

# Health and the natural environment: A review of evidence, policy, practice and opportunities for the future

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## Abbreviations

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AHRC	Arts and Humanities Research Council
CCG	Clinical Commissioning Group
CEH	Centre for Ecology and Hydrology
DCLG	Department for Communities and Local Government
DCMS	Department for Culture, Media and Sport
Defra	Department for Environment, Food and Rural Affairs
DH	Department for Health
ECEHH	European Centre for Environment and Human Health
ESRC	Economic and Social Research Council
GP	General Practitioner
HEAT	Health Economic Assessment Tool
HPRU	Health Protection Research Unit
HWbB	Health and Wellbeing boards
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
JSNA	Joint Strategic Needs Assessments
LNP	Local Nature Partnership
MENE	Monitor of Engagement with the Natural Environment
NCD	Non-Communicable Disease
NE	Natural environment
nef	new economics foundation
NERC	Natural Environment Research Council
NGT	Nominal Groups Technique
NIHR	National Institute for Health Research
NGO	Non-Governmental Organisations
PHE	Public Health England
TCV	The Conservation Volunteers
TEEB	The Economics of Ecosystems and Biodiversity
RSPB	Royal Society for Protection of Birds
UEMS	University of Exeter Medical School
UKNEA	UK National Ecosystem Assessment
WG	Welsh Government

# Health and the natural environment: A review of evidence, policy, practice and opportunities for the future.

## Executive Summary

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### Background

The physical environment is a recognised determinant of health [1, 2]. At the most fundamental level human health and wellbeing is dependent on the goods and services the environment provides: air, food, shelter and water. However, exposure to and use of natural environments has a direct impact on health and natural environments are important components of ‘healthy places’ with a role in promoting, maintaining and returning to a state of good health.

Recognising and harnessing the role of the natural environment in promoting good health is of increasing importance. Populations are experiencing epidemics of non-communicable disease (NCD), including heart and other circulatory diseases, diabetes type 2, and mental health disorders [3]. Whilst many factors are involved, understanding the potential ways in which the natural environment may contribute to the prevention and mitigation of these diseases or states is crucial in addressing the issues and reducing the associated burden on health and social care systems.

This report details the outcomes of the Natural Environment and Health Fellowship, a partnership between Defra and the University of Exeter Medical School’s (UEMS) European Centre for Environment and Human Health (ECEHH). The work focused on the interconnections between the natural environment and good health (it does not consider environmental risks or stressors), and the ways in which these are, or could be harnessed in policy and practice. The majority of the work was undertaken in 2015-2016, prior to a number of significant developments such as the EU referendum and the publication of the 25 Year Plan to Improve the Environment. The research informed development of the 25 Year Plan and can inform the delivery of both the health themes of the 25 Year Plan and the development of environmental policy after leaving the European Union.

### Aims and objectives of the fellowship

The aims of the work were to: i) clarify what is known about the linkages between natural environments and good health, to characterise how different social groups understand the health potential of the natural environment, and to examine the factors that may facilitate or prevent the realisation of those benefits; ii) evaluate how evidence relating to the linkages between natural environments and health is recognised, taken into account by, and

incorporated into existing policy and practice; and iii) identify effective and promising opportunities to act on the potential of natural environments to promote better health.

The report relates predominantly to the UK context (and more specifically to England) and is aimed at a variety of audiences though primarily governmental (national and local) departments with responsibility for, or an interest in how the natural environment may relate to the health of the population.

A range of methodologies were used to complete the project:

- Production of a summary statement of the evidence for the relationship between natural environments and health and articulation of the extent and strength of the current evidence
- Review of evidence relating the ways in which different social groups perceive of and value the natural environment as a resource for health
- Documentary analysis to examine how different types of evidence has been used to support and inform existing health and environment relevant policies, positions and activities
- Case studies of activity relating to the health promoting potential of natural environments, including examining the role of evidence in relevant decision making
- Consulting with a range of stakeholders (from health, environment and other relevant sectors) regarding the linkages between natural environments and health, and in relation to decision making processes
- Participatory and deliberative methods to collaboratively identify effective and promising opportunities (in relation to future research, policy and/or practice) to act on the potential of natural environments to promote better health

### **Policy context**

The links between the natural environment and indirect and direct health outcomes are recognised, to some degree, in existing policy and practice at a range of scales. International policy, such as that from the World Health Organisation or the European Union, identifies the importance of the environment in determining health [2, 4]. In the UK, policy and position statements from the various departments of the devolved administrations and local governments also integrate understanding of the complex interactions [5]. However, no single governmental department or body appears to have ‘ownership’ or is tasked with ensuring that the potential opportunities of the natural environment to contribute to better population health are recognised; this appears to have contributed to a lack of leadership and meaningful policy activity.

Beyond governments, there is a considerable amount of interest in and support for the greater recognition of the linkages between natural environments and health amongst the 3<sup>rd</sup> sector. A number of organisations, from both the health (e.g. Mind) and environment (e.g. Wildlife Trusts) sectors, have integrated the importance of the natural environment to health into to their policy and practice.

## Evidence of the linkages between the natural environment and good health

Although there are a number of issues regarding the consistency, robustness and reliability of the existing evidence, the linkages between natural environments and multiple direct health outcomes are increasingly well understood [6].

