FINAL REPORT

A contribution to the evidence base for evaluating health interventions in natural environment settings

A review of methods and evaluation approaches

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by

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Executive Summary

Introduction

- This report reviews the research methods and approaches used to evaluate UK-based health interventions and programmes that are in, use, or seek to change the natural environment. It develops work established through the Outdoors and Health Network - OHN (www.outdoorshealthnetwork.co.uk)
- The review asks: *what measurement tools and research approaches are used in the evaluation of health interventions based in natural environments?*
- The results of this review are important for people and organisations conducting interventions and associated evaluations in the UK and may have international applicability.

Methods and search results

- A search strategy identified potentially relevant studies that were then tested against the following inclusion criteria:
    - *The intervention is UK based and has been evaluated*
    - *The evaluation was published between 2000 and 2010*
    - *The intervention has a stated health aim and/or wellbeing improvement or promotion*
    - *The intervention must be in, use, or seek to change/ improve the natural environment*
- Forty evaluations were found to meet the selection criteria. Interventions were categorised into three main types of intervention: multi-project – evaluation considers larger multi-project scheme (13); site-specific – evaluation considers one project (18); and research–led – evaluation established by researchers (9). Category of intervention, type of participant, intervention aims, natural environment setting and location were collected for all the interventions.

Health interventions and evaluations in natural environments

- Despite the complex relationship between individuals, natural environments and health being illustrated in many studies, there was limited use of methods and evaluation approaches adequate in design or application to address this complexity.
- Broad aims of interventions do not 'lend themselves' to current evaluation methods and approaches.
- Most evaluations were non-experimental in design.
- There was limited evidence of longitudinal approaches in data collection being used.
- Process evaluation documents and analyses the development and implementation of an intervention, highlighting what worked well and what did not. More process evaluations would increase the utility of the findings for the development and success of future interventions.

Measurement tools and research approaches

- A variety of quantitative and qualitative approaches were used. Some mixed methods were applied but the way in which the use of these approaches provided a truly mixed approach was questioned. If effectively used, mixed methods may overcome the methodological limitations of quantitative and qualitative approaches used alone. More rigorous approaches to quantitative evaluation techniques than qualitative approaches were found.
- In terms of quality and transparency, the content of evaluation reporting means that the ability to identify the application of robust techniques is often limited (particularly in qualitative studies).
- Validated health measures were used by two fifths of the evaluations. Validated physical activity measures were less commonly used.
- A lack of economic appraisal within evaluations and overall was identified.
- Key strengths and weaknesses of current methods and approaches are suggested. They illustrate key methodological problems and challenges evaluators of health and natural environment interventions face. These include: scale; generalisability; specific aims; demonstrating cause and effect; ensuring confidence in findings/evidence base.
- Intervention design should be appropriate for the delivery of the intended outcomes and the evaluation should examine whether the intervention is delivering these outcomes. Aims and objectives of both interventions and evaluations should be clearly stated and explained.
- It was recognised that all evaluations will have limitations (such as time, money, researcher expertise and capacity) but there were ways identified in which research approaches used in future evaluations could be improved.

Conclusions and Recommendations

The conclusions and recommendations highlight the ways that evaluation approaches and methods can be strengthened. The authors suggest these aspects are those that policy makers and funders should consider when commissioning or undertaking an evaluation:

- Clear and specific evaluation aims which match the overall objectives of the interventions.
- Use of robust and appropriate methods and approaches that, where possible, draw on evidence from previous evaluations to produce a strong evidence base.
- Evaluations which consider long-term impacts using a longitudinal approach to evaluation.
- Use of mixed-methods which are iterative in process, evaluation and analysis.
- Clear description of the way in which data are to be analysed so that the quality and transparency of data can be examined.
- Validity, representativeness and the generalisability of findings should be considered.
- Use of validated health and physical activity measures.
- Greater consideration given to the inclusion of economic evaluation methods and approaches.
- Training and development, provided by funders, to support those undertaking evaluations of interventions to learn from best practice and evidence, and develop evaluations as a result.

- Intention to widely disseminate findings and results so that the evidence base can be further developed.

1 Introduction

1.1 Background

This review has been commissioned by Forestry Commission GB and Forestry Commission Scotland and has been carried out by Aileen Marshall-Brown and Lucy Johnston, researchers contracted by the Centre for Rural Health at the University of Highlands and Islands (UHI). Dr Margaret Currie and Dr Sarah-Anne Muñoz of the Centre for Rural Health, UHI, assisted and advised the reviewers.

The Centre for Rural Health at UHI led a UK wide initiative, the "Outdoors and Health Network" (OHN)[1]. The Economic and Social Research Council and Medical Research Council funded the development of this network for one year in 2009/10. The objectives were to bring together an interdisciplinary group of researchers to create new understanding through networking activities and to carry out project work focused on the longitudinal surveys and qualitative methods that can be used to explore the relationship between nature and health.

An emergent finding from across the work streams of the OHN was an identified gap in the critical review of UK methodologies and research approaches taken in evaluating health related interventions in natural environments.

In the last ten years a series of reviews have looked at the evidence of the links between greenspace and health (e.g. Morris, 2003; Croucher, Myers and Bretheron, 2007; Newton, 2007; Bell *et al.*, 2008; and Sustainable Development Commission (SDC), 2008).

This review is differentiated from these works as its primary purpose is to examine research methods and approaches used to evaluate publically funded interventions and consider ways in which they can be strengthened. Whilst the links between health and natural environments have been well documented, the most effective ways in which environments can be best utilised to improve health remains largely elusive. Health interventions in the outdoors are growing in number across the UK. Evaluations of these should be viewed as practical and tangible ways in which both the links and benefits of health promoting activities in natural environments can be demonstrated. It is the results of these evaluations that are currently informing policy makers as to the effectiveness of programmes and interventions that aim to improve the health of populations, communities and individuals.

By scrutinising intervention evaluations, the way in which the natural environment can be utilised for health improvement and promotion will be clearer. More importantly for this review – the knowledge base will become more transparent and its current limitations and potential better understood. In the absence of scrutiny of the methods and analysis that underpin the evidence, the knowledge base will remain problematic, under-developed and under exploited.

1.2 Aim

The project aimed to review the research methods and approaches used to evaluate UK based health interventions and programmes that are in, use or seek to change the natural environment.

[1] http://www.outdoorshealthnetwork.co.uk

1.3 Anticipated audience

This report will be of use to:

- NHS Health Scotland in relation to its national strategic priority to "provide accurate and evidence based advice"
- The Green Exercise Partnership as it pursues its objective "to explore approaches to improve the evidence base and ways to use it to inform policy and practice on the ground"
- Forestry Commission and other providers of natural environments as they seek to maximise cost effectively the health benefits of their land and open spaces.
- Public agencies that commission health interventions in the outdoors aiming to improve the health of their communities via proven interventions that offer best value for money.
- Those providing support for organisations carrying out evaluations, such as NHS Health Scotland and Evaluation Support Scotland which aims to provide specialist support to voluntary organisations and funders to enable them to evaluate and learn and so provide better services for communities
- Researchers and academics seeking to strengthen and develop approaches to investigating health and the outdoors.

1.4 Research Questions

The review was framed around the primary question "what measurement tools and research approaches are used in the evaluations of health interventions based in natural environments?" In answering this question, the review sought to examine and illustrate how current evaluation methods and approaches can be strengthened.

The review posed five key questions. These were:

1. *How clear is the rationale for the choice of research methods/approaches used?*
2. *How generalisable and transferable are the evaluation findings?*
3. *To what extent does the evaluation link the health outcomes of the intervention with the environment in which the activities took place?*
4. *Have the evaluators reflected on the impact of the chosen methods/tools on the results of the evaluation?*
5. *What are the strengths and weaknesses of current research approaches to the evaluation of health interventions in natural environment settings?*

The review questions were based on a knowledge-gap identified by the OHN and were formed in consultation with Forestry Commission and peer-advisors.

2 Methods

2.1 Search strategy

A search strategy was developed based on systematic review methods. A review was undertaken covering a broad range of peer-reviewed and grey literature that was framed to be manageable within the time and resource allocation for the search. A database of interventions developed by the OHN (Marshall, 2010) formed the basis of the search and a further ten literature reviews, several databases and websites were also searched for relevant studies[2].

Studies were first scanned by author, title and year of publication and abstract. The shortlisted studies were tested against the inclusion criteria and duplications were removed. The research team each tested a selection against the criteria as a test of bias. Studies with contradictory results from this test were discussed at length and a final inclusion decision made.

2.2 Inclusion criteria

The inclusion criteria were strictly applied to include only studies that would directly assist researchers to answer the research question. The criteria used were as follows:

1) *The intervention is UK based and has been evaluated.*
2) *The evaluation was published between 2000 and 2010. (Interventions with unfinished evaluations will be included only if interim evaluation reports are available).*
3) *The intervention has as a stated aim health[3] and/or well-being improvement or promotion.*
4) *The intervention must be in, use or seek to change/improve the natural environment[4] to meet criteria 3.*

A number of evaluation reports that covered the same type of intervention were excluded, as a result off time constraints. This is particularly true of evaluations of health walks. However the screening and selection process ensured that interventions explicitly meeting the natural environment criteria are included in this review. Pedometer-based walking programmes were not included because none of the studies encountered referred explicitly to the environment in which the participant was walking. The evaluation was therefore assumed not to take into consideration the effect of the environment on the health of the participant, just the impact of any increase in physical activity.

Similarly active travel, cycling and walking to school or to work interventions were excluded due to a lack of definition of the outdoor environment in which the activity occurred. Most often these interventions occurred in urban environments and the natural environment was not mentioned in the reports. Moreover a recent review (Stead *et al.*, 2010) had been published that looked specifically at the evidence for these community based interventions.

[2] See Appendix A

[3] A wide definition of health is assumed: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." (World Health Organization, 1948)

[4] Natural environments are defined as places outside that, to some extent are natural, or contain nature. This includes wildernesses, but also includes 'semi-natural' or man-made environments, from urban greenspaces, public parks and private gardens to agricultural and wilderness environments.

Interventions which took place in or aimed to change the built environment were not included unless natural elements of the environment played a significant role in the project. Interventions that were evaluated to determine health or wellbeing impacts of an intervention not aiming to improve or promote health were excluded e.g. John Muir Award and Forest Schools. Due to the time constraints only publicly available evaluation reports were included.

2.3 Data extraction

Data from each of the included reports was extracted into a template devised specifically around the key questions[5]. The research team carried out cross-checks to ensure that data were extracted in a consistent way according to the protocols code-lists and template.

