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PROJECT REPORT

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The value of contact with nature for health promotion: how the
evidence has been reviewed

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Executive summary

Background: This paper reports on the findings of a piece of work undertaken as the first stage of a systematic review project which aimed to characterise and synthesise the evidence-base for the natural environment as a promoter of human health and well-being. Many publications exist that discuss the links between nature and health; however, it was not clear to what extent this body of evidence had been systematically reviewed. This study aimed to assess the utility of existing reviews on nature and health as tools to inform the development of evidence-based policy.

Study design: A literature search and appraisal of reviews on the impacts of nature on health.

Methods: Databases, websites and bibliographies were searched for articles and inclusion/exclusion criteria applied to identify reviews on the links between 'nature' and 'health'. Articles deemed relevant were then appraised using a minimum set of criteria designed to assess the quality of the reviews.

Results: Seventy seven relevant reviews were identified and retrieved but only nine of the reviews met all appraisal criteria. These nine reviews included both broad and more focused reviews of specific types of interventions such as horticultural therapy.

Conclusions: Despite the large number of publications about the links between nature and health, few systematic reviews have been conducted and critical knowledge gaps remain. Systematic reviews in this 'cross-over' area present a methodological challenge but are needed in order to facilitate the most effective use of the natural environment in promoting health.

Introduction

There is increasing emphasis on the potential role of the ‘natural environment’ or ‘nature’ in promoting human health and well-being¹⁻³. People may be exposed to nature through a number of routes, from viewing a picture or looking through a window, to being within a ‘green space’ or directly interacting with nature, such as when gardening⁴. Different theories have been proposed to explain why there may be a positive impact on health from exposure to nature. For instance, being within a natural environment, or simply viewing a natural scene, may have restorative effects on mental health by allowing recovery from stress and mental fatigue⁵. Alternatively, access to natural environments, such as a public park, may promote health-enhancing behaviour such as walking to work or jogging⁶. A number of organisations have put in place programmes which use the natural environment as part of a health promotion initiative (e.g. British Trust for Conservation Volunteer’s Green Gyms⁷).

In order to make the most effective use of nature as part of a health promotion strategy, the evidence obtained from research studies is crucial. The large number and diversity of the studies available on this topic⁸⁻¹² mean that reviews which collate and synthesise the findings of different studies can play an important role. Reviews can provide an overview of the current level of understanding of the subject and may offer support for a particular intervention; they may also identify evidence gaps where good quality research is lacking and thus highlight areas where future research could be conducted¹³. Thus, for decision makers, they can be important sources of information to guide the development of evidence-based policy and practice. Systematic reviews which assess the evidence for the effectiveness of specific interventions have become an established and important part of evidence-based policy in health care¹⁴⁻¹⁶. More recently, this approach has been extended to environmental management and conservation^{17,18} and it is therefore timely to consider their use where these two disciplines converge.

Many literature reviews and other non peer-reviewed publications e.g.¹⁹ have been written that discuss the impacts of the natural environment on health. As the number of these documents accumulates, their volume may create the impression that the evidence to support the hypothesis of a link between nature and health is abundant and strong. Most traditional literature reviews of the link between nature and health, do not aim to produce information to inform evidence-based policy, rather, their purpose is usually to summarise an existing body of research on some aspect of the ‘nature’ and ‘health’ relationship. For the decision-maker, the utility of these reviews will depend on the relevance of the review question, but also the reviewing procedure, which will affect the presence of bias in the review findings and the objectivity of conclusions reached²⁰. In this study, we searched for documents that reviewed studies on the impact of the natural environment on health and we assessed their usefulness as tools to inform decision-making using key systematic review criteria. Our aims were twofold: (1) to assess the extent to which existing literature reviews of the evidence on the link between nature and health may be of sufficient relevance and rigour to be useful for decision-makers (2) to assess the need for undertaking systematic reviews on the effectiveness of particular uses of nature as a resource to promote health.