### *Evidence of the direct linkages between natural environments and health*

**Mental health and wellbeing:** There is strong and consistent evidence for mental health and wellbeing benefits arising from exposure to natural environments, including reductions in psychological stress, fatigue, anxiety and depression [6]. These benefits may be most significant for marginalised groups. Socioeconomic inequality in mental well-being has been shown to be narrower among those who report good access to green or recreational areas, compared with those with poorer access [6-8]. Although most studies have assessed short term outcomes, the use of longitudinal data and stronger study designs have resulted in more robust evidence and indications of a causal relationship.

**Self-rated health:** Several studies have found self-rated health tends to be higher in those with a greater amount of natural environment around the home, and especially so if the environment is good quality [9, 10].

**Mortality:** An extensive and robust body of evidence has shown that living in greener environments (e.g. greater percentage of natural features around the residence) is associated with reduced mortality [11, 12]. Reduced rates of mortality have been found for specific population groups including men, infants and lower socio-economic groups [8, 13]. There is evidence to suggest that socio-economic health inequalities (in all-cause mortality) may be lower in greener living environments [8].

**Maternal, foetal and child cognitive development:** Exposure to green space during pregnancy is associated with foetal growth and good birth weight outcomes and a number of cognitive development indicators in childhood [14, 15].

**Internal biome:** A newly emerging but robust and relatively consistent body of evidence has demonstrated the importance of direct contact with nature to the development of a healthy internal biome. A relationship has been identified between exposure to natural environments and the maintenance of a healthy immune system and reduction of inflammatory-based diseases such as asthma [16-18].

**Obesity:** Although mixed, there is evidence to suggest that rates of obesity tend to be lower in populations living in greener environments [19]. Across eight European cities, people were 40% less likely to be obese in the greenest areas, after controlling for a range of relevant factors [19].

**Other physiological outcomes:** Smaller bodies of evidence have shown that exposure to natural environments is linked with more favourable: heart rate; blood pressure; vitamin D levels; recuperation rates; and cortisol levels and is also associated with lower prevalence of diabetes type 2. There is consistent evidence from birth cohort studies which shows exposure

to green space during pregnancy is associated with fetal growth and higher birth weight [6, 11, 20-22].

### *Pathways and influencing factors*

**Physical activity:** Although the outcomes are mixed, the evidence tends to demonstrate that accessing and using natural environments is associated with a higher likelihood and rates of physical activity [6, 19, 23]. The evidence suggests that physical activity in natural environments is more beneficial to health than that undertaken in other environments and that people enjoy it more [24]. However physical activity does not appear to explain the health benefits (as described above) of exposure to natural environments and the mere presence of natural environments (e.g. parks in urban settings) does not necessarily translate into higher population levels of activity without further interventions encouraging and supporting use [6].

**Social and community:** Positive relationships have been found between natural environments and social contact and community cohesion in a small number of studies [6, 25].

### *Factors which influence the nature and direction of the links between natural environments and health*

**Socio-demographic factors:** The impacts of exposure to natural environments and direct use of green space often differ between social and demographic groups [26]. Variation has been found in health outcomes associated with exposure to, in physical and psychological perceptions of accessibility, and in motivations for use of natural environments [27, 28]. Socio-economic inequalities in health are lower in greener living environments. Although lower socio-economic groups are thought to disproportionately benefit from natural environments they often face the greatest barriers to use and the lowest levels of availability [29-34].

**Environmental type and quality:** The quality of the environment appears to influence health outcomes; higher quality, biodiverse natural environments and those that are well maintained (e.g. free from litter) and in which people feel safe are associated with good health. Although much of the evidence relates to urban greenspace there is evidence to suggest that exposure to other types of natural environment (broadleaf woodland, arable and horticulture, improved grassland, saltwater and coastal) result in greatest health gain [35].

**Quantity and proximity of natural environments:** There is a significant volume of evidence showing that a greater quantity and proximity of natural spaces (mainly in relation to living environment) is consistently positively associated with health outcomes [36]. Understanding of a potential dose-response relationship is growing [37, 38].

### *How different social groups perceive the health benefits of natural environments*

Existing evidence suggests that many people consider that the natural environment is a contributory factor to their health and wellbeing. These understandings are expressed in many different ways and appear to differ according to life stage, activity and in relation to both

internal (to the individual) and external factors (e.g. the socio-cultural context). However, there is still a need to better understand the values people hold as they are crucial to the development of appropriate policy and interventions options.

### *Evidence of the effectiveness of interventions*

There is a growing body of evidence regarding the effectiveness of specific natural environment related interventions. Newly emerging evidence is clarifying how the siting, design or maintenance of natural environments (particularly in urban areas) can enhance health, however the results are mixed [39, 40]. Interventions which have sought to encourage access or engagement with, or which have used the environment as a setting to promote health (preventative or therapeutic) have typically resulted in positive impacts to outcomes such as quality of life, walking behaviours and mental health [41, 42].

There is a wealth of small scale programme and project evaluations relating to health outcomes of targeted health interventions using or based in the natural environment some of which are suggestive of positive outcomes. However, these are rarely peer-reviewed or brought together and synthesized using robust replicable methods such as systematic review [43-45].

### *Monetised health values of the natural environment*

There are, as of yet, few studies which have sought to specifically value the direct health benefits of exposure to, or use of natural environments on health outcomes. Recent activity, by academics, consultancies and a number of public or third sector organisations has however begun to explore potential monetary values. These values are in general positive and show that interventions represent good value for money [46, 47].