3 Search results

A total of 40 evaluations[6] of health interventions in natural environments were found to meet the predetermined inclusion criteria for this review.

Table 1: Source of evaluations included in the review

Source	
1. OHN database	21
2. Reviews	8
3. Databases	4
4. Websites	7
Total	*40*

3.1 Outdoors and Health Network database

The database developed for the OHN (Marshall, 2010) contained 122 records of UK-based health promotion and environmental interventions. OHN's academic and public sector members contributed to the development of Marshall's mapping study, giving it an up-to-date, wide geographic and thematic spread. Interventions were reassessed using the inclusion criteria set for this review. Of the 122 interventions, 56 had evaluation reports and 42 of these were shortlisted for further review. Twenty-one evaluations from this database are included in this review.

3.2 Review of existing literature reviews

The reference lists of ten literature reviews were examined to identify studies meeting the inclusion criteria. The reviews covered over 1140 references, the majority directly related to the links between health and the natural environment.

The following studies were reviewed: Bell *et al.*, (2008); Bowler, *et al.* (2009); Croucher, Myers and Bretheron (2007); Davies and Deaville (2008); Morris (2003); Newton (2007) Ogilvie, *et al.* (2007); Stead, *et al.* (2010); SDC (2008), and Velarde, Fry and Tveit (2007). As a body of evidence these ten reports reviewed reports from different disciplines (health, social science, environmental science,

[5] See Appendix A

[6] For some evaluations we found more than one report e.g. the official report and papers published in academic journals. We counted these as one entry if they are presenting the data from the same intervention/programme.

landscape and planning), different UK and non-UK areas, various document types (peer-reviewed journal articles and grey literature) and there were descriptive studies, observational or cross-sectional studies, strategy and policy papers or reviews of other research. The literature reviews examined have not included evaluations of interventions in great numbers. This is in part due to the fact that some do not meet the set quality related inclusion criteria (Stead et al, 2010).

Fifty seven studies were shortlisted for inclusion from the studies. The results were checked for duplicates and compared with the OHN results. Fourteen reports met the criteria but as six were duplicates of the OHN only eight additional studies were included.

Table 2: Breakdown of short-listed studies from existing literature reviews

Study	No. studies examined	No. shortlisted	No. non-UK
Bell et al (2008)	46	3	31
Bowler et al (2009)	59	5	36
Croucher, Myers, and Bretheron (2007)	86	5	34
Davies & Deaville (2008)	87	9	41
Morris (2003)	148	2	81
Newton (2007)	196	9	94
Ogilvie et al (2007)	48	0	23
Stead et al (2010)	170	19	60
SDC (2008)	228	4	26
Velarde, Fry and Tveit (2007)	72	1	61
Total	*1140*	*57*	*487*

3.3 Databases

A range of databases were searched to ensure an unbiased, comprehensive and up-to-date sample of evaluation studies was found. The following databases were searched: PubMed; OVID (includes Cochrane Library, CAB abstracts, EMBASE, MEDLINE, DARE); EBSCO (including CINAHL, PsycINFO, Greenfile, and IBSS); SCOPUS; TRoPHI; National Research Register Archive, and the Environmental Evidence library.

Table 3: Breakdown of short-listed studies from database searches

Database	No. records viewed	No. shortlisted	No. included
PUBMED	3134	61	4
OVID	1631	32	1
SCOPUS	3696	40	4
EBSCO	2494	6	1
Total	*10995*	*139*	*10*

No studies were found to meet the criteria in the TRoPHI, National Research Register Archive or the Environmental Evidence library. Once duplication of the ten studies was cross-checked with the previous searches, only four new studies were added to the database.

3.4 Websites

Websites of relevant organisations were searched for evaluation reports. The primary focus of this search was to boost the number of Scottish interventions in the sample. The following websites were selected to be searched based on Marshall (2010) and Stead, *et al.* (2010):

- *British Heart Foundation*
- *Central Scotland Forest Trust*
- *Countryside Council for Wales*
- *Countryside Recreation Network*
- *Forest Research*
- *Forestry Commission*
- *Glasgow Centre for Public Health*
- *Greenspace Scotland*
- *John Muir Trust*
- *National Trust for Scotland*
- *Natural England*
- *NHS Health Scotland*
- *OPENspace*
- *Paths for All*
- *Physical Activity and Health Alliance*
- *Scotland and Northern Ireland Forum For Environmental Research (SNIFFER)*
- *Scottish Allotments and Gardens Association (SAGS)*
- *Scottish Centre for Healthy Working Lives*
- *Scottish Natural Heritage*
- *Scottish Physical Activity Research Collaboration (SPARColl)*
- *Sustainable Development Research Network (SDRN)*
- *Sustrans*
- *The Scottish Government*
- *The Woodland Trust*
- *University of Essex*
- *Venture Scotland*
- *Youth Scotland*

A limited number of internet searches were undertaken using the Google search engine. The first three pages of results were consulted for each search. In total from all the website searches and the Google searches 69 studies were shortlisted. After cross-checking and removal of duplicates only seven additional reports meeting the inclusion criteria were added to the database.

3.5 Contacts

OHN members were approached to provide unpublished materials or to suggest interventions that might meet the inclusion criteria. Nothing was suggested that had not already been included.

4 Health interventions in natural environments

4.1 Contributing to the evidence through scrutiny of UK intervention evaluations

This review only includes UK based evaluations as they will be of most relevance to the development and strengthening of methods and resulting knowledge-base.

Six of the studies looked at projects situated around the entire of the United Kingdom. In studies such as Barton and Pretty (2010) or Pretty *et al.* (2005) a number of projects were examined as case studies in areas around the UK (including Northern Ireland). Other evaluations such as Yerrell (2008) looked at interventions that had a UK-wide coverage such as the BTCV Green Gym.

Twenty seven studies were based in England, mostly in a regional or local setting. Five of the studies were England-wide. Three evaluations took place in Wales, two nationally and one at a local level.

Five of the studies were Scotland-based with one nationwide study and four regionally focused evaluations. The Scottish studies included two path network evaluations, the evaluation of a forestry

and mental health project in Glasgow and a research-led walking intervention in the Central Belt. See ***Table 6*** for more details of where the forty interventions were set around the UK.

4.2 Type of intervention

The researchers assigned each intervention a 'Type'. Mostly an indication of scale the type also reflects the overall rationale for the intervention. Projects in the data extraction fell naturally into one of these three categories (see ***Table 4***).

Table 4: Type of intervention categories

Multi-project intervention	Evaluation considers large multi-project schemes either: • Each sub-project has the same aim but different activities in different locations e.g. Mentro Allan • Each sub-project has the same intervention held in different locations e.g. Walking for Health	13
Site-specific intervention	Evaluation considers only one project either: • that is part of a bigger overall programme e.g. individual Walking for Health schemes • or is a one-off project not part of a bigger programme • or is a demonstration /pilot project and a pre-cursor to larger scale roll-out e.g. Green Exercise	18
Research-led intervention	Evaluation considers an intervention trial set up by researchers to investigate the effects of an intervention on the health of the participants	9

Multi-project interventions

There are thirteen multi-project interventions in the review. The evaluation studies included in this group evaluated interventions over several sites across varying geographic areas. They are comparing the effectiveness of different sub-projects or evaluating the effectiveness of the scheme as a whole and the impact on the participants. Some also aimed to develop and test evaluation methodologies.

The interventions fall into two main groups. Firstly, there are projects which have a common aim but have implemented several different projects. An example of this is the Mentro Allan project, which aims to increase the physical activity levels of less active groups in Wales and has implemented 15 projects around Wales all providing different activities and engaging different groups.

The second group of interventions in this category are on-going schemes that facilitate the same intervention in different geographic areas. Examples include the Walking for Health Initiative (WHI, formerly known as the Waking the Way to Health Initiative), the BTCV Green Gym scheme and Paths for All's provision of local path networks.

Site-specific projects

The evaluations of 18 site-specific projects have been reviewed. These include one-off or independent projects such as the Wye Wood project (Howie, Aldridge and Parrott, 2007), that aren't part of a wider scheme. Also included in this group are evaluation studies

focusing on one local sub-project of a wider scheme e.g. Reynolds' (2002) evaluation of the BTCV Green Gym at Portslade and evaluations of individual pilot or demonstration projects whether they are independent or part of a wider initiative e.g. the Natural England Green Exercise demonstration projects. Most of these interventions had a strong community engagement element with the main purpose being to make a difference to the health and wellbeing of the community members and disadvantaged groups at grass roots level.

Researcher-led interventions

Many of the interventions in the previous two categories have been evaluated by academic or independent researchers. The interventions categorised as researcher-led interventions differ from the other two categories as, in this case, the researcher has instigated the intervention in order to study the interaction between the intervention and its participants' health in to test a hypothesis. For the other two categories, the intervention has taken place as a practical on-the-ground project aimed at improving health and researchers have evaluated the impact and success of these activities. Nine studies included in this review are categorised as researcher-led e.g. Roe and Aspinall (2011) compared two mental health groups in urban and rural walking settings.

4.3 Interventions covered by the review

Three quarters of the evaluations included in this review were not peer-reviewed, although some may be published this way in the future. Mostly they were primary research studies published by the intervention lead organisation or funder. Twelve studies were printed in peer-reviewed academic journals, the majority of which from research-led interventions. None of the multi-project interventions had peer reviewed evaluations. Four of the site specific projects had peer-reviewed publications associated with their evaluation. Primarily these were written in addition to an official publication by the intervention lead or funder.

As many of the studies reviewed were small scale their validity and representativeness should be scrutinised (Velarde, Fry and Tveit, 2007) and a number of authors would question the extent to which findings from such small studies can be generalised to wider communities or populations (Croucher, Myers and Bretheron, 2007; Bell, *et al.* 2008; Bowler, *et al.* 2009).

Group walks and health walking are the most common category for evaluated interventions found, with the aim to increase physical activity and improve health and social interaction. Horticultural interventions and nature conservation activities are also common, especially paired with 'Green Gym' style practical activities. The most common groups targeted by the evaluated interventions were people with mental health problems, young people, local communities, sedentary and older people, and those living in areas of deprivation. See ***Table 5*** for detailed breakdown of the activities and target audience for each of the 40 interventions included in this review.

The interventions took place around the UK in a variety of natural environment settings including woodlands and local greenspaces. Generally speaking there was a lack of specificity in the description of the natural environment setting used in the interventions, for example several simply referred to 'the outdoors'. ***Table 6*** shows the environment settings and locations for the reviewed interventions.