Methods

Literature search

Following a systematic review approach, a variety of sources of published and unpublished literature including databases, relevant websites and references from publications were searched for relevant articles. Database searches were conducted in October and November 2007 by applying relevant keywords to several databases (ASSIA, Medline, PyscInfo, Social Science Citation Index, CINAHL and SportsDiscus, PubMed). Keywords were applied using Boolean phrases to extract articles containing at least one health key word (health, wellbeing, well-being, social, mental or physical); at least one environment key word (natural environment; green space, open space, nature, wilderness or countryside or park or green or garden) and at least one review word (review or synthesis) within the title, keywords or abstract) using wild card terms as appropriate. Full details are available from the authors upon request.

The websites of 22 public health and environmental organisations (listed in Appendix 1) were searched for publications. A general internet search was undertaken using www.alltheweb.com and scholar.google.com using combinations of health (health, wellbeing, well-being) and environment words (natural environment, green space). The first fifty hits of each search were explored. Further references were obtained from the text of retrieved publications and bibliographies and a number of other references were found in the general search process while pursuing other articles using the internet.

Selection criteria

An inclusion/exclusion filter was applied to all articles retrieved by the above searches to identify relevant articles. Articles were identified as a 'review', and hence included, if there was evidence that the findings from empirical studies on some aspect of nature and health had been collated and discussion of this literature was, at least partly, a focus of the publication. Articles were excluded if they were judged to be: 'promotional' material with no or a minimal literature review element; primarily dealt with the effects of natural disasters and other negative environmental effects such as air pollution; or considered the role of natural medicines or pet animals.

There was an element of subjectivity in defining an article as a review and so as an interim check of the repeatability of the application of the inclusion/exclusion criteria by the main reviewer (DB), an additional reviewer (TK) checked a 20% (n=17) sample of the first 83 publications that had been identified as potentially relevant based on their title and abstract. Kappa analysis was used to verify the level of repeatability (K=0.514). The four papers over which there was discrepancy had been identified by both reviewers as border-line cases and agreement was reached over their inclusion. Kappa was repeated again on a 20% sample of additional articles identified as potentially relevant (n=11) and reviewer agreement was 100%.

As more references were retrieved and read, more articles were identified as potentially relevant from their bibliographies. Retrieval of documents follows a 'law of diminishing returns' and a somewhat arbitrary line has to be drawn as to when retrieval efforts cease. For this review, searching and retrieval of papers was halted at the end of January 2008. We are confident however that the articles retrieved and