Example values include an estimated annual saving of £2.1 billion achieved through averted health costs if everyone in England had equal '*good perceived and/or actual access to green space*' [48]. The economic values of the health benefits of increased physical activity resulting from the Forestry Commission's Woods In and Around Towns Challenge Fund was estimated to amount to approximately £0.36m per year [49]. The economic value of the health benefits of walking on the Welsh coast path was estimated at £18.3 million per year [50]. The monetary value of five participants' involvement in Mind's Ecominds programme (nature based health interventions for mental health) was estimated to represent cumulative savings of £35,413 per year, achieved through reduced NHS costs, benefits reductions and increased tax contributions [51].

### *Limitations of the current evidence base and evidence gaps*

Although our understanding of the benefits of the natural environment to health is growing, the current evidence base is limited by the:

- lack of causal evidence and which can explain explanatory mechanisms [6, 20];
- low use of robust designs, such as natural experiments, with adequate controls, sample sizes and study duration, and the reliance on self-reported rather than objective data [16];

- lack of understanding of the heterogeneity and inconsistency of outcomes [6, 35];
- lack of studies which have been specifically designed to inform the development of policy and interventions [16, 38];
- lower quality policy, programme or project evaluations, existing examples are often not of a quality suitable to inform policy and practice and are rarely disseminated and shared effectively; and
- relatively little inter- or trans-disciplinary research [52].

Key evidence needs relate to:

- how evidence of the connections between natural environments and health is understood and acted upon by professionals or within institutions, for instance, in relation to the acceptability of green prescriptions approaches;
- a greater understanding of the socio-cultural and temporal factors within environment-health relationships;
- the necessary conditions for natural environments to be effective in promoting health, and the life stages during which interventions to promote the health benefits of natural environments are most effective;
- development of valuation methodologies and new approaches to understanding the potential economic outcomes of the benefits;
- the factors or interventions that are effective in encouraging health related use of the natural environment and how this can be achieved without exacerbating health inequalities; and
- the role of the natural environment in promoting individual or community health related resilience (particularly in relation to multiple deprivation).

### **Extent of activity building on the potential of the natural environment to promote better health**

The linkages between natural environments and health are recognised in the practice of many organisations from governmental departments, research institutions, funding bodies, to 3rd sector and civil society organisations. Multiple types of activity and decision making processes are evident, these include: local health intervention delivery, such as the health programmes on Dartmoor and Exmoor National Parks (Case study 1); regional efforts to coordinate and deliver health intervention activity, such as in the Liverpool region (Case study 2); collaboration between institutions to improve policies and practices, such as interaction between a Local Authority and a university to better understand the transferability and applicability of evidence for decision making (Case study 3); and to national and international integrated framing of issues, such as through the Natural Capital agenda (Case study 4).

#### *Factors which act as facilitators or barriers to activity*

There are a number of common factors which appear to act as facilitators or constraints to environment-health activity. Examples of facilitators include linkages at strategic points (e.g. between chairs of Health and Wellbeing Boards and Local Nature Partnerships); interest from key funders (e.g. Big Lottery); perceived legitimacy (i.e. local action backed by national

policy); and persuasive (though not necessarily evidenced) ‘arguments’ and narratives (for instance the Nature Deficit Disorder). Some of the key constraints of activity appear to be similar to those faced by other cross-departmental and complex issues and are often structural, relating to the organisation of government (local and national) or institutions. Other barriers to activity relate to: the perception of the peripherality of the environment to health; reorganisations of institutions and the loss of networks and knowledge; difficulties in demonstrating impacts and outcomes of environment-health interventions; and the constrained budgets and perceived rigidity of the health and social care system.

### *How evidence of the potential of natural environments to promote health is used, taken into account by and incorporated into decision making*

The role of evidence in supporting and contributing to decision making varies greatly. In some circumstances the evidence of linkages between natural environments and health has supported activity and has helped make the case for action, in other situations the evidence has failed to convince decision makers that activity is justified. There is a perception that current research activity is decoupled from decision making processes, with few research studies explicitly making it clear how the results will be useful and what they will add to decision makers’ knowledge.

In general, the types of evidence that are prioritised (in the health sector and beyond) are those which are quantified and, where possible, monetised. Whilst other types of evidence (including socio-cultural, non-monetary) are used, particularly to provide a ‘narrative’, key decision makers such as Directors of Public Health prioritise clinical outcomes and, where possible, monetised evidence. In response, there is ongoing research activity which is seeking to produce evidence more suited to these types of demanding decision making contexts.

### **What are the most promising opportunities to act on the potential of natural environments to promote better health?**

Future strategies to improving our understanding, and increase activity around the value of natural environments to health need to be multi-dimensional and inter-sectoral, and should reflect the complex systems within which natural environments could be used to help promote better health. Future strategies should involve multiple i) partners, ii) policy instruments and iii) delivery methods at a variety of scales.

The results of the reviews and the outcomes of a series of interviews, meetings and workshops (with policy/decision makers, practitioners and the research community from across health and environment fields) were used to identify three sets of key priorities, actions and strategies to better take account of the potential of the natural environment to promote health.

#### *Evidence and evaluation opportunities:*

#### **Evidence and evaluation opportunity 1: Supporting the ongoing collation of robust, causal and explanatory evidence**

There is a clear demand for more robust and causal evidence (both quantitative and qualitative) relating to the link between natural environments and health outcomes. There is also a need to better understand the magnitude of impacts. Two main strategies were identified to address this need: first, there needs to be greater interaction between policy/decision makers, practitioners and researchers so that opportunities to apply more robust research designs can be identified at an early enough stage to be effective. Second, as large scale data collection and research is expensive, there may need to be greater coordination and sharing/pooling of resources between departments, governments (e.g. England and the devolved regions), and research councils/charitable funders to achieve this aim.