Table 5: Intervention activities and target audience

		INTERVENTION ACTIVITIES																			TARGET GROUP																								
		Walking and led/group walking	Green Exercise	GP Referral Scheme	Sport and Physical activity	Cycling	Jogging/Running	Horse riding	Sailing/Canoeing	Horticulture and gardening	Conservation volunteering	Forestry skills & bushcraft	Arts and Crafts	Outdoor education & play	Outdoor activities	Adventure & wilderness	Relaxation techniques	Path networks & facilities	Info & intepretation		Population	Local community	Adults	Children and young people	Older people	Families	Women and girls	Black, minority and ethnic groups	Low income/disadvantaged	Isolated and vulnerable	Live in areas of poor health	Care givers	People with disabilities	People with learning difficulties	People with mental health issues	People at risk of heart disease	Physically inactive/sedentary	Obese and overweight people	Various
Multi-project interventions	CARNEGIE RESEARCH INSTITUTE, 2007.	●		●																														●								
	DAWSON, et at. 2006.	●																				●						●	●	●												
	DOUST and TOD, 2007.	●																																●								
	HALL AITKEN, 2009.				●																			●	●		●	●	●				●										
	HECLA CONSULTING, 2007.																	●				●																					
	INTERFACE NRM LTD, 2004.	●										●						●	●																							●	
	MATTINGLEY, 2006.	●			●	●		●	●	●	●														●		●	●		●	●	●	●									
	O'BRIEN and MORRIS, 2009.	●				●					●				●			●	●					●	●		●	●	●			●										
	REYNOLDS, 2005.	●																				●																					
	SEMPIK, ALDRIDGE, and BECKER, 2005.									●																		●														
	SPORT INDUSTRY RESEARCH CENTRE, 2007.																	●			●																					
	YERRELL, 2008.									●	●										●																					
	YERRELL, 2009.									●	●													●								●				●						
	No. multi-project interventions per category	**7**		**1**	**2**	**2**		**1**	**1**	**4**	**4**		**1**		**1**			**4**	**2**		**2**	**3**		**3**	**3**		**3**	**3**	**4**	**3**	**1**	**1**	**3**	**1**	**2**		**2**	**1**	**1**	
Site-specific interventions	A WORD IN EDGEWAYS, 2010.	●	●							●	●															●	●						●	●		●					
	ASHLEY, et al. 2000.	●																				●																			
	FARRELL and PRICE, 2010.	●		●							●											●														●	●	●	●		
	FIELDHOUSE, 2003.									●																										●						
	HIGGINS, NICOL and CHRISTIE, 2010.				●								●											●				●										●			
	HOWIE, ALDRIDGE and PARROTT, 2007.	●			●							●	●	●										●	●	●	●									●					
	MCGEENEY, 2004.	●	●										●	●																						●					
	MILTON, KELLY and FOSTER, 2009.	●																								●														
	OWEN, 2007.	●				●																						●		●										
	PEACOCK, HINE and PRETTY, 2007.	●																●				●																			
	PEACOCK, HINE and PRETTY, 2008.													●	●									●				●													
	PEACOCK, et al. 2005.	●				●	●				●							●				●																			
	REYNOLDS, 2002.									●	●											●																			
	SNOWDON, 2006.	●		●									●	●						●		●	●	●													●				
	SPORT INDUSTRY RESEARCH CENTRE, 2010.			●		●																	●																	
	SPORT INDUSTRY RESEARCH CENTRE, 2010a.	●																						●																	
	SPORT INDUSTRY RESEARCH CENTRE, 2010b.	●								●	●				●	●								●	●			●		●						●					
	WILSON, 2009.		●								●	●	●				●																				●					
	No. site-specific interventions per category	**12**	**3**	**3**	**2**	**3**	**1**			**4**	**6**	**2**	**3**	**4**	**3**	**2**	**1**	**2**	**1**			**6**	**2**	**6**	**2**	**2**	**2**	**1**	**3**	**1**	**2**					**7**	**1**	**4**	**1**	
Research-led interventions	BARTON and PRETTY, 2010.	●	●			●		●	●	●																															●
	ISAACS, et al. 2007.	●		●																●			●																		
	LAMB, et al. 2002.	●		●																●			●																		
	MILLIGAN and BINGLEY, 2007.	●									●	●	●											●																	
	MILLIGAN, GATRELL and BINGLEY, 2004.									●															●																
	O'BRIEN, TOWNSEND and EBDEN, 2010.										●												●																		
	PEACOCK, HINE and PRETTY, 2007a.	●	●							●	●	●																													
	PRETTY, et al. 2005.		●																																					●
	ROE and ASPINALL, 2011.	●																																						
	No. research-led intervention per category	**6**	**3**	**2**		**1**		**1**	**1**	**3**	**2**	**2**	**1**	**1**					**2**				**3**	**1**	**1**															**2**
Total	**No. interventions per category**	**25**	**6**	**6**	**4**	**6**	**1**	**2**	**2**	**11**	**12**	**4**	**5**	**5**	**4**	**2**	**1**	**6**	**5**		**2**	**9**	**5**	**10**	**6**	**2**	**5**	**4**	**7**	**4**	**3**	**1**	**3**	**1**	**13**	**1**	**6**	**2**	**3**
	% interventions per category	**63%**	**15%**	**15%**	**10%**	**15%**	**3%**	**5%**	**5%**	**28%**	**30%**	**10%**	**13%**	**13%**	**10%**	**5%**	**3%**	**15%**	**13%**		**5%**	**23%**	**13%**	**25%**	**15%**	**5%**	**13%**	**10%**	**18%**	**10%**	**8%**	**3%**	**8%**	**3%**	**33%**	**3%**	**15%**	**5%**	**8%**

Table 6: Intervention environment setting and location

		ENVIRONMENT SETTING															LOCATION																	
		Various	Woodlands and forests	Outdoors - unspecified	Local greenspace	Allotments/community gardens	Coastal and marine environment	Path networks	Parks and gardens	Urban areas	Rural areas	School grounds	Open space	Wilderness	Inland waterways		UK	**England**	England-North East	England-North West	England-Yorkshire and Humber	England-East Midlands	England-West Midlands	England-East England	England-London	England-South East	**Scotland**	Scotland-South	Scotland-Central	Scotland-Glasgow	Scotland-Highlands	**Wales**
Multi-project interventions	CARNEGIE RESEARCH INSTITUTE, 2007.	●																●															
	DAWSON, et at. 2006.			●													●																
	DOUST and TOD, 2007.	●																															●
	HALL AITKEN, 2009.			●														●															
	HECLA CONSULTING, 2007.							●																			●				❖		
	INTERFACE NRM LTD, 2004.		●															●				❖											
	MATTINGLEY, 2006.	●																															●
	O'BRIEN and MORRIS, 2009.		●															●															
	REYNOLDS, 2005.	●															●																
	SEMPIK, ALDRIDGE, and BECKER, 2005.	●				●											●																
	SPORT INDUSTRY RESEARCH CENTRE, 2007.							●																			●						
	YERRELL, 2008.			●													●																
	YERRELL, 2009.											●	●					●																
	No. multi-project interventions per category	**5**	**2**	**3**		**1**		**2**				**1**	**1**				**4**	**5**				**1**					**2**				**1**	**2**	
Site-specific interventions	A WORD IN EDGEWAYS, 2010.				●	●			●									●							❖								
	ASHLEY, et al. 2000.			●						●								●							❖								
	FARRELL and PRICE, 2010.						●											●				❖											
	FIELDHOUSE, 2003.					●												●						❖									
	HIGGINS, NICOL and CHRISTIE, 2010.				●													●	❖														
	HOWIE, ALDRIDGE and PARROTT, 2007.		●															●								❖							
	MCGEENEY, 2004.		●															●						❖									
	MILTON, KELLY and FOSTER, 2009.	●																●		❖													
	OWEN, 2007.	●																															●
	PEACOCK, HINE and PRETTY, 2007.						●											●	❖														
	PEACOCK, HINE and PRETTY, 2008.						●							●				●						❖									
	PEACOCK, et al. 2005.							●										●						❖									
	REYNOLDS, 2002.			●														●							❖								
	SNOWDON, 2006.		●															●	❖														
	SPORT INDUSTRY RESEARCH CENTRE, 2010.				●				●									●		❖													
	SPORT INDUSTRY RESEARCH CENTRE, 2010a.				●													●			❖												
	SPORT INDUSTRY RESEARCH CENTRE, 2010b.				●										●			●				❖											
	WILSON, 2009.		●																								●			❖			
	No. site-specific interventions per category	**2**	**4**	**2**	**5**	**2**	**3**	**1**	**2**	**1**				**1**	**1**			**16**	**3**	**2**	**1**	**1**	**1**	**1**	**3**	**3**	**1**	**1**			**1**		**1**
Research-led interventions	BARTON and PRETTY, 2010.	●															●																
	ISAACS, et al. 2007.			●														●							❖								
	LAMB, et al. 2002.				●													●								❖							
	MILLIGAN and BINGLEY, 2007.		●															●		❖													
	MILLIGAN, GATRELL and BINGLEY, 2004. `					●			●									●		❖													
	O'BRIEN, TOWNSEND and EBDEN, 2010.	●																●	❖	❖							●	❖					
	PEACOCK, HINE and PRETTY, 2007a.	●																●															
	PRETTY, et al. 2005.	●															●																
	ROE and ASPINALL, 2011.									●	●																●		❖				
	No. research-led intervention per category	**4**	**1**	**1**	**1**	**1**			**1**	**1**	**1**						**2**	**6**	**1**	**3**					**1**	**1**		**2**	**1**	**1**			
Total	**No. interventions per category**	**11**	**7**	**6**	**6**	**4**	**3**	**3**	**3**	**2**	**1**	**1**	**1**	**1**	**1**		**6**	**27**	**4**	**5**	**1**	**1**	**2**	**1**	**4**	**4**	**1**	**5**	**1**	**1**	**1**	**1**	**3**
	% interventions per category	**28%**	**18%**	**15%**	**15%**	**10%**	**8%**	**8%**	**8%**	**5%**	**3%**	**3%**	**3%**	**3%**	**3%**		**15%**	**68%**	**10%**	**13%**	**3%**	**3%**	**5%**	**3%**	**10%**	**10%**	**3%**	**13%**	**3%**	**3%**	**3%**	**3%**	**8%**

5 Measurement tools and research approaches used in the evaluation of health interventions in natural environments

The primary research question is "What measurement tools and research approaches are used in the evaluation of health interventions based in natural environments". Relevant information to answer this question was extracted from the forty evaluations included in the review. Data were collected on the type of evaluation that was carried out, the research methods and design, and types of data collected. ***Table 7*** shows the evaluation design and type for each of the forty reports reviewed.