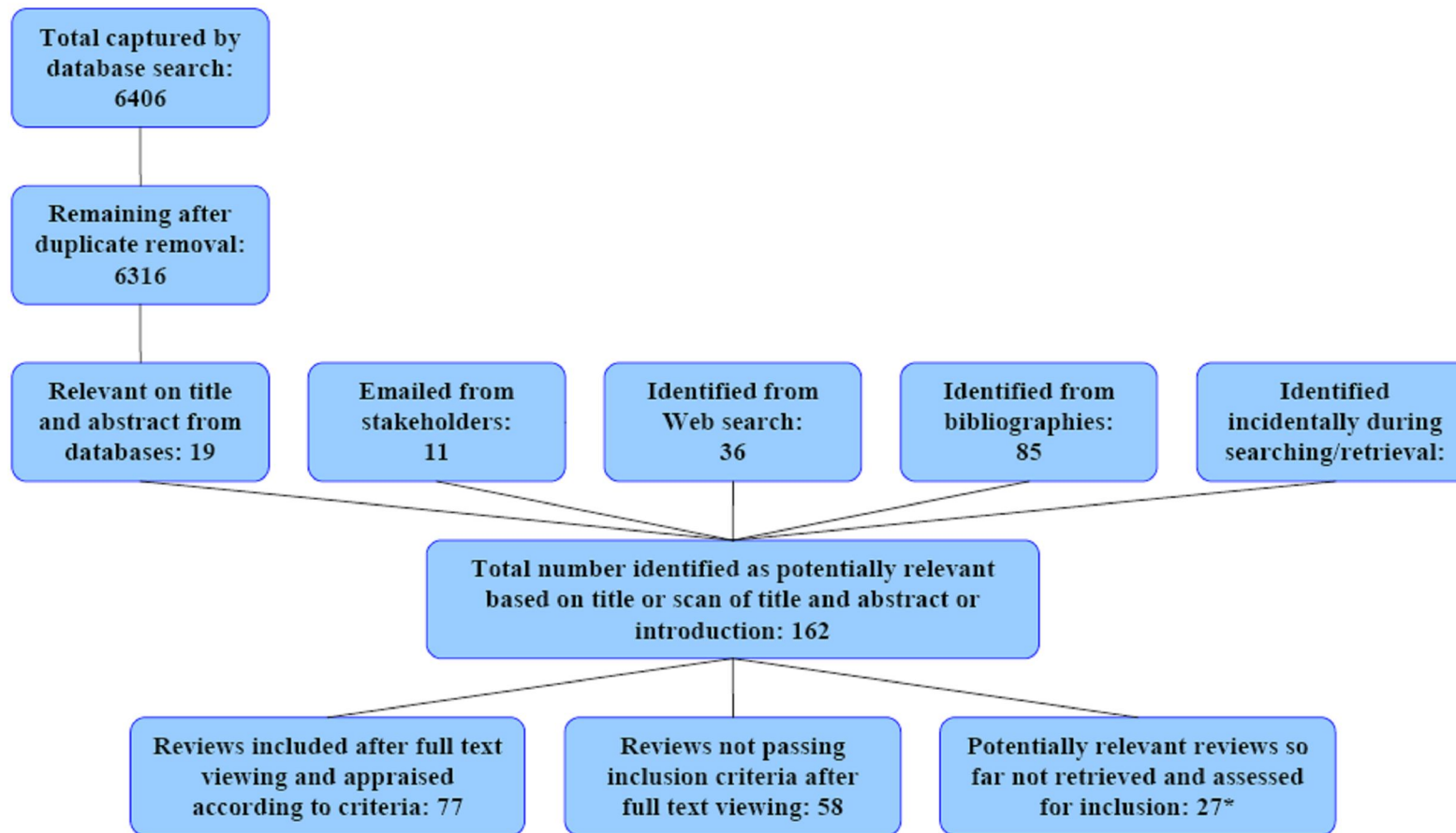


Figure 1. Flow chart showing the source of reviews identified and the numbers included in the review and appraised.

* To note: a recent major report by the Sustainable Development Commission entitled 'Health, place and nature. How outdoor environments influence health and well-being: a knowledge base' is not included in this figure as it was identified outside the time frame of this review.

included in this review represent the most accessible articles on the nature-health relationship and therefore those most likely to be used by decision makers.

Appraisal of reviews as tools to inform decision-making

It was clear that most of the selected articles did not set out to be systematic reviews and there was variation in the methodologies employed to review the literature. Sets of criteria have been developed for appraising the quality of systematic reviews^{20,21}. We used these to develop a simplified set of criteria which included only those we considered the most essential for assessing ‘fitness for purpose’ in relation to guiding decision-making. In publications which considered ‘nature’ and ‘health’ along with other issues, appraisal was restricted to sections relevant to this topic. The reviews were assessed by one reviewer against the following criteria:

- 1) Was the review question defined?
- 2) Was the search strategy defined in terms of keywords and databases used?
- 3) Were the criteria used to include/exclude studies from the review stated?
- 4) Is there any evidence of quality appraisal of research methodology in interpreting the findings of any of the studies discussed?
- 5) Has the material discussed been drawn together into an overall conclusion or summary statement?
- 6) If so, is there any evidence that the strength of the conclusions have been weighted by the methodological quality of the studies?
- 7) Or, is there any evidence that the strength of conclusions have been weighted by the quantity and/or focus of studies available?