### **Evidence and evaluation opportunity 2: Effective evaluation and mixed economies of evidence**

Many health-environment policies, programmes and projects are inherently complex with potential for win-win outcomes (e.g. to both the environment and health) or for unintended consequences. There is a need to take a more strategic approach to the evaluation of these policies, programmes and projects and to make use of multiple forms of knowledge regarding what is (cost-)effective, for whom and in what contexts. Potential actions to address this need include: support for methods development, particularly in relation to non-monetary approaches; support for ‘mixed economies of evidence’ from authoritative voices such as National Institute of Health and Clinical Excellence (NICE) or Public Health England (PHE) and advocating for the production, translation and use of a broader evidence base; increase in support for and capacity to undertake meaningful and robust evaluative activity; moving away from trying to understand the impacts of (complex) interventions in isolation; and the development and promotion of a standardised set of measures and tools to allow for cross-evaluative synthesis (this would also need the infrastructure to support the ongoing collation and synthesis of the evaluative activity).

### **Evidence and evaluation opportunity 3: Identifying what works, for whom and when**

There is a lack of knowledge regarding the most effective interventions which harness the potential of the natural environment to promote good health, furthermore our understanding of ‘what works, where and for whom’ is limited. There may be value in supporting further ‘what works’ activity which focuses on considering effective environment and health practice. In addition to understanding what works, a particularly important step is to translate existing knowledge into meaningful formats suitable to inform policy and practice decision makers. Key actions include: identifying and researching effective intervention options; clarifying how the intervention works, in what contexts and for whom; undertaking process evaluations; making best use of mixed economies of evidence; and undertaking transferability and scalability assessments and cost-benefit analyses. Key would be support from authoritative voices such as Cabinet Office, Treasury and local leadership and avoiding the development of narrow and limited toolkits.

## *Delivery and intervention opportunities*

### **Delivery and intervention opportunity 1: Supporting the development of plausible mental health, physical activity and obesity interventions in key target groups**

Although limited in extent, there is now evidence which suggests that some interventions which make use of the natural environment as a setting to promote health and prevent ill-health are effective and of value. Such activities have been developed and used by a range of providers (public and 3<sup>rd</sup> sector) including Mind, The Conservation Volunteers, and some Local Authority public health departments. The interventions range from walking groups, conservation activities, or therapeutic horticulture to more clinically orientated options such as eco-therapy. Often the interventions are targeted at specific groups, such as those at risk of unemployment through stress, or at risk of diabetes and other ‘lifestyle diseases’ through lack of activity. There would be value in further supporting and developing such initiatives. Commissioners could work with providers to establish effective and sustainable routes to delivery, ensure interventions are embedded in wider care and support structures so not provided in isolation. Efforts should be made to work cross-sectorally, by articulating how the intervention might, for example, contribute to multiple policies and delivery strategies. As further evidence is needed, commissioners and delivery bodies should work with researchers to enhance understanding of the effectiveness of specific interventions.

### **Delivery and intervention opportunity 2: Engage children with nature and foster lifelong motivations to use natural environments for healthful activities**

Evidence suggests that whilst there is widespread agreement that experiencing nature is beneficial for children, opportunities to actually do so are decreasing. This is problematic for a number of reasons, including: i) the benefits of natural environments to children’s health are multiple; ii) greener living environments are associated with more positive educational and developmental outcomes [54]; and iii) patterns of engagement with the natural environment in adulthood are strongly influenced by experiences during childhood [55]. Defra (and its equivalents at a more local level) could work with other departments to find effective ways in which children can be encouraged to use their local natural environments. This would likely need to be a multi-armed strategy. Efforts could be made to increase positive perceptions towards natural environments of not only the children themselves, but also those of their parents and carers, and of teachers and health professionals. Effective options are likely to be those which take a whole systems approach and build use of the natural environment into everyday activities such as play, active travel, or even as a learning space, and which create systems and contexts where going out into the natural environment is easy, safe and enjoyable.

### **Delivery and intervention opportunity 3: Improve the amount, quality, standards and accessibility of urban natural environments**

Some of the strongest and most robust associations relate to the positive health outcomes of living in areas with a greater amount of good ‘quality’ (e.g. well maintained) natural environment. Evidence suggest that people who live in the greenest neighbourhoods enjoy

lower mortality [6], better mental health [23], and lower rates of obesity [56-59]. Such spaces support or facilitate a range of activities which may be beneficial to health including play, exercise, and social contact, volunteering, and active travel. The evidence suggests that different forms of urban natural environments (e.g. parks, street trees, gardens and so on) are important. Although the impacts of greener living environments may be relatively small at an individual level, at a population level these can aggregate to become quite significant and may represent important cost savings to the health system. Defra (and its equivalent at a local level) could work with other departments, and in particular those with responsibility for planning and urban composition, to encourage and support increases in the: i) amount; ii) quality (in terms of maintenance); iii) proximity; and iv) (where appropriate) accessibility of natural environments in neighbourhoods. Efforts could be made to protect and improve the quality of existing spaces.

#### **Delivery and intervention opportunity 4: Building on the potential of National Parks and other designated spaces**

Some of the most innovative work linking natural environments and health outcomes is taking place in National Parks. For instance, the Naturally Healthy projects based on Dartmoor and Exmoor are co-funded by the Parks Authorities and by Local Authority public health departments and aim to tackle poor mental health in people living locally. It is suggested that Defra and others could work with the National Parks and other partners (from a variety of sectors - public, private and 3rd) to help realise the value of the physical resources they manage. Key actions include: identifying the most effective ways in which National Parks can be used to promote health of those who live locally and of visitors; creating sustainable and enduring systems through which the National Parks can be used to deliver health related policies and programmes; and developing structures through which the National Parks Authorities, NGOs and health sector can work together to identify suitable interventions.