5.1 Evaluation design

Thirty two of the forty evaluations were non-experimental in design. This means they did not assign a control group as a comparator with the participants.

Milton, Kelly and Foster (2009) assigned a control group in their study by using a group of adults who were existing users of Action for Children Centres in nearby towns. They wanted to determine whether the demographics and baseline physical activity levels of the participants were similar to what might be observed in other similar locations. It also gave more confidence that any behaviour change could be attributed to the programme and not to other factors. Neither group was randomly assigned.

Barton and Pretty (2010) carried out a standardized meta-analysis to overcome validity issues with their purposive sampling of case studies. The selection was based on the cases having identically comparable data.

An evaluation to determine the effectiveness of the Thames Valley Health Walks (Ashley and Bartlett, 2001) was non-random and had no control as its aim was to determine the benefits to users. It was however paired with a randomised controlled trial (RCT) studying the effect of the health walks (Lamb, *et al.* 2000).

The only other evaluation using a RCT design was the EXERT project evaluated by Isaacs, *et al.* (2007). They carried out an evaluation comparing a GP referral for leisure centre-based exercise with community-based walking and advice only. Participants were randomly assigned to one of the three arms. Follow-up questionnaires and health checks assessed the effectiveness of each approach.

5.2 Type of evaluation

The research-led studies all undertook impact or outcome evaluations. It would be more unusual for academic researchers to look primarily at the process. However, the multi-project and site-specific interventions were also lacking in process evaluation. A small number had formative evaluation e.g. Milton, Kelly and Foster (2009), so were designed to continually assess the effectiveness of the intervention and to provide feedback to inform future development of the activities and evaluation. However on the whole, the evaluations were looking at the impact the programmes had on the participants or testing if the interventions had achieved outcomes to match their aims. Process evaluation was underused in the evaluations although it did appear as a secondary evaluation type

for a small number of the impact evaluations. Impact evaluation asks 'did it work?' whereas a process evaluation would ask 'how did it work?' Within most studies much less attention was given to analysing this latter question. Evidence of this would increase the utility of the findings in further development of the natural environment as a beneficial site for health interventions. Process evaluations are of significant importance to the strengthening of the evidence base for health interventions in the outdoors.

Table 7: Design and types of evaluations of interventions reviewed

		TYPE OF REPORT			EVALUATION LEAD				EVALUATION DESIGN					EVALUATION TYPE					
		Peer reviewed	Primary research - not peer reviewed		University	Public sector/NDPB	Consultancy		Non-experimental	Quasi-experimental	Experimental - RCT	Meta-analysis		Impact	Outcome	Process	Formative	Economic analysis
Multi-project interventions	CARNEGIE RESEARCH INSTITUTE, 2007.		●		●				●						●			●
	DAWSON, et at. 2006.		●		●				●						●			
	DOUST and TOD, 2007.		●		●				●					●		●		
	HALL AITKEN, 2009.		●				●		●						●			
	HECLA CONSULTING, 2007.		●				●		●					●				●
	INTERFACE NRM LTD, 2004.		●				●		●						●	●		
	MATTINGLEY, 2006.		●			●			●					●		●		
	O'BRIEN and MORRIS, 2009.		●			●				●					●		●	
	REYNOLDS, 2005.		●		●				●					●				
	SEMPIK, ALDRIDGE, and BECKER, 2005.		●		●				●					●				
	SPORT INDUSTRY RESEARCH CENTRE, 2007.		●		●				●					●				●
	YERRELL, 2008.		●		●				●						●			
	YERRELL, 2009.		●		●				●					●				
	No. multi-project interventions per category	**0**	**13**		**8**	**2**	**3**		**11**	**1**				**7**	**6**	**3**	**1**	**3**
Site-specific interventions	A WORD IN EDGEWAYS, 2010.		●				●		●							●	●	
	ASHLEY, et al. 2000.	●			●				●						●			
	FARRELL and PRICE, 2010.		●		●				●					●		●		
	FIELDHOUSE, 2003.	●			●				●					●		●		
	HIGGINS, NICOL and CHRISTIE, 2010.		●		●				●					●		●		
	HOWIE, ALDRIDGE and PARROTT, 2007.		●				●		●						●	●		
	MCGEENEY, 2004.		●			●			●					●		●		
	MILTON, KELLY and FOSTER, 2009.		●		●					●				●			●	
	OWEN, 2007.		●			●			●					●				
	PEACOCK, HINE and PRETTY, 2007.		●		●				●					●				
	PEACOCK, HINE and PRETTY, 2008.		●		●				●						●	●		
	PEACOCK, et al. 2005.	●	●		●				●						●			
	REYNOLDS, 2002.		●		●				●					●				
	SNOWDON, 2006.	●	●			●			●					●			●	
	SPORT INDUSTRY RESEARCH CENTRE, 2010.		●		●				●					●		●		
	SPORT INDUSTRY RESEARCH CENTRE, 2010a.		●		●				●					●				
	SPORT INDUSTRY RESEARCH CENTRE, 2010b.		●		●				●					●		●		
	WILSON, 2009.		●			●			●						●			
	No. site-specific interventions per category	**4**	**16**		**12**	**4**	**2**		**17**	**1**				**12**	**5**	**9**	**3**	**0**
Research-led interventions	BARTON and PRETTY, 2010.	●			●							●		●				
	ISAACS, et al. 2007.	●			●						●			●				●
	LAMB, et al. 2002.	●			●						●				●			
	MILLIGAN and BINGLEY, 2007.	●			●				●					●				
	MILLIGAN, GATRELL and BINGLEY, 2004.	●			●				●					●				
	O'BRIEN, TOWNSEND and EBDEN, 2010.	●				●			●					●		●		
	PEACOCK, HINE and PRETTY, 2007a.		●		●					●				●				
	PRETTY, et al. 2005.	●			●				●						●			
	ROE and ASPINALL, 2011.	●			●					●				●				
	No. research-led intervention per category	**8**	**1**		**8**	**1**			**4**	**2**	**2**	**1**		**7**	**2**	**1**		**1**
Total	**No. interventions per category**	**12**	**30**		**28**	**7**	**5**		**32**	**4**	**2**	**1**		**26**	**13**	**13**	**4**	**4**
	% interventions per category	**30%**	**75%**		**70%**	**18%**	**13%**		**80%**	**10%**	**5%**	**3%**		**65%**	**33%**	**33%**	**10%**	**10%**

5.3 Longitudinal and follow-up evaluations

Twenty six of the evaluations included the collection of some sort of before and after data, mostly through the use of self-completed questionnaires asking if activity levels or health had changed as a result of participation. Most studies did a post-intervention follow up or during intervention follow-up but scarcely did any follow-up any later than 12 months after the baseline. This was probably due to funding reasons and other difficulties of long term follow-up. A number of studies kept the follow-up period relatively soon after the initial baseline data collection so that they could follow-up with the same cohort without fear of too high a level of attrition. This limits the ability of the evaluation to track long term impacts on health and activity levels. Difficulties with low number of follow-ups being completed or incomplete submissions reduced the viability of comparing results with the baseline and monitoring behaviour change (Bull, Giles-Corti and Wood, 2010). Some studies used continual monitoring such as diaries or regular check-ups to gather longitudinal data from participants e.g. Doust and Tod (2005); Reynolds (2005); Isaacs, *et al.* (2007).

A number of studies gathered baseline data from participants as they registered to take part in the intervention, whilst some used a baseline profile gathered using other sources of data. Several gathered data during or after the intervention asking the participants to give baseline data retrospectively e.g. “Are you doing more exercise than you were before you started the programme?” This relies on accurate recollection from the subject which can be prone to under or over estimation.

Several of the evaluation reports recommended that their work would be strengthened through the use of a longitudinal approach/methods e.g. Peacock, Hine and Pretty (2008); O’Brien and Morris (2009); Wilson (2009); Barton and Pretty (2010).

5.4 Research methods

A variety of research methods have been employed by the evaluation teams. Qualitative research was undertaken according to various approaches: participatory action research (Mattingley, 2006; O’Brien and Morris, 2009); ethnography (Milligan, Gatrell and Bingley, 2004); Participatory Monitoring and Evaluation (Interface NRM Ltd, 2004), and art therapy (Milligan and Bingley, 2007).

By far the most commonly used methods were questionnaires, interviews and discussion/focus groups but the approach taken was heterogeneous across the board. The majority of studies included elements of quantitative and qualitative data collection. Some studies took a wholly qualitative approach with the intention of understanding the participants’ experiences and perceptions, whilst others stuck rigorously to quantitative health measurements. Most studies were somewhere in the middle with both quantitative and qualitative methods.

Table 8 sets out the quantitative and qualitative methods used in the reviewed evaluations and demonstrates which of the evaluation used longitudinal approaches.