Given the varied nature of the reviews appraised, we were generous in our application of the criteria, in order to tend towards inclusion. For instance, a study was deemed to pass criterion 4 if there were any comments at all regarding the quality of a study in the discussion of the review.

Results and discussion

From the search, 162 articles were identified as potentially relevant on the basis of title and abstract/introduction and 77 (listed in Appendix 2) passed our inclusion/exclusion criteria at full text and were appraised according to the review quality criteria. Table 1 presents the number of these reviews that passed each assessment criterion.

Table 1. The criteria used to critically appraise the 77 reviews which were included at full-text and the number and percentage of these that met each criterion.

Quality criteria	No. of Reviews	%
1. Question	74	97.4
2. Search strategy	14	18.4
3. Inclusion/exclusion criteria	9	11.8
4. Study appraisal	33	43.4
5. Conclusions	71	93.4
6. Conclusions weighted by study quality	27	35.5
7. Conclusions weighted by study quantity	46	60.5

Review question

Identifying a clear question is important for the transparency of the review process, particularly to show that the question was identified *a priori* rather than being fitted around the study findings²⁰ and it also serves to demonstrate to the reader the scope of the review. Virtually all (97 %) of the reviews appraised had a review question expressed in some form, however there was a great deal of variability in the clarity of the question. Some were not phrased as questions but took the form of an explicit statement while others could only be inferred by the title or subject heading. However, we recognise that this was often due to the breadth of the topics that the review aimed to discuss. Most reviews were broad, covering a range of different mental and/or physical health outcomes, but several focused on physical activity. A variety of terms and phrases were used to describe the type of nature under consideration, with varying degrees of specificity, from 'gardens' to terms such as 'green' and 'open' space.

Search strategy

Reporting of the search strategy was relatively poor as only 18 % reported the keywords and databases used to search for publications and only 12 % of the reviews reported any inclusion/exclusion criteria. For the reader, this lack of transparency means that it cannot be verified whether the studies reviewed reflect a comprehensive and representative sample of the studies available or a biased sample of studies. Bias can be introduced into a review through different routes. The reviewer may introduce bias by selecting articles for inclusion which support a particular hypothesis and if the search for studies has been limited. Publication bias is suspected to be an important source of bias²² and so a search should generally include published and unpublished material, preferably from multiple sources, to ensure the search retrieves a comprehensive and unbiased sample of the literature. Clearly, reporting of the search strategy and inclusion criteria in a review is important so the reader can make an informed decision on the likely degree of bias in the review conclusions.

Critical appraisal

Critical evaluation of the quality of the studies included in the review is a crucial component of a systematic review as the findings of a particular study can be strongly affected by the methodology of data collection²³. For instance, in experimental studies, bias can be introduced if the intervention is not randomly assigned to individuals or participants. A range of other methodological issues, such as sample size and appropriate controls, affect the quality of a study, and hence the reliability of its findings^{21,23,24}. The outcome of the appraisal can be included in the review conclusions so that the strength of the inferences drawn in the conclusions are weighted by the quality and quantity of studies available. Under half of the reviews that were assessed (43 %) had any indication that the quality of study methodology had been considered. Indeed, this figure reflects a generous assessment, as signs of appraisal were often limited to brief comments on only one or two studies within the discussion section of the review rather than a uniform appraisal of all studies. Most reviews (93 %) had a conclusion, in some form, in which there was some attempt to discuss or state the overall findings of the studies. While over half of the reviews (61 %) took into account the focus and quantity of studies available as limiting the extent of their conclusions, and identified areas where future work was needed, about

a third (36 %) demonstrated that the quality of study methodology had been specifically taken into account in drawing conclusions. None of the reviews attempted a quantitative synthesis of the findings from different studies.