#### **Delivery and intervention opportunity 5: Developing and implementing the use of Social and Environmental Impact Bonds**

An Impact Bond is a form of contract which aims to improve specific outcomes by making funding conditional on achieving results, and are sometimes known as mechanisms for ‘payment by results’. Individuals or organisations invest in the project at the start of the project and receive payment based on results. Rather than focusing on inputs or outputs, impact bonds are based on the delivery of predefined and measurable outcomes. There is growing interest in the use of social and health impact bonds to ‘drive more effective policies’, this partly driven by Cabinet Office and relates to a number of policy areas<sup>1</sup>. There are examples relating to the health system, for example they have been used to fund social prescribing). There is potential to further develop the use of impact bonds as a means of co-delivering social, health *and* environmental outcomes. The bonds could be used to support interventions which improve both health and environmental outcomes through delivery (e.g.,

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<sup>1</sup> [Social Impact Bonds](#)

conservation volunteering) or through improving environmental provision (e.g. changing the location or management of environmental assets in order to maximise health and wellbeing benefits), and/or on user-oriented interventions which make use of natural environments, but which may not directly improve environmental outcomes.

### *Structures and systems opportunities*

#### **Structures and systems opportunity 1: Strategic cross-sectoral and departmental working**

There is a danger that the considerable health resource of the natural environment is, and will continue to be undervalued and underappreciated. This may partly be because no department or sector (at a variety of scales) has ‘ownership’ or responsibility for ensuring that the health values of natural environments is recognised or acted upon; the resource is managed by one department but the health or societal issues are the concern of another. Cross-departmental (and potentially cross-governmental) activity is likely to be necessary to realise the potential benefits offered by the effective use of natural environments. Key strategies to achieving more synergistic working are: understanding and translating priorities across systems and departments; finding methods of communication to highlight the co-benefits of cross-departmental activities; statements of the state of evidence need to be tailored (or packaged) appropriately for particular audiences and, in particular, for key decision makers; recognition of the value and potential of collaborative working; and identification of where the motivation and capacity for synergistic activity exists. There needs to be an examination of how government can more effectively work with non-governmental bodies (some of whom represent enormous numbers of the public) and the private sector, both of which are significant land owners.

#### **Structures and systems opportunity 2: Ensuring sustainability and continuity of activity**

There is a need to identify strategies to ensure the sustainability and continuity of effective activity where it has been achieved. Momentum can easily be disrupted; an example was found in the disruption of advocacy process during the reorganisation from Primary Care Trusts to Clinical Commissioning Groups. Other disruptive factors include: the short-term nature of project/research funding; the need to develop ‘innovative’ programmes of activity; and the turnover of individuals who occupy key strategic roles. Potential actions to address this issue include: learning from the process of effective activity; building on synergies and shared interests; ensuring that sustainability is a pre-requisite of funded or commissioned activity; developing mechanisms for sustainable and long-term support for effective initiatives and certain forms of research (e.g. longitudinal); and provision of a context in which long term decision making is a rational option.

### **Conclusions**

The weight of evidence suggests that those with responsibility for, or whose activities could influence or impact on the natural environment or health (including Defra, but also the Departments for Communities and Local Government, Education or Health, and their

equivalents at a more local scale and within the private, civil and 3<sup>rd</sup> sector) should recognise the potential of the natural environment as a resource for promoting health (and indeed the variety and variance of the potential). This potential should be integrated into future decision making. There is tangible cross-sectoral interest in using the environment to help tackle some of the most intractable health problems society faces.

There are many good examples of policies, programmes and interventions which could be further developed to make best use of the considerable resource the natural environment represents. Key actions may include:

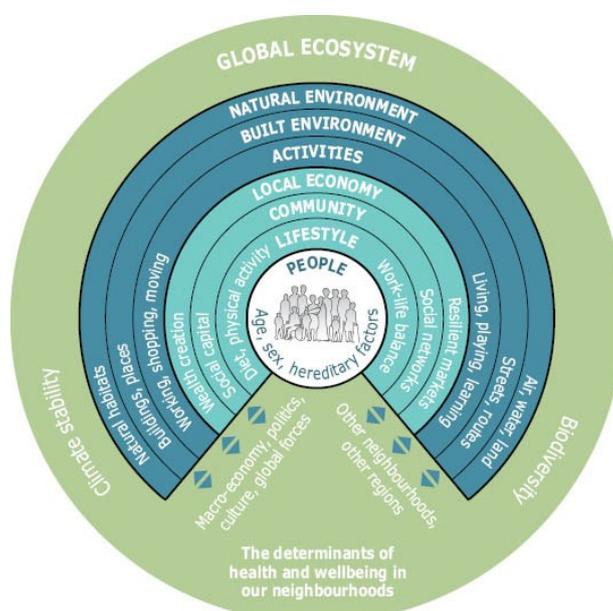
- recognising the value and potential of the natural environment to contribute to better health while increasing understanding of key mechanisms;
- ensuring interventions are effective, appropriate and equitable;
- working collaboratively (e.g. across government and between sectors) and integrating awareness of the value of natural environments to health across social, health and environmental policies; and
- facilitating systems through which activity can be supported and sustained.