Table 8: Quantitative and qualitative methods used to evaluate reviewed

		QUANTITATIVE METHODS													QUALITATIVE METHODS														LONGITUDINAL EVALUATION			
		Interviewer-led onsite questionnaires	Telephone, postal and online surveys	Pre and post activity questionnaires	Self-report repeat questionnaires	Validated questionnaires	Structured diaries	Project audit data - visitor numbers	Health/well-being measurements	Physical activity measures	Antropometric measures	Composite questionnaire	Quizdom consultation		Semi-structured interviews	Telephone & face-to-face interviews	Narrative interviews	Informal/exploratory interviews	Case studies	Focus groups	Discussion groups	Stakeholder consultation/interviews	Learning exchange events	Reflective questionnaires/diaries	Observational journals	Participant observations	Video diaries - Big Brother style	Video and photography images	Craft/Art workshops & art therapy	Before and after measures	Follow-up with the same people	During/after activity measures only	Retrospective baseline measures
Multi-project interventions	CARNEGIE RESEARCH INSTITUTE, 2007.			●					●									●											●			
	DAWSON, et at. 2006.		●	●					●																				●			
	DOUST and TOD, 2007.		●		●	●		●	●	●											●								●	●		
	HALL AITKEN, 2009.		●							●								●				●										
	HECLA CONSULTING, 2007.		●							●											●											
	INTERFACE NRM LTD, 2004.		●			●			●						●						●											
	MATTINGLEY, 2006.									●																				●			
	O'BRIEN and MORRIS, 2009.	●						●		●										●										●			
	REYNOLDS, 2005.	●	●		●	●			●	●									●											●	●		
	SEMPIK, ALDRIDGE, and BECKER, 2005.														●	●					●												
	SPORT INDUSTRY RESEARCH CENTRE, 2007.	●							●	●					●	●																●	●
	YERRELL, 2008.			●	●	●				●																				●	●		
	YERRELL, 2009.			●	●	●				●																				●	●		
	No. multi-project interventions per category	**3**	**6**	**3**	**5**	**5**		**2**	**4**	**11**					**3**	**2**			**2**	**1**	**1**	**4**	**1**							**8**	**4**	**1**	**1**
Site-specific interventions	A WORD IN EDGEWAYS, 2010.																●	●				●					●						●
	ASHLEY, et al. 2000.		●															●												●			
	FARRELL and PRICE, 2010.		●													●			●													●	
	FIELDHOUSE, 2003.			●															●					●	●					●	●	●	
	HIGGINS, NICOL and CHRISTIE, 2010.	●		●																	●									●			
	HOWIE, ALDRIDGE and PARROTT, 2007.	●														●		●	●	●												●	●
	MCGEENEY, 2004.																			●					●								●
	MILTON, KELLY and FOSTER, 2009.			●												●			●		●							●		●	●		
	OWEN, 2007.		●	●				●		●								●						●	●					●	●		
	PEACOCK, HINE and PRETTY, 2007.				●				●	●		●											●										
	PEACOCK, HINE and PRETTY, 2008.			●	●	●			●						●								●		●		●			●	●		
	PEACOCK, et al. 2005.								●	●		●											●									●	●
	REYNOLDS, 2002.					●			●	●	●					●														●			
	SNOWDON, 2006.	●	●	●	●										●	●				●										●			
	SPORT INDUSTRY RESEARCH CENTRE, 2010.												●								●					●					●	●
	SPORT INDUSTRY RESEARCH CENTRE, 2010a.												●								●					●				●	●	●
	SPORT INDUSTRY RESEARCH CENTRE, 2010b.												●								●										●	●
	WILSON, 2009.			●		●				●					●					●				●						●			
	No. site-specific interventions per category	**3**	**4**	**7**	**3**	**3**		**1**	**4**	**5**	**1**	**2**	**3**		**3**	**5**	**1**	**4**	**3**	**4**	**3**	**4**		**3**	**3**	**4**	**2**	**2**	**1**	**10**	**4**	**7**	**7**
Research-led interventions	BARTON and PRETTY, 2010.				●	●			●																					●	●		
	ISAACS, et al. 2007.			●	●	●			●	●	●																			●	●		
	LAMB, et al. 2002.		●	●	●	●			●	●	●																			●	●		
	MILLIGAN and BINGLEY, 2007.															●				●									●	●		
	MILLIGAN, GATRELL and BINGLEY, 2004. `						●								●				●				●							●	●		
	O'BRIEN, TOWNSEND and EBDEN, 2010.					●			●			●						●												●			
	PEACOCK, HINE and PRETTY, 2007a.					●			●			●																		●			
	PRETTY, et al. 2005.			●		●			●	●		●																		●			
	ROE and ASPINALL, 2011.	●		●		●			●														●							●			
	No. research-led intervention per category	**1**	**1**	**4**	**3**	**7**	**1**		**7**	**3**	**2**	**3**			**1**	**1**		**1**		**1**	**1**			**2**					**1**	**9**	**5**		
Total	**No. interventions per category**	**7**	**11**	**14**	**11**	**15**	**1**	**3**	**15**	**19**	**3**	**5**	**3**		**7**	**8**	**1**	**5**	**5**	**6**	**5**	**8**	**1**	**5**	**3**	**4**	**2**	**2**	**2**	**27**	**13**	**8**	**8**
	% interventions per category	**18%**	**28%**	**35%**	**28%**	**38%**	**3%**	**8%**	**38%**	**48%**	**8%**	**13%**	**8%**		**18%**	**20%**	**3%**	**13%**	**13%**	**15%**	**13%**	**20%**	**3%**	**13%**	**8%**	**10%**	**5%**	**5%**	**5%**	**68%**	**33%**	**20%**	**20%**

5.5 Validated health and physical activity measures

The review has examined the extent to which validated health measures have been utilised by evaluators to gather objective self-reported health data. SF12v2™ and the Rosenberg Self Esteem scale were the most commonly used questionnaires. Some studies used more than one measure, with most using two or three different questionnaires to address different health aspects. No one measure stood out as being used more frequently and no association can be seen between type of measure used and type of evaluation. Other clinical health measures have also been used including body mass index (BMI), waist-to-hip ratio, VO2Max (lung efficiency), cholesterol levels and blood pressure. These measures are generally used in the more experimental studies e.g. Isaacs, *et al.* (2007).

Non-validated self-reported health data were collected in a number of studies using questionnaires asking participants questions about how they were feeling, if participating had made them feel any different, if they felt any benefit from taking part in the activity, if participation had increased their confidence, stamina, feeling of general health and well-being etc. This data is more prone to over or under-estimation and bias but can give clear information of the perceived health effects of participation.

Wider buy in to the use of validated measurement tools is required to improve evaluations. OHN reviewed validated measurement tools in a pilot study Marshall, *et al.* (2010) with a view to suggesting an ideal question set including questions related to health, well-being and environment.

Few standardised physical activity questions were used in the evaluations Most of the other studies used non-standardised self-reported measures of exercise and fitness. Only one evaluation gathered more objective data using accelerometers.

Table 9 below highlights the studies which have used clinical health measurements, and validated health and/or physical activity measures.

Table 9: Clinical and validated health and physical activity measures used in evaluations

		CLINICAL HEALTH MEASUREMENTS									VALIDATED HEALTH MEASURES																VALIDATED PHYSICAL ACTIVITY MEASURE					
		Body Mass Index - height to weight ratio	Waist to Hip Ratio	Blood pressure and heart rate	Cholesterol	% body fat	Isometric strength - muscle power + strength	Cardiorespiratory fitness: submaximal bike/walk test	Lung function - spirometer test, VO2 max		Short Form 12/36 Version 2	Paediatric Quality of Life Index	EuroQol EQ VAS/EQ 5D	Rosenburg Self Esteem Scale	Profile of Mood States	Nottingham Health Profile	Warwick Edinburgh Mental Health B Scale	Emotional State Scale	Personal Well-being Index	Connectedness to Nature Scale	General Health Questionnaire	Beck Depression Inventory	UWIST Mood Adjective Checklist	5-item Personal Project Scale	Hospital Anxiety and Depression Scale		International Physical Activity Questionniare	Scottish Physical Activity Questionniare	Stanford 5 Cities PA Questionnaire	Single item physical activity measure	Stages of Change Questionnaire	BHF Daily Activities Questionnaire
Multi-project interventions	CARNEGIE RESEARCH INSTITUTE, 2007.																															
	DAWSON, et at. 2006.																															●
	DOUST and TOD, 2007.										●		●														●				●	
	HALL AITKEN, 2009.																															
	HECLA CONSULTING, 2007.																															
	INTERFACE NRM LTD, 2004.										●					●																
	MATTINGLEY, 2006.																															
	O'BRIEN and MORRIS, 2009.																															
	REYNOLDS, 2005.	●		●		●			●		●										●	●			●							●
	SEMPIK, ALDRIDGE, and BECKER, 2005.																															
	SPORT INDUSTRY RESEARCH CENTRE, 2007.																															
	YERRELL, 2008.										●																					
	YERRELL, 2009.											●																				
	No. multi-project interventions per category			**1**		**1**			**1**		**4**	**1**	**1**			**1**					**1**	**1**			**1**		**1**				**1**	**1**
Site-specific interventions	A WORD IN EDGEWAYS, 2010.																															
	ASHLEY, et al. 2000.																															
	FARRELL and PRICE, 2010.																															
	FIELDHOUSE, 2003.																															
	HIGGINS, NICOL and CHRISTIE, 2010.																															
	HOWIE, ALDRIDGE and PARROTT, 2007.												●																			
	MCGEENEY, 2004.																															
	MILTON, KELLY and FOSTER, 2009.																										●			●		
	OWEN, 2007.																															
	PEACOCK, HINE and PRETTY, 2007.												●																			
	PEACOCK, HINE and PRETTY, 2008.													●	●					●												
	PEACOCK, et al. 2005.	●											●	●	●																	
	REYNOLDS, 2002.										●																					
	SNOWDON, 2006.																															
	SPORT INDUSTRY RESEARCH CENTRE, 2010.																															
	SPORT INDUSTRY RESEARCH CENTRE, 2010a.																															
	SPORT INDUSTRY RESEARCH CENTRE, 2010b.																															
	WILSON, 2009.										●						●											●				
	No. site-specific interventions per category	**1**									**2**		**3**	**2**	**2**		**1**			**1**							**1**	**1**		**1**		
Research-led interventions	BARTON and PRETTY, 2010.													●	●																	
	ISAACS, et al. 2007.	●	●	●	●	●	●	●	●		●		●													●						
	LAMB, et al. 2002.	●		●	●			●																					●			
	MILLIGAN and BINGLEY, 2007.																															
	MILLIGAN, GATRELL and BINGLEY, 2004. `																															
	O'BRIEN, TOWNSEND and EBDEN, 2010.																	●	●													
	PEACOCK, HINE and PRETTY, 2007a.													●	●																	
	PRETTY, et al. 2005.												●	●	●						●											
	ROE and ASPINALL, 2011.														●								●	●								
	No. research-led intervention per category	**2**	**1**	**2**	**2**	**1**	**1**	**2**	**1**		**1**		**2**	**3**	**4**			**1**	**1**		**1**		**1**	**1**	**1**				**1**			
Total	**No. interventions per category**	**3**	**1**	**3**	**2**	**2**	**1**	**2**	**2**		**7**	**1**	**6**	**5**	**6**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**2**		**2**	**1**	**1**	**1**	**1**	**1**
	% interventions per category	**8%**	**3%**	**8%**	**5%**	**5%**	**3%**	**5%**	**5%**		**18%**	**3%**	**15%**	**13%**	**15%**	**3%**	**3%**	**3%**	**3%**	**3%**	**5%**	**3%**	**3%**	**3%**	**5%**		**5%**	**3%**	**3%**	**3%**	**3%**	**3%**

6 Strengthening evaluation approaches and methods

This section presents and discusses the strengths and weaknesses the review has identified in evaluation approaches and methods. The issues covered have been chosen as they are considered to be of key importance to the strengthening of methods and evaluation approached in the field of health interventions in natural environments. In summary the review identified a number of strong elements within the chosen evaluation methods and approaches. It is of note that the evaluations did not display strengths in large numbers and few demonstrated a clear combination of strong methodological elements. Weaknesses were found in most evaluations and many displayed a high concentration of these elements within the one study. The strengths and weaknesses discussed in this chapter are:

- Mixed methods
- Quality and transparency of analysis and reporting
- Developing methods through reflection
- Use of economic evaluation methods
- Generalizability/transferability
- Context and complexity – including the aims of intervention and the evaluation
- Causation - Addressing the impact of the natural environment

Health interventions and natural environments are both complex and dynamic. Overall the results of this review suggest that evaluation approaches and tools are currently neither complex nor dynamic enough to capture and interpret the processes and outcomes that are resulting from natural environment based health interventions. .