Of the 76 reviews assessed, only nine met all our assessment criteria although only four of these identified themselves as a systematic review. Table 2 presents details of the focus of these reviews. Most of these reviews aimed to address a specific aspect of the nature-health relationship such as using nature as a therapeutic intervention (Jones & Haight 2002; Sempik *et al.* 2003; Van den Berg 2005) or effects of green space on physical activity or mental health (Clark *et al.* 2006; Foster *et al.* 2006; NICE 2006; Kaczynski & Henderson 2007). Two others covered the topic more broadly and discussed the range of evidence available (Davies 2007; Croucher *et al.* 2007). Overall, these reviews indicate that there can be positive impacts of nature on health.

Systematic reviews in the cross-over area of the natural environment and public health

There are a number of factors which may make a systematic review of public health interventions more complex than, for example, a review of clinical trials of a particular treatment. Relevant literature on nature and health is likely to be found in both public health and environmental literature, which therefore increases the time needed to devise and conduct the search for literature and this may also necessitate collaboration between different sectors²⁵. As observed in this study, combinations of relevant nature and health keywords also tend to retrieve large numbers of citations, partly due to ambiguity in many of the relevant words. Search specificity may be aided by the development of more database index terms relevant to the area (e.g. Medical Subject Headings²⁶), which are assigned to articles in databases and allow focused and specific searches for relevant studies.

An additional factor that may increase the complexity of a systematic review in this cross-over area is the diversity of study designs that have been used to assess the health impacts of nature and of interventions that use some form of the natural environment. In general, a full assessment of interventions aimed at promoting public health, in terms of effectiveness and implementation, is likely to require evidence from different study designs and interventions²⁷. There has been some discussion on the methods of assessment of public health interventions for the development of evidence-based policy²⁷⁻²⁹. In particular, incorporating qualitative research has been considered to be important to be able to address the significance of the intervention for the end users and to identify factors that may affect the success of an intervention^{27,30}. Methods have been proposed to integrate quantitative synthesis with the information gained from qualitative research in a systematic review³⁰ and also to synthesize outcomes from diverse studies when a quantitative meta-analytical synthesis is not suitable^{21,31}. Thus, a growing number of tools are available which may be useful in reviewing the impacts of natural environment interventions on public health.

Table 2. Reviews which met all the critical appraisal criteria applied in this assessment and details of the focus of these reviews.

Author	Year	Title	Focus
Clark <i>et al.</i>	2006	A systematic review of the evidence on the effect of the built and physical environment on mental health	Impact of physical environment (built and natural) on mental health
Croucher <i>et al.</i>	2007	The links between greenspace and health: a critical literature review	Links between greenspace, particularly in urban areas on physical, mental and social well-being
Davies	2007	Natural Heritage: a pathway to health	Impact of the natural environment on health and well-being
Foster <i>et al.</i>	2006	Assessing the relationship between the quality of urban green space and physical activity	The relationship between aspects of greenspace and physical activity
Jones & Haight	2002	Environmental Transformation: An Integrative Review.	Use of the natural environment as a therapeutic intervention
Kaczynski & Henderson	2007	Environmental correlates of physical activity: A review of evidence about parks and recreation	The relationship between parks and recreation settings (indoor and outdoor) and physical activity
NICE	2006	Physical activity and the environment: Review 3: Natural Environment	The effectiveness of interventions to the natural environment in increasing physical activity
Sempik <i>et al.</i>	2003	Social and therapeutic horticulture: Evidence and Messages from Research	The effect of horticulture and gardening on health and well-being
Van den Berg	2005	Health impacts of healing environments: A review of the benefits of nature, daylight, fresh air and quiet in healthcare settings	The benefits of nature, daylight, fresh air and quiet in healthcare settings

Discussion

The majority of the reviews we identified were lacking in some aspect of methodological rigour which might limit their utility for informing decision-making on the most effective use of the natural environment in promoting public health. While this result may partly be due to a lack of reporting of the review methodology, it is likely to be also due to a genuine lack of systematic and comprehensive searching, critical appraisal, and incorporation of this critique in the review conclusions.