# 1 Introduction

## 1.1 Background

The physical environment, whether built or natural, is recognised to be a determinant of health [1, 2]. Barton and Grant's [1] (Figure 1) adaptation of the Dahlgren and Whitehead [60] model of the determinants of health to specifically include natural environments nested within ecosystems, climate and biodiversity illustrates the greater prominence the environment has recently had in our understanding of the factors which support good health and wellbeing.

**Figure 1. Determinants of health (reproduced from Barton and Grant, 2006)**



At the most fundamental level human health and wellbeing is dependent on the goods and services the environment provides us: air, food, shelter and water. However, exposure to and use of natural environments (whether gardens, parks, forests and woodland, coasts, or species rich protected and designated places) has a direct impact on health. Whilst those exposures may be damaging, for instance in relation to zoonotic disease, poor air quality or other forms of pollution, natural environments are also important components of 'healthy places' with a role in promoting, maintaining and returning to good health.

This is not a new understanding. We have known for a long time that natural environments are important to our health. Writing about the historical links between landscapes and health, Ward Thompson follows the thread from the ancient Persians, whose word for enclosed gardens or orchards '*pairi-daeza*' is the origin of the term 'paradise' and the Mesopotamians who conceived of their paradise '*as a mountain covered with cedars, a fruitful garden of the gods, the source of rivers, and the plant that gives life*' [61 p188]. The 'sanctuaries' of ancient Greeks were typically cited away from urban centres, protected by mountains with

running clear water and sacred groves of olive trees [62]. This tradition continued through human history, from the ancient civilisations through to the mediaeval and enlightenment periods.

In more recent times the founding philosophy of the parks movement in the 19<sup>th</sup> century was strongly associated with health and wellbeing. In the United States of America (USA), for example, the Olmsteds were concerned with facilitating the free access of the people to natural environments, arguing that the newly emerging parks should be managed in such a way as to, '*promote public recreation and public health through the use and enjoyment by the people...of the natural scenery and objects of interest*' [63]. The arguments put forward by the proponents of parks and protected spaces seem surprisingly modern, Frederick Law Olmsted wrote that natural environments '*operate by unconscious processes to relax and relieve tensions created by the artificial surroundings of urban life*'. John Muir, the enormously influential advocate of the preservation of wilderness and a founding father of the National Parks movement in the USA also saw free access to such special places as fundamental to health '*Thousands of tired, nerve-shaken, over-civilized people are beginning to find out going to the mountains is going home; that wilderness is a necessity...*' [64].

Recognising and harnessing the potential of the natural environment to support good health is of increasing importance. Although premature death rates from causes such as respiratory and circulatory disease have reduced significantly over the past 50 years, rates of non-communicable disease (NCD), including heart and other circulatory diseases, diabetes type 2, and mental health disorders have reached what have been described as 'epidemic' levels [3, 65]. Whilst many factors are involved (see Figure 1), understanding how the places in which we live may contribute to the prevention and mitigation of these diseases is crucial in addressing the issues and reducing the associated burden on health and social care systems.

A considerable body of research has documented how the natural environment in and around our homes influences health and wellbeing [6]. Existing evidence has demonstrated how exposure to, and use of natural spaces is associated with certain health behaviours, improved physical and mental health, and reduced socio-economic health inequalities. Generally, positive relationships are reported and various explanatory theories have been proposed. Key elements include provision of locations and motivation for physical activity, access to culturally valued environments (thus contributing to sense of place and quality of life), improved quality of life, and a number of psychological and physiological processes [6]. While natural environments may not be as influential as some other determinants of health, the aggregate gains at the community level may be significant. However, there is enormous variation in if and how different social groups engage with and benefit from the natural environment and the spatial distribution in the availability of 'accessible' natural environments.

Efforts to harness the potential of the natural environment for health are inherently cross-departmental in nature; the outcomes are of interest to the Department of Health (DH) and Department of Communities and Local Government (DCLG), the resource is managed by the Departments of Environment Food and Rural Affairs (Defra) and Department of

Communities and Local Government, whilst some of the exposure and use mechanisms are of interest to Department of Culture, Media and Sport (DCMS) and, perhaps, to the Department of Education (DoE). This plurality is reflected at the Local Authority level and across the devolved nations. In addition, there are many civil, 3<sup>rd</sup> sector and private or commercial organisations with an interest.

Despite the difficulties of such a complex decision-making context, the natural environment is an important resource in maintaining and promoting the health of the population of the UK and should be valued as such. Failure to do so risks missing the enormous potential. The challenges are i) how to robustly measure (value) the health and well-being benefits from natural environments while taking care to reflect the plurality of different expressions and understandings of those values and perspectives and ii) how to help decision makers incorporate these values into effective decision making.

## 1.2 The report

This report details the outcomes of the Natural Environment and Health Fellowship, a partnership between Defra and the University of Exeter Medical School's (UEMS) European Centre for Environment and Human Health (ECEHH). The work has focused on the interconnections between the natural environment and good health, specifically in relation to the use of different types of evidence in decision making.

The primary aim of the fellowship was to work collaboratively, by facilitating dialogue and interaction between academics, practitioners and decision makers, to review policy, practice and opportunities relating to the relevance of the natural environment to contribute to good health. The objectives were to:

1. clarify what is known about the linkages between natural environments and good health;
2. evaluate how evidence of the linkages between natural environments and health are used, taken into account by, and incorporated into existing decision making, policy and practice; and
3. identify effective and promising opportunities to act on the potential of the natural environment to promote better health.

The report is aimed primarily at governmental (national and local) departments with responsibility for, or an interest in, how the natural environment may relate to the health of the population of the UK. It may also be of relevance to the many non-governmental organisations who are active in promoting or acting on the potential of the natural environment to contribute to better health outcomes.