6.1 Mixed methods

This review has found that most of the research approaches and methods used to study health and natural environments are often one-dimensional and not necessarily designed to deal with interdisciplinarity. Mixed methods are promoted as offering potential to overcome the methodological limitations of qualitative or quantitative data being used in isolation.

A combination of two or more methods may help in overcoming the weaknesses of each single method. The weaknesses they may help overcome include:

- Quantitative methods can be used to provide a robust picture of a large sample of a population; whilst qualitative methods can be used to add depth and raise questions.
- Quantitative methods can establish the links between the natural environments and health; whilst qualitative can explain how this happens and what the benefits are and can thus add value.
- Quantitative methods may not be as effective at explaining values for different groups – qualitative can target specific groups and can explain the way in which relationships exist.

To summarise, if applied appropriately, mixed methods can be used so that the weaknesses of quantitative approaches are overcome by the strengths of qualitative methods and vice versa. As health is affected from a number of different dimensions, mixed-methods can help understand these.

Many of the evaluations considered in this review used mixed methods, but the results of this review would however raise questions of whether the methods are truly 'mixed' (in that the quantitative and qualitative methods are used to complement each other). It is suggested here that evaluations of health interventions in natural environments use 'many' methods. In some cases different stakeholders may require different aspects of the intervention to be evaluated, which will explain why multiple methods are used. However, the added value of mixing is not evident in the analysis and reporting of findings. Bell (2010) concludes that whilst the methodological basis for research is strong improvements could be made by using multidisciplinary methods, improving baseline data and solving issues of incorporating different forms of data e.g. spatial, qualitative, quantitative. Further tailoring and linking of the methods and how they are applied to the natural environment is needed to improve the quality of results.

6.2 Quality and transparency of analysis and reporting

Due to the perceived lack of robustness of qualitative methods, this review based its quality assessment of qualitative evaluations on the four central principles of the assessment framework set out by the Cabinet Office in Spencer *et al.* (2003). These are shown in Figure 1 below.

Figure 1: Principles of quality assessment of qualitative evaluations

Principles of qualitative analysis

- *Contributory in advancing wider knowledge or understanding about policy, practice, theory*
- *Defensible in design by providing a research strategy that can address the evaluative questions posed*
- *Rigorous in conduct through the systematic and transparent collection, analysis and interpretation of qualitative data*
- *Credible in claim through offering well-founded and plausible arguments about the significance of the evidence generated.*

Source: Spencer, *et al.* (2003)

Varied and limited approaches to the analysis, interpretation and presentation of qualitative data were found. Only a small number of evaluations provided any detail at all as to their approach to data analysis and any theories that were informing these approaches. For example, only three studies reported that interviews were transcribed, although many more used interviews as a research method. That the types of information necessary to assess the quality of qualitative

evaluations are not being routinely reported does not necessarily mean that evaluators have not designed a 'defensible' or 'systematic' methodology but that their reporting does not provide enough information for this to be assessed. This may be because a 'defensible' strategy and 'transparent collection' were not prioritised, or considered appropriate, by evaluators in their reporting.

Studies reporting detail on data collection include O'Brien, Townsend and Ebden (2010) and Milton, Kelly and Foster (2009) undertook a thematic analysis of qualitative data, using NVivo software and Wilson (2009) describes their approach as "interpretive phenomenological analysis". Dawson, *et al.* (2006) describes the data collection and analysis process in some detail, ensuring that findings and interpretation of findings are transparent to the reader.

This review questions the extent to which the analysis undertaken, especially of qualitative data sets, is of sufficiently justified and reported. The review found that a number of evaluations demonstrated a propensity to present the overall positive case for health interventions in the outdoors, that is not fully justified or credible if based solely on the evaluation findings. This review would therefore question the extent to which the quality and scale of health intervention evaluations can support the strength of the conclusions and recommendations they make.

6.3 Developing methods through reflection

The evaluations reviewed were searched specifically for evaluator reflections on their choice of methods, application and impact on evaluation process and findings. The evaluations of all research led and multi-project interventions included a good level of reflection on methods and approaches. This is important for policy makers, who must understand clearly the limitations of the evidence base as well as its potential and other evaluators (both academic and practitioner) in relation to informing future studies. For site-specific interventions a lower level of reflection and demonstration of limitations was evident within their reporting.

Although some studies did set out the case for their choices this was often not well evidenced: greater discussion of the thought-process underlying methods and analysis selection would aid in meeting the principles of qualitative analysis. There was little reflection on the experiences of previous evaluations and therefore over the 10 year period of this review there was consequently little development in the methods and approaches used in multi-project and site-specific projects. Bell (2010) concludes "New research should be based on a more comprehensive catalogue of existing studies. Substantial research has been carried out, but it is widely dispersed. Finding need to be cross-referenced, for example, against other health care and epidemiological research.

Research-led projects report greater efforts to learn from previous limitations through experience and also through more thorough review of literature e.g. Peacock, Hine and Pretty (2007a) identified a lack of quantitative and longitudinal data in the evidence base so included validated quantitative health questionnaires and extended follow-up for 3 years to improve on the existing data. Although site-specific studies are being left behind in terms of the methods and approaches used and the consequent quality of the evaluations, there is limited evidence of methodological developments – the same types of evaluations have being re-enacted across the UK over the 10 year period investigated with seemingly little methodological progression in that time.

6.4 Use of economic evaluation methods

OHN identified a significant gap in evaluations which considered both costs and benefits of health interventions in natural environments. This review has confirmed the limited use of economic evaluations.

Few of the evaluations included any assessment of economic costs or benefits associated with the intervention. Two studies that did not carry out such analysis nevertheless concluded that theirs was a low cost, value for money intervention. Another did no analysis of their own but referred to Bird (2004) for estimates of economic benefits. Some of the studies stated that economic appraisal was not in the remit of their evaluation and would require robust, quantifiable monitoring and evaluation to be built into future development in order to make this possible.

The Sport Industry Research Centre (SIRC) (2007) carried out an economic and social impact study of local path networks in Scotland. They concluded that although there are direct economic benefits of the pathways there are also indirect economic benefits associated with health and well-being etc., and without clear baseline data it is difficult to fully calculate the true value. They suggest 'Where possible, economic appraisals need to be 'bolted in' to evaluations rather than 'bolted on'. O'Brien and Snowdon (2007) recommend the need for robust methodologies that can determine long term cost effectiveness. Willis and Liesl, (2005) identified the current methods and approaches for evaluating health and natural environment interventions as a key factor limiting the assessment of economic costs and benefits.

6.5 Generalizability/transferability

Overall not many of the methods and approaches used in evaluations within this review are readily transferable or generalizable. This is primarily due to methodological limitations identified in this review, scale and also in part a reflection of the design and aims of both the intervention and the evaluation. For example site specific interventions and their evaluation may lack the strategic purpose of informing a wider evidence base. In the absence of transferability the knowledge gained from evaluating health interventions in the outdoors can only continue to 'pepper' the evidence base and not strengthen it.

Key to the transferability of results is replicability and the quality and resulting transparency of analysis and interpretation. These two imperatives are absent from most of the evaluations reviewed. Evaluations would struggle to replicate their work as there is a severe lack of detail as to the intervention itself, the evaluation process and analytical theories and approaches used. For example there is a lack of specificity in the description of the natural environment setting used in the interventions. Kjellgren and Buhrkall (2010) and Davies and Deaville, (2008) argue that more replication in studies is needed.

A related point is the impact of a large proportion of the literature on health interventions in natural environments being based in other countries. This has implications for transferability, but also for the development of the research methods used in the UK.

The number of non-UK studies was noted for each of the ten major literature reviews, screened for this review. Within these ten reviews, 487 out of 1140 references were non-UK studies and many of these were interventions. The most commonly encountered countries producing relevant literature were: USA, Canada, Australia, Scandinavia, Netherlands, Japan and Korea.

6.6 Context and complexity– including the aims of intervention and the evaluation

Many authors seek to illustrate the complex relationship between individuals, natural environments and health. For Henwood (2001), these include socio-economic, access, environmental and psychological issues. The review has found that there is limited use of methods and evaluation approaches to address the complexity of health improving activities within natural settings. Evaluations can look at health benefits and perceptions and benefits of the natural environment but there is still the need for one evaluation to get the holistic view and comprehensive accurate understanding of the compounded impact of the health intervention being in the natural environment rather than any other environment.

Furthermore only a small number attempted to look at the indirect benefits of the intervention. Doust and Tod (2007), Ashley, *et al.* (2000) and O'Brien and Morris (2009) all acknowledge that there will be some. Also missing from the evaluations in this review is sufficient consideration of the attitudinal, behavioural, motivational and social aspects of prime relevance to health promotion, access and use of natural environments.

The interventions and their evaluations are obviously not homogenous. As shown, they differ in scale and scope. They also differ in their stated aims and objectives. This is to be expected among a sample of multi-project, researcher led and site specific, sometimes condition specific interventions.

Of note however is the homogeneity in the lack of specificity in many of the aims of health interventions in natural environments. What health intervention actually set out to do should have a direct impact on any evaluation approach and chosen methods

Intervention aims covered broad and general 'ambitions' such as to "improve health", "improve health and well-being" and "encourage exercise" and "increase physical activity". (See ***Table 10*** below) In general most of the interventions had relatively unspecific health or well-being aims. The most common health category by far was physical activity with interventions such as WHI encouraging inactive people to take regular walks for their health. The second most common health categories were general health and well-being and mental health. Many of the interventions were designed to be restorative, to relieve stress, support people with mental illness, lead to a general improvement of health and an overall feeling of well-being. Self-esteem and mood were also targeted and people suffering from depression. Other studies looked at participant's awareness and connection with the natural environment, and social connectedness and interactions and community engagement in relation to their mental health and general well-being.