Of the nine reviews which met our quality assessment criteria, none attempted a quantitative synthesis such as meta-analysis or alternatively, a formal synthesis of qualitative evidence, which would increase the rigour of the conclusions drawn.

Two of the final group of nine reviews aimed to provide a broad-brush assessment of the evidence and to demonstrate the wide variety of ways in which nature might impact on health. The remaining seven reviews addressed different, more specific, aspects of nature and of health. Given the variety of forms in which nature and the natural environment could be used, and the variety of possible health outcomes, it becomes clear that the small number of good quality reviews we identified only begins to tackle the evidence need of decision makers. Croucher et al. (2007) identified several questions which warrant further attention. For instance, they highlight that it is not understood if benefits of green space arise from direct contact with, or simply viewing, nature nor whether there is an extra benefit from carrying out an activity such as exercise in natural settings compared to an indoor activity. Variation in the effects of different types of nature and the natural environment and variation in its impacts among different sectors of the population has also been neglected. We further suggest that future reviews on this topic could be improved by greater focus on specific types of health outcomes or interventions. This would aid the search and synthesis of studies, and also allow a deeper understanding of the relationship, which is crucial to the successful implementation of programmes designed to use the natural environment as a way of promoting health.

We conclude that more good quality systematic reviews which assess the evidence on these more specific issues are required. Given that both the public health and environment management communities recognise the importance of the natural environment to the promotion of health, and the establishment of systematic review as an important tool to support decision-making within both fields, we propose that a multidisciplinary Natural Environment and Health Review Group be established to promote and undertake systematic reviews in this cross-over area. This Review Group would be ideally placed to work with the Cochrane (www.cochrane.org), and Campbell (www.campbellcollaboration.org) Collaborations and the Collaboration for Environmental Evidence (www.environmentalevidence.org) to further develop the methodology for mixed method reviews and for integration of qualitative with quantitative data.

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Appendix 1

Websites of the following organisations were searched for relevant articles:

British Trust for Conservation Volunteers
Campbell Collaboration
Cochrane Library
Commission for Architecture and the Built Environment
Countryside Recreation Network
Environment Agency
Forest Research
Forestry Commission,
Green Space, Green Space Scotland
Groundwork Trust
Health Development Agency
Institute of Rural Health
National Trust
Natural England
NICE
OPENspace
Parks Victoria
Royal Society for the Protection of Birds
The Nature Conservancy
UK Man and Biosphere Committee Urban Forum
Walking the Way to Health Initiative (WHI)
Woodland Trust

Appendix 2

The list of articles which passed inclusion/exclusion at full-text and which were subject to critical appraisal.

1. Bird W. *Natural Fit: Can green space and biodiversity increase levels of physical activity?* RSPB; 2004.
2. Bird W. *Natural Thinking*. RSPB; 2007.
3. Brown C, Grant M. Biodiversity and human health: What role for nature. *J Built Environ* 2005;**31(4)**: 326-38.
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18. Frumkin H. Healthy places: Exploring the evidence. *Am J Public Health* 2003;**93(9)**:1451-6.
19. Frumkin H. White coats, green plants: Clinical epidemiology meets horticulture. *Acta Horticulturae* 2004;**639**:15-26.

20. Gullone E. The Biophilia Hypothesis and Life in the 21st Century: Increasing Mental Health or Increasing Pathology? *Happiness Studies*. 2000;**1(3)**:293-321.
21. Henwood K. *Environment and health: Is there a role for environmental and countryside agencies in promoting benefits to health?* Health Development Agency; 2002.
22. Ho C, Payne L, Orsega-Smith E, Godbey G. Parks, recreation and public health: parks and recreation improve the physical and mental health of our nation. *Parks & recreation* 2003;**38(4)**:20-7.
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