## 1.3 Scope

The scope of the work related to the ways in which the natural environment can be considered as a resource to promote and support good health (including preventative and therapeutic use). It does not focus on environmental threats and stressors such as poor air

quality or zoonotic disease. The work was funded by Defra and, therefore, focuses primarily, though not exclusively, on England. Although methods and methodological challenges are discussed, this was not a research methods project.

## 1.4 Structure

The following report is broadly structured around the three primary research questions:

**Section 3** addresses **Research question 1: What do we know about the linkages between natural environments and health?** Evidence for the links between natural environments and health is reviewed. This is followed by the results of the new synthesis of the ways in which perceptions and understandings differ between social groups. The section also considers monetised and institutional values. Finally, evidence gaps and needs highlighted through the reviews are discussed.

**Sections 2 and 4** address **Research question 2: How has, or is evidence of the value of natural environments to health used, taken into account by, and incorporated into existing policy and practice?** In this section, the ways in which the linkages between natural environments and health are manifest in policy, practice and decision making are reviewed. Four case studies are used to illustrate, in more detail, the experiences of particular organisations or key mechanisms.

**Section 5** addresses **Research question 3: What are the key opportunities and options to act on the potential of natural environments to promote better health?** In the final section the collaboratively identified and prioritised opportunities to develop and support decision making, which take better account of the linkages between natural environments and good health, are discussed.

## 2 Policy context

In this section the ways in which the linkages between natural environments and health are manifest in policy, practice and decision making are reviewed.

### 2.1 Political context and support

The links between the natural environment and direct health outcomes, such as those detailed in the review of the evidence, do appear to be recognised, to some degree, in existing policy and practice at a range of scales.

The World Health Organisation (WHO) statement on the determinants of health notes that *‘Many factors combine together to affect the health of individuals and communities. Whether people are healthy or not, is determined by their circumstances and environment. To a large extent, factors such as where we live, the state of our environment...have considerable impacts on health, whereas the more commonly considered factors such as access and use of health care services often have less of an impact’* [2].

At a global level the WHO has worked with the Convention on Biological Diversity (CBD) to produce a state of the evidence report, the aim of which was to support a collaborative effort to examine the interlinkages between biodiversity and health [66]. This document supported the 2014 CBD’s Conference of Parties (195 nation states and the European Union) ratification of decision XII/21 *‘Biodiversity and human health’* which encourages members to *‘consider the linkages between biodiversity and human health in the preparation of national biodiversity strategies and action plans, development plans, and national health strategies’* and enhance cooperation *‘between sectors and agencies responsible for biodiversity and those responsible for human health’* [4].

The WHO is also producing a non-statutory indicator of health related accessible urban greenspace [67]. The ‘Intergovernmental Platform on Biodiversity and Ecosystem Services’ (IPBES) which is assessing the state of the planet’s biodiversity, its ecosystems and the essential services they provide to society, also has a focus on health. Deliverable 3(d) relates to *‘Policy support tools and methodologies regarding the diverse conceptualization of values of biodiversity and nature’s benefits to people including ecosystem services’*. In Europe the EU commissioned an evaluation of the social, cultural and health value of its protected sites network, Natura 2000 [68].

In national government, both Defra and the Department of Health’s (DH) most recent white papers (though released under a previous administration) explicitly recognise the linkages between natural environments and health. For example, the ‘Healthy Lives, Healthy People’ white paper from DH states that *‘The quality of the environment around us also affects any community...’* [5 p17]. Defra’s 25 Year Plan for the Environment integrates a consideration of health and wellbeing outcomes<sup>2</sup>. There are also clear statements of support from senior representatives of Health and other departments. For instance, Jeremy Hunt, Secretary of

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<sup>2</sup> [25 Year Plan for the Environment](#)

State for Health, and Duncan Selbie, Chief Executive of Public Health England (PHE), writing to chief executives of Local Authorities in 2013<sup>3</sup>, noted that, *'it will be your responsibility to tackle the wider determinants of health at a local level, putting people's health and wellbeing at the heart of everything you do – from adult social care to transport, housing, planning and environment'*. Duncan Selbie, Chief Executive of PHE, also recently wrote [69 p3], *'Recognising the role of the natural environment as a primary determinant of health is in many ways the foundation of modern public health. Good health and wellbeing is not solely the absence of illness, the role of the environment we live in is hugely important in shaping our lives and, consequently, our health... access to high quality, local natural environments is critically important to promoting physical health and wellbeing in children, and adults'*.

Despite these positive indications no single governmental department or body appears to have 'ownership' of the issues and this, perhaps, has contributed to the lack of leadership and meaningful policy activity. Whilst (in England at least) the Departments whose remits in some way relate to the relevance of the natural environment for good health outcomes (Health, Defra, DCMS and DCLG especially) do in general recognise the potential benefits, there is a sense that activity would be a peripheral concern and outside of their responsibilities. In Wales a more 'joined-up' approach is underway. The 'Wellbeing of Future Generations Act (2015)'<sup>4</sup> aims to embed sustainable development and an explicit consideration of the wellbeing of current and, importantly, future into the activities of all Public Bodies. The Act includes the creation of Public Service Boards for each local Authority in Wales. Natural Resources Wales will sit alongside the Local Health Board, Local Authority and the Fire and Rescue Authority on these boards. The public service boards will be required to create a wellbeing plan (informed by a review of wellbeing in their area and relating to health) and detail how they are collectively working towards the goals.