Such general statements of intent do not lend themselves easily to robust evaluations. As such, for many of the reviewed evaluations the aims are equally as general and for some arguably over ambitious. Only a handful of the evaluations in this review specified exactly what was to be evaluated. These were mostly research-led interventions that drilled down to examine specific, individual benefits or outcomes, such as Peacock, Hine and Pretty (2008) and Yerrell, (2008). However a number were found to specify evaluation aims that were outside the capacity of the chosen tools and research approaches. In these cases the evaluation aims become merely 'aspirational' – setting out ambitions of "determining impact" "identifying changes" and "establishing the impact".

Table 10: Stated health aims of the reviewed interventions

	HEALTH AIMS OF INTERVENTION	Physical activity	General health and wellbeing	Mental health	Connection to the environment	Well-being - self esteem/mood	General health - younger people	General health-older people	General health - deprived people	Obesity	Depression	Various
Multi-project interventions	CARNEGIE RESEARCH INSTITUTE, 2007.	●										
	DAWSON, et at. 2006.	●										
	DOUST and TOD, 2007.	●										
	HALL AITKEN, 2009.	●										
	HECLA CONSULTING, 2007.	●										
	INTERFACE NRM LTD, 2004.		●									
	MATTINGLEY, 2006.	●										
	O'BRIEN and MORRIS, 2009.	●										
	REYNOLDS, 2005.											●
	SEMPIK, ALDRIDGE, and BECKER, 2005.			●								
	SPORT INDUSTRY RESEARCH CENTRE, 2007.	●	●	●								
	YERRELL, 2008.	●	●	●								
	YERRELL, 2009.	●								●	●	
	No. multi-project interventions per category	**10**	**3**	**3**						**1**	**1**	**1**
Site-specific interventions	A WORD IN EDGEWAYS, 2010.	●										
	ASHLEY, et al. 2000.	●										
	FARRELL and PRICE, 2010.		●									
	FIELDHOUSE, 2003.			●								
	HIGGINS, NICOL and CHRISTIE, 2010.	●			●							
	HOWIE, ALDRIDGE and PARROTT, 2007.	●										
	MCGEENEY, 2004.			●								
	MILTON, KELLY and FOSTER, 2009.									●		
	OWEN, 2007.								●			
	PEACOCK, HINE and PRETTY, 2007.		●									
	PEACOCK, HINE and PRETTY, 2008.					●						
	PEACOCK, et al. 2005.		●									
	REYNOLDS, 2002.	●	●	●								
	SNOWDON, 2006.	●										
	SPORT INDUSTRY RESEARCH CENTRE, 2010.	●	●		●							
	SPORT INDUSTRY RESEARCH CENTRE, 2010a.				●							
	SPORT INDUSTRY RESEARCH CENTRE, 2010b.		●	●	●							
	WILSON, 2009.	●	●			●						
	No. site-specific interventions per category	**8**	**6**	**4**	**4**	**2**			**1**	**1**		
Research-led interventions	BARTON and PRETTY, 2010.					●						
	ISAACS, et al. 2007.	●										
	LAMB, et al. 2002.	●										
	MILLIGAN and BINGLEY, 2007.						●					
	MILLIGAN, GATRELL and BINGLEY, 2004.							●				
	O'BRIEN, TOWNSEND and EBDEN, 2010.		●									
	PEACOCK, HINE and PRETTY, 2007a.			●								
	PRETTY, et al. 2005.		●	●								
	ROE and ASPINALL, 2011.			●								
	No. research-led intervention per category	**2**	**2**	**3**		**1**	**1**	**1**				
Total	**No. interventions per category**	**20**	**11**	**10**	**4**	**3**	**1**	**1**	**1**	**1**	**1**	**1**
	% interventions per category	**50%**	**28%**	**25%**	**10%**	**8%**	**3%**	**3%**	**3%**	**3%**	**3%**	**3%**

This lack of specificity resulted in broad, vague, findings relating to the 'success' of the intervention as a whole. Of more use to policy makers and practitioners would be unambiguous determination of the extent to which key aims of the intervention have been met. SPARColl (2009) also suggest that a key limitation in monitoring of interventions is "a lack of focus over the key questions being addressed by the evaluations".

Another factor affecting the choice of method was the funders' requests that the evaluation be 'light touch' so as not to impose overly on the participants. Similar to this for site-specific evaluations the evaluation methods were sometimes chosen to be fun and relaxed for the subjects. Five of the evaluations in this review specifically reflected upon the potential impact their research methods and tools may have had on participants. One selected tools to minimise their impact – but this had implications for the thoroughness and effectiveness of the evaluation overall (Reynolds, 2005).The evaluator has to balance participants' experience carefully with method choice to meet the interventions aims alongside their evaluation aims.

Time and resource allocation to the evaluation seem to be one factor limiting methodological development and quality improvement. Some studies mentioned this limiting their choice of methods and sample size, some favouring a questionnaire as a lower cost option whilst other have chosen a very small sample with the justification that qualitative data collection will gather in-depth rich data from these few.

Evaluators of interventions need to weigh up their methodological choices to effectively address and understand both the constraining factors limiting their evaluation whilst at the same time choosing methods that will address complexity and provide high quality results.

6.7 Causation - Addressing the impact of the natural environment

The review explored if the evaluations had tried to link the health outcomes of the intervention with the environment in which the activities took place. A few of the research-led studies such as Roe and Aspinall (2011), Peacock, Hine and Pretty (2007a) and Milligan and Bingley (2007) focused on this in their studies but on the whole many of the evaluations did not make this link.

A common problem with many evaluations was participants who were not selected at random and so self-selection bias exists, this makes it difficult to draw causal or correlative conclusions. Several of the studies have tried to overcome these problems: O'Brien and Morris (2009) interviewed the surrounding communities of the forest project sites to explore the benefits and barriers to using green space for physical activity; they targeted participants in the projects and also non-users as a comparison. Peacock, Hine and Pretty (2007a) and Roe and Aspinall (2011) compared people carrying out the same activity in different environments, indoors vs. outdoors and rural vs. urban respectively. This allowed them to test if the environment made any difference to health and well-being all others thing being equal. Different population groups and in fact different individuals appear to have different relationships with the natural environment (de Vries, 2010; Mentro Allan, 2010; Milligan and Bingley, 2007). Further study of these differences is suggested by Bell (2010).

Much of the qualitative work included questions relating to experience, perceived benefits, changes to use and connection with the natural environment but the review found limited evidence of evaluation even attempting to look at causal mechanisms. Generally, there has been little attempt to generate evidence of links between physical activity or general health and the natural environment

in the evaluations. Self-reported data from participants does not strongly link the environment with the increase in activity (SIRC, 2007; Farrell and Price, 2010). De Vries (2010) notes that there is little quality evidence available about the links between physical activity levels and natural environments and that it is difficult to determine the direction of causality between factors such as accessibility or proximity to greenspace and physical activity levels. Mental health and therapeutic benefits of the natural environment have been explored more explicitly in the evaluations in this review.

Many authors in this field acknowledge the challenge of evidencing the cause and effect mechanism within health interventions in the natural environment. Roe and Aspinall (2011) say "As with all quasi-experimental research, there is difficulty in controlling for the many confounding variables present in external settings." Bell (2010) suggests that to establish the casual mechanisms needs some fresh thinking and some multi-disciplinary well-designed larger scale research

The pursuit of causation is limited by the current methodological tools. Croucher, Myers and Bretheron (2007) suggested that longitudinal approaches could assist in identifying causation. There is a general consensus that there is a pressing need to develop and actually use evaluation and research methods and approaches that can establish or isolate the role of natural environments within health interventions in these settings (see for example Health Council of the Netherlands (HCN), 2004; National Institute for Health and Clinical Excellence (NICE), 2006; Bell, *et al.,* 2008; Maas, *et al.,* 2009, and Croucher, Myers and Bretheron, 2007).

7 Conclusions

So far this review has indicated that:

- There is a variety of evaluated intervention available in the UK. Most are primary research studies and few have been peer-reviewed.
- The interventions and evaluations cover a very wide range of activities and natural environments.
- Broad aims of interventions do not 'lend themselves' to current evaluation methods and approaches.
- There is evidence that evaluation aims can be too broad and ambiguous. There are therefore restricted links between the evaluation aims, methods and findings.
- Most evaluations are non-experimental.
- RCTs, whilst considered a 'gold standard' for evidence, their utility for health and natural environments is questioned. This places greater emphasis on the need to develop and use appropriate and robust alternative methods and approaches.
- Evaluations tend to concentrate upon physical activity related health benefits – whether measured or perceived to the exclusion of indirect benefits and the wider social, attitudinal and behavioural factors that are of relevance to this field of study.
- Longitudinal and follow up studies are of value, but limited in application of solid methods.

- A range of research and evaluation methods have been used within the evaluations reviewed. The question of whether these are projects that use 'many methods' or truly 'mixed methods' has been raised.

- The findings from the review also question the quality and transparency of the provided analysis and interpretation within the evaluation reports. The content of evaluation reporting mean that the ability to identify the application of robust, especially qualitative data analysis techniques is very limited.

- Validated health and physical activity measures are used within evaluations. The scale of their use and the resulting power of the statistics presented is questioned for some evaluations.

- There is little use of economic evaluation methods and approaches.

- Key strengths and weaknesses of current methods and approaches are suggested. Taken together they illustrate key methodological problems and challenges evaluators of health and natural environment interventions face. These include
    - Scale
    - Generalizability
    - Specific aims
    - Demonstrating cause and effect
    - Ensuring confidence in findings/evidence base

7.1 Mixing methods and disciplines

Harnessing the value of both mixed methods and inter-disciplinary input could strengthen evaluations. This powerful combination will increase the power of the evaluations to address and encompass the complexity and dynamism of health interventions in natural environments. In particular, a true blending of both methods and disciplines will enhance the required development of applied analytical capacity and capabilities, many evaluations currently lack.

Morris, *et al.* (2003) call for enhanced multi-disciplinary collaboration to overcome the limitations of what they describe as "fragmented and mono-disciplinary research activities" in the field of health and natural environments. Bell (2010) also agrees that cross-sectoral and multi-disciplinary research is needed along with common methodological frameworks.

7.2 Using the available UK evidence

This review has shown that evaluations of UK interventions are not a significant part of systematic literature reviews, possibly as a result of quality related inclusion criteria. The scrutiny of the interventions and evaluation results presented in this review reveals key learning points that will contribute to compounding evidence and expertise in health and natural environments.

