical activity outcome data

20		Petersburn Barra Drive Link	No physical activity outcome data
21		Saltings	No physical activity outcome data
22		Stirling Maxwell Forest Park	No physical activity outcome data
23		South Kessock Environmental Project	No physical activity outcome data
24		Victoria Park, Bo-ness	No physical activity outcome data
25		Wemyss Bay Woodland	No physical activity outcome data
26		Westburn Community Woodland	No physical activity outcome data
Forestry Commission			
27	Forestry Commission (2004)	West Midlands Woodland & Health Evaluation	Includes a summary of 4 Woodland Improvement Grant (WIG) projects. Two of these projects include some physical modifications to the natural environment; schemes are linked to walking way to health initiative. Evaluation relates to whether people are walking more as a result of the led walks programme rather than as a result of the improvements to the natural environment. Outcome measure is weak, sample size is small (n=3), outcome relates to behavioural measure rather than physical modification. The physical modifications to the natural environment had to be the intervention (independent variable) and physical activity the outcome (dependent variable)

28	Snowdon H (2006)	Evaluation of the Chopwell Wood Health Project	The scheme involves two elements 1) healthy school education programme and 2) a GP referral scheme. Neither element of the project involves a physical modification to the natural environment. The project is about using the natural environment for educational purposes and/or as a setting for physical activity. The physical modifications to the natural environment had to be the intervention (independent variable) and physical activity the outcome (dependent variable) The GP referral scheme includes woodland gardening, tai chi, walking and cycling. But these do not count as a form of physical modification to the natural environment. PA outcome data: number of visitors/referrals, number of people in activity groups, number of people formerly inactive but does not provide data of the number of people using the wood regularly now.
Transport Enhancement projects http://www.enhancements.org/examples_search.asp:			
29		Farmington Canal Linear Park	No physical activity outcome data
30		West Orange Trail	No physical activity outcome data
31		Southeast Michigan Greenways	No physical activity outcome data

32		Schuylkill River Park	No physical activity outcome data
33		Cliff Walk Restoration	No physical activity outcome data
34		George S. Mickelson Trail	No physical activity outcome data
35		Greenbrier River Trail	No physical activity outcome data
36		Mon River/Capterton/Deckers Creek Trail System	No physical activity outcome data
37		Mineral Wells to Weatherford Rail-Trail	No physical activity outcome data
38		Anacostia Trail System	No physical activity outcome data
39		Silver Comet Trail	No physical activity outcome data
40		Great Allegheny Passage	No physical activity outcome data
41		Mineral Belt Trail	No physical activity outcome data
42		Greenway Trail	No physical activity outcome data
43		Chief Ladiga Trail	No physical activity outcome data
44		Lydgate Park Coastal Multi-Use Path	No physical activity outcome data
45		River's Edge Trail Historic Union Pacific Rail Trail State Park	No physical activity outcome data
46		Iron Horse State Park Trail	No physical activity outcome data
47		Heart of Iowa Nature Trail	No physical activity outcome data
48		Chesapeake & Ohio Canal National Historic Park	No physical activity outcome data
49		Tennessee Riverwalk	No physical activity outcome data
50		Hot Springs Creek Greenway	No physical activity outcome data
51		Leavenworth Landing Riverfront Park and Trail	No physical activity outcome data
52		Florida Suncoast Trail	No physical activity outcome data
53		Pere Marquette Rail-Trail	No physical activity outcome data
54		Trail of the Coeur D'Alenes	No physical activity outcome data
Forestry Commission Funded Projects			
55		Berwick Glade	Details unable to obtain within the timeframe of this review

56		Cely Woods	Details unable to obtain within the timeframe of this review
57		Harold Court Woods	Details unable to obtain within the timeframe of this review
58		Bonnetts Wood	Details unable to obtain within the timeframe of this review
59		Folkes Lane Woodland	Details unable to obtain within the timeframe of this review
60		Ingrebourne Valley	Details unable to obtain within the timeframe of this review
61		Pages Wood	Details unable to obtain within the timeframe of this review
62		Tylers Wood	Details unable to obtain within the timeframe of this review
63	Forestry Commission (2002)	Wye Wood Project	No physical activity outcome data
Countryside Agency & Forestry Commission Community Forests			
64	Countryside Agency and Forestry Commission (2005)	National Community Forests – National programme annual report	No physical activity outcome data
65		Mersey Forest: Northwich Community Woodlands	No physical activity outcome data
66		Mersey Forest: REACT Health Project in Liverpool	No physical activity outcome data
67		Thames Chase: (THERAPI) Tackling Health Through Environmental Regeneration And Public Involvement	Details unable to obtain within the timeframe of this review
68		Thames Chase: Mardyke Valley Project	No physical activity outcome data
69		Red Rose Forest	No physical activity outcome data

70		Greenwood Forest Project	No physical activity outcome data
71		Watling Chase Forest: Composers Park Rest Plan	No physical activity outcome data
72		Great Western Forest	No physical activity outcome data
73		Forest of Marston Vale	No physical activity outcome data
74		Great North Forest	No physical activity outcome data
Other case studies/papers			
75	Stewart (2006)	Edinburgh Green Belt Trust	No physical activity outcome data
76	Angus (2006)	Roughcastle Woodland Management	No physical activity outcome data
77	Kane E (2006)	West Dunbartonshire Greenspace	No physical activity outcome data
78		Watergate Forest Park, Gateshead	No physical activity outcome data
79		Kauai's 17-Mile Coastal Multi-Use Pathways Project	No physical activity outcome data
80	Transport Energy	Greenways to Greenway	No physical activity outcome data
81	CJB Consulting (2005)	Economic benefits of accessible green spaces for physical and mental health: scooping study. *Final report for the Forestry Commission.*	Not an intervention and no modification to natural environment.
82	Milton Keynes South Midlands Health & Social Care Group (2004)	Healthy Sustainable Communities: What works.	Review to highlight how health and health change link to wider determinants of health.
83	University of Western Australia, Department for Planning & Infrastructure & the National Heart Foundation	RESIDE (Perth): Residential Environments Project	Examines the impact of existing community design on people's leisure time activities, health and transport patterns, however does not modify the natural environment.
84	McCloy (2003)		No physical activity outcome data
85	Environment Agency	Delivering regeneration by improving the	No physical activity outcome data

	(2006)	Environment	
86	Heritage Lottery Fund (2003)	Old Moor and Dearne Valley Wetlands	No physical activity outcome data
87	Stone D & Hanna J	Health & Nature: the sustainable option for healthy cities	No physical activity outcome data
88	Gulez et. Al. (2004)	An evaluation method for the determination of forest recreation potential: A case study	No physical activity outcome data
89	Wells N & Lekies K (2006)	Nature and the Life Course: Pathways from Childhood Nature Experiences to Adult Environmentalism	No physical activity outcome data
90	Chang C Y	Psychophysiological Responses to Different Landscape Settings and a Comparison of Cultural Differences	No physical activity outcome data
91	Chang CY (2004)	Relationships Between Landscape Ecology Structures and Residents' satisfaction with Their Living Environment	No physical activity outcome data

Appendix H - Glossary

CBA	Controlled before and after
CPHE	Centre for Public Health Excellence
DfT	Department for Transport
DH	Department of Health
CC	Collaborating Centre
NHS	National Health Service
NICE	The National Institute for Health and Clinical Excellence
NSF	National service frameworks
PDF	Portable document format
PHCC	Public Health Collaborating Centre
PDG	Programme Development Group
QALY	Quality-adjusted life year
RCT	randomised controlled trial
Multi-use trails	Routes open to cyclists and pedestrians, but closed to motor traffic.
Woodland	The definition of woodland in United Kingdom forestry statistics is land under stands of trees with a canopy cover of at least 20% (or having the potential to achieve this), including integral open space, and including felled areas that are awaiting restocking.
Green Exercise	Green exercise refers to a range of schemes which provide an alternative to traditional facility based physical activity programmes, they encourage individuals to be active whilst being directly exposed to nature, such as gardening, farming, conservation activities, trekking, cross-country running or horse-riding. These schemes aim to change participants' physical activity; they may or may not change some aspect of the natural environment as part of the physical activity intervention.

References

BTCV (2006) What is a green gym?
http://www2.btcv.org.uk/display/greengym

CABE (2004) The value of public space: how high quality parks and public spaces create economic, social and environmental value. London: CABE

Department of Health., (2004) At least five a week. Evidence on the impact of physical activity and its relationship to health. A report from the Chief Medical Officer. London: Department of Health.

Department of Transport., (1995) Transport Statistics Report. National Travel Survey; 1992/94. London: HMSO.

Department of Transport., (2005) Transport Statistics Report. National Travel Survey; 2004. London: TSO.

Department of Health. (2006) Health Survey for England.
http://www.dh.gov.uk/PublicationsAndStatistics/PublishedSurvey/HealthSurveyForEngland/fs/en

Giles-Corti, B., Broomhall, M., Knuiman, M., Collins, C., Douglas, K., Ng, K., Lange, A and Conovan., R. (2005) Increasing walking: how important is distance to, attractiveness and size of public open space? American Journal of Preventive Medicine, 28 (2S2), 169-176.

Henwood, K. (2001) Exploring linkages between the environment and health: Is there a role for environmental and countryside agencies in promoting benefits to health? A report for the Forestry Commission.

Humpel, N., Owen, N. and Leslie, E. (2002) Environmental factors associated with adults' participation in physical activity. American Journal of Preventive Medicine. 22 (3): 188-199.

Kaplan, R. and Kaplan, S. (1987) The garden as restorative experience: a research odyssey. In: M. Francis and R.T. Hester (Ed.s) The meanings of the Garden: Conference Proceedings. University of California: Davis, Centre for Design Research.

Morris, J.N. (1994) Exercise in the prevention of coronary heart disease: today's best buy in public health. Medicine and Science in Sports and Exercise. 26: 807-814.

Morris, N. (2003) Health, Well-being and Open Space: Literature Review. OPENspace: Scotland.

National Institute for Health and Clinical Excellence. (2006a) Physical Activity and the Environment: Review One - Draft Transport Review. NICE, London: UK

National Institute for Health and Clinical Excellence. (2006b) Physical Activity and the Environment: Review Two - Draft Urban Design and Planning Review. NICE, London: UK.

National Institute for Health and Clinical Excellence. (2006b) Public health guidance: development process and methods. London: NICE.

White, R. and Heerwagen, J. (1998) Nature and mental health: biophilia and biophobia. In: A. Lundberg (Ed.) Environment and mental health. London: Lawrence Erlbaum. Pp: 175-192.

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