Three quarters of the evaluations included in this review were not peer-reviewed. Mostly they were primary research studies published by the intervention lead organisation or funder. Twelve studies were printed in peer-reviewed academic journals, the majority of which from research-led interventions. None of the multi-project interventions had peer reviewed evaluations. Four of the site specific projects had peer-reviewed publications associated with their evaluation. Primarily

these were written in addition to an official publication by the intervention lead or funder. This may reflect that peer-reviewed publications are not necessarily a required, or desired output, of many evaluations.

The Sustainable Development Research Network (2008) suggested that there is a need to collate the analysis resulting from intervention evaluations to create what they term a "bottom up evidence base". This review supports that proposal as one vehicle for strengthening methods and evaluation approaches, by sharing and disseminating widely both positive and negative experiences and good practice.

7.3 Developing high quality evidence

Two of the evaluations included in this review recommended to their funders/commissioners the use of controlled trials in any further evaluation of the intervention (Yerrell, 2008; Doust and Tod, 2007). RCTs are always categorised as 'evidence' of the highest quality in health focussed research. It would be simple for a review such as this to merely recommend that the evaluation field pursue this standard. However researchers in this field have looked at the implications of using RCTs and many would argue that this approach cannot be used effectively assessing links between health and natural environment research for a number of reasons. **Error! Not a valid bookmark self-reference.** below gives the views of Peacock, Hine and Pretty (2007a), they comment upon the methodological issues of RCTs in relation to health interventions in natural environments, suggesting that evaluation methodologies must attempt to "try to use as many elements of classic randomised trials as they can". The feasibility of this is currently being tested by researchers at Loughborough University looking at social and therapeutic horticulture.

Figure 2: Appropriateness of RCTs to health and natural environment interventions

Evaluation of green care and green exercise interventions may find it difficult to live up to the standard (of RCTs), as they, by their very nature, preclude the use of one (or several) desirable methodological elements. The main reasons for this are:-

- *Green exercise does not involve the application of a discrete or defined 'treatment' such as a medicine*
- *Green exercise is not applied to an identifiable population of 'patients' (therefore randomised samples of 'treated' and 'untreated' patients are not identifiable)*
- *Green exercise is not amenable to placebo (e.g. it is not possible to design an activity that is just like a country walk, but isn't a country walk at all.)*
- *Green exercise activities cannot be blinded as it would not be possible for a patient to be honestly unsure whether they had been on a country walk or not.*
- *The outcomes being looked for are not discrete or easily measurable (e.g. feelings of improved general wellbeing, augmented social capital, "healthy communities")*

Source: Peacock, Hine and Pretty (2007a)

7.4 Coordination and support of evaluative research

The evaluations within this review were predominantly conducted by university based research centres or research focused organisations such as HECLA and Forest Research. To some extent this 'cluster' of developing expertise and practice is of great value to the devising, developing and strengthening of research methods and approaches in this area. This review suggests that the 'lessons' to be learned require much greater dissemination – as evaluations across the UK are repeating past 'mistakes' and therefore under-taking evaluations of such limited power as to be holding the developing evidence base back.

There are of course already collaborations such as the Green Exercise Partnership, SPARColl and the OHN. However in tune with the SDRN call for a 'bottom up' evidence base – this review suggests that there is also a real need for coordination and support of evaluative research on the frontline, at ground level. This will reinforce the partnerships that are developing along more strategic lines.

7.5 Recommendations and guidance for funders of future interventions and evaluations

The ways in which the authors suggest that evaluation approaches and methods can be strengthened, and, as such, the aspects funders should consider when tendering or planning an evaluation include:

- Clear and specific evaluation aims which match the overall objectives of the interventions.
- Use of robust and appropriate methods and approaches that, where possible, draws on the lessons learnt from previous evaluations to produce a strong evidence base.
- Evaluations which consider long-term impacts using a longitudinal approach to evaluation.
- Use of mixed-methods which are iterative in process and evaluation.
- Clear description of the way in which data are to be analysed so that the quality and transparency of data can be examined.
- Use of validated health and physical activity measures where possible.
- Greater consideration given to the inclusion of economic evaluation methods and approaches.
- Training and development, provided by funders, to support those undertaking evaluations to learn from best practice and evidence and develop evaluations of interventions which reflects these developments.
- Intention to widely disseminate findings and results so that the evidence base can be further developed; and better use of international studies to progress methodological development and approaches.

8 References

8.1 Literature reviews included in the search

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SUSTAINABLE DEVELOPMENT COMMISSION (SDC) (2008) *Health, place and nature: How outdoor environments influence health and well-being: a knowledge base.* London: Sustainable Development Commission.

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9 Appendix A – Search terms and data extraction templates

9.1 Search terms

Combinations of the following search terms will be used to search the sources identified in Section 2.1 (* denotes a wildcard term e.g. searching using wood* will return all records including wood, woods, woodland, woodlands, woody). The search terms will be combined using Boolean terms (such as AND, OR, NOT) when possible. Search terms will be modified accordingly if they are found to be too general, too complex or generating spurious hits. The search process will be documented and changes to the strategy recorded including the reasons for the change. The keywords have been developed according to Marshall's study (2010) which recorded terms used to describe the natural environment, activities and health outcomes. These have been cross checked with the keywords used in the Bowler *et al.* (2009) and Stead *et al.* (2010) studies and additional appropriate terms have been included from those studies. Search results will be stored and tracked using the online reference management tool 'Refworks'.

Figure 3: Keywords used to search databases

Environment Keywords: Natural environment, Outdoor*, Green* Green space* Open space*, Wilderness, Wild*, Public space, Nature, Wood*, Forest, River, Park, Garden*, Countryside, Biodiversity, Allotment

Intervention keywords: Evaluat*, Intervention, Trial, Project, Programme, Initiative, Scheme,

Health keywords: Health, Well-being, Wellbeing, Physical activit*, Exerc*, Mental health, Health promote*, Psycholog*, Therap*, Rehabilitat*, Restorati*, Recovery, Salutogenic, Treatment, Quality of life

Activity keywords: Conservation, Garden*, Recreation, Volunteer*, Walk*, Green gym, Adventure, Residential, Educat*, Art*, Craft*, Train*

A two-phased approach will be used to search the databases. Firstly, the databases listed in section 2.1 will be searched using the environment and intervention keywords. Results will be further refined (if necessary) using the health keywords. If initial searches of these databases do not return sufficient numbers of studies then the activity keywords will be applied.

9.2 Data extraction and synthesis

A data extraction template and a data analysis template have been developed. Supporting code lists have been created to give consistent data extraction. The templates and code lists have been developed based on Marshall (2010), Rychetnik *et al.* (2002) and Spencer *et al.* (2003) and are tailored to the aims of this review.

The data will be extracted into an Excel spreadsheet using the template as column headers. This will allow the data to be sorted and filtered for the synthesis and discussion. The database will also be

used to create descriptive tables for quick referral by the reader, allowing them to easily identify the characteristics of the interventions being evaluated and the methods used in the evaluations.

9.3 Data extraction template

Data will be extracted using the following template headings:

1. Unique ID
2. Criteria 1-4 met? (must meet ALL 4)
3. Report author(s)
4. Report date
5. Report title
6. Publisher (journal, volume, page numbers OR publisher, city of publication)
7. Abstract
8. Web links/docs
9. Name of intervention
10. Type of intervention (code list), category of intervention (code list)
11. Target group/intended beneficiaries (code list)
12. Category of health/well-being (code list)
13. Natural environment setting (code list)
14. Aim (s) of intervention (separate out where possible health aims and others related to contact with/changes etc. to and natural environments)
15. Intervention lead
16. Location of intervention (code list)
17. Scale of intervention (no. participants and duration etc.)
18. Intervention cost/budget
19. Evaluation cost/budget
20. Who carried out the evaluation?

9.4 Data analysis template

The following data will be extracted for the analysis section of the report:

1. *Type of evidence* - RCT in a peer reviewed journal; Primary research study - within a peer reviewed journal; Primary research study - not peer reviewed; Reports on participant views and experiences
2. *Aims of the evaluation*
3. *Key findings/outcomes of evaluation*
4. *Key recommendations*
5. *Research methods used*
6. *Research design* – What is the basis for their choice of methods? Is it convincing? Does it make sense? Evidence base? (This relates to a key objective of the study to "critically review the basis for choice of methods/approach". Basically asking do the methods lend themselves to answering the set evaluation aims/questions. Document the evaluator's rationale and reasoning behind choice. Note if none is given.)
7. *Weaknesses of evaluation approach/methods*, including sample size – ensure evaluator identified weaknesses are separated from reviewer suggestions
8. *Strengths of evaluation approach/method*, including sample size, innovations– ensure evaluator identified strengths are separated from reviewer suggestions

9. *The extent to which evaluators have reflected upon the impact of the method/tools on the results of evaluation/intervention*
10. *Recommendations made by evaluators re methods/evaluation approach in the future*
11. *Evaluation category* – experimental RCT; quasi-experimental – non-random assignment with control/comparison group; non-experimental – no control group; natural experiment (as defined by evaluators)
12. *Primary type of evaluation* – formative, process, outcome, impact
13. *Secondary type of evaluation* – formative, process, outcome, impact
14. *Does the evaluation look at cost effectiveness/cost benefit analysis/value for money?*
15. *Validated measures of health/well being used in evaluation*
16. *Other measures of health/well being used in evaluation*
17. *Measures of changes in physical activity used in evaluation*
18. *Were before and after measures of health/well-being improvement taken?* – Yes; No, after only; No measures used
19. *Were before and after measures of level of physical activity taken?*
20. *Are the different features of the design/ methods/ sources evident in the findings? What methods contribute most to the findings set out?* (We are looking here for which methods 'rise to the top' in evaluations. What have the evaluators relied most on to get to their conclusions? Qualitative vs. quantitative? Whose voice/which participants are given priority in findings and recommendations. NB we are concentrating on METHODS primarily and not so much on quality of analysis. However evidence of triangulation, using multiple sources to evidence a conclusion is important.)
21. *To what extent do the findings separate the impact of the intervention from the impact of the natural environment? How is this done/measured/assessed?*
22. *Extent of generalisability /transferability/external validity of findings. Is there a discussion of what can be generalised to wider populations?* Is there enough detail of the contexts in which the evaluation was conducted to allow applicability to other settings to be assessed?
23. Other comments on evaluation

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