The remit of Local Authorities (e.g. County, District, City, and Borough Councils), which have responsibility for some aspects of public health, natural environmental management and regulation, and planning, provides a context in which the values of natural environments to health could be, and indeed in some places are being considered [70]. Many of the strategies (national and local) Local Authorities need to respond to provide a structure through which the linkages between natural environments and health could be recognised and acted upon. At the national level these include [71]:

- Natural Environment White Paper
- Public Health White Paper
- Mental Health Strategy
- Biodiversity Framework
- National Planning Policy Framework

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<sup>3</sup> [Duncan Selbie, devolution of health to Local Authorities](#)

<sup>4</sup> [Wellbeing of Future Generations Act](#) (Wales)

At the local level:

- Green Space Strategies
- Green Infrastructure Plans
- Rights of Way Improvement Plans
- Play Strategies
- Biodiversity Action Plans
- Local Development Frameworks

The NHS's Sustainable Development Unit produced a toolkit for Local Authority Health and Wellbeing Boards which advocates for cross-departmental recognition of the relevance of the natural environment to health<sup>5</sup>. The toolkit includes a number of recommendations related to the natural environment: i) working with local people through the planning process to design healthy places which includes conserving and enhancing the natural environment; ii) embedding greenspace in Joint Strategic Needs Assessments (JSNA); iii) supporting initiatives such as the NHS Forest; and iv) encouraging recognition of health and wellbeing in Local Nature Partnerships.

In some Local Authorities meaningful activity is evident. Bedford Borough Council, for example, considered the value of the natural environment resource in a recent Joint Strategic Needs Assessment [71]. The Council concluded that they would:

- 1. Ensure key wider determinants of health interests, including natural environment and green space, are suitably represented on the Borough Health and Well Being Board and its associated sub groups/ for a.*
- 2. Raise awareness amongst the health sector of the significant contribution that the natural environment and accessible, high quality green space makes to public health and wellbeing (physical and mental) and associated evidence base.*
- 3. Work with Public Health, GPs and mental health professionals and community groups to trial development and delivery of programme of interventions aimed at providing and promoting use of green spaces and rights of way and specific led activity programmes.*
- 4. Work with Public Health, Adult Services, Sports Development, GPs and public health professionals to trial development and delivery or expansion of programme of outdoor health activities within parks targeting specific sections of most deprived communities.*

Similar activity is underway elsewhere including in Dorset, Cornwall, Hampshire, Northamptonshire. The Local Government Association, while it appears to have no explicit statement or working group which focuses on the value of the natural environment to health, does use Barton and Grant's [1] model of the determinants of health (Figure 1) which recognises the contribution of the natural environment, global ecosystem, and biodiversity<sup>6</sup>.

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<sup>5</sup> [NHS SDU toolkit](#)

<sup>6</sup> [LGA determinants of health](#)

## 2.2 Non-governmental and civil society context

There is a considerable amount of interest in and support for the greater recognition of the linkages between natural environments and health amongst the 3<sup>rd</sup> sector. The Wildlife Trusts and Royal Society for the Protection of Birds (RSPB) led ‘Nature and Wellbeing Act’ focuses heavily on the value of natural environment and makes clear links to health, *‘Nature’s recovery would bring a range of benefits, not least, for our health and wellbeing. Inactivity and obesity are escalating; poor mental health is having a significant impact on wellbeing... A high-quality natural environment and greater engagement with wildlife-rich green spaces can make a significant and effective contribution to all of these issues’* [72].

The act gained considerable amounts of attention when released in Spring 2015. In autumn 2015 the ‘Response for Nature’ documents (there is one for each of the countries of the UK), which were the result of coordinated activity between 34 different conservation organisations, called for far greater recognition of the potential of natural environments in supporting and promoting health [73]. Action 6 recommended that, *‘By 2018, 1% of the public health budget should be invested in using the preventative and restorative value of nature to provide cost effective health solutions. This should include a commitment to improve public health locally, by increasing the extent, quality and accessibility of natural green and blue spaces in all urban and rural settlements’* [73].

Examples can also be found in non-(natural) environmental 3<sup>rd</sup> sector bodies. These include the mental health charity Mind’s (now completed) ‘Ecominds’ programme<sup>7</sup> and Macmillan’s support (in collaboration with the Ramblers) of the ‘Walking for Health’ programme<sup>8</sup>. The Kings Fund (a health focused think tank) highlighted the role of the natural environment as a mechanism through which local authorities could promote the health of their populations, *‘Access to open spaces and leisure and recreational facilities has direct and indirect impacts on people’s physical and mental health, but can also enable people to build social capital’*. The Faculty of Public Health argued in a Briefing Statement that evidence to suggest that *‘contact with safe, green spaces can improve a number of aspects of mental and physical health and wellbeing’*<sup>9</sup> was sufficiently compelling to recommend a range of actions:

- *Local Authorities should provide more green spaces.*
- *Local strategic partnerships should explore ways of maximising the use of available green space for promoting health and wellbeing among all groups and communities*
- *GPs should make more use of alternatives to medication for mental illness, including advice to spend time and exercise in green spaces.*
- *Exercise prescription schemes in general practice should encourage and incorporate physical activity in green spaces.*

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<sup>7</sup> [Mind’s Ecominds projects](#)

<sup>8</sup> [Walking for Health](#)

<sup>9</sup> Faculty for Public Health [Great Outdoors](#)

The Town and Country Planning Institute and the Landscape Institute have also produced position papers detailing their interest in the health values of natural environments [74].

## 3 State of the evidence of linkages between natural environments and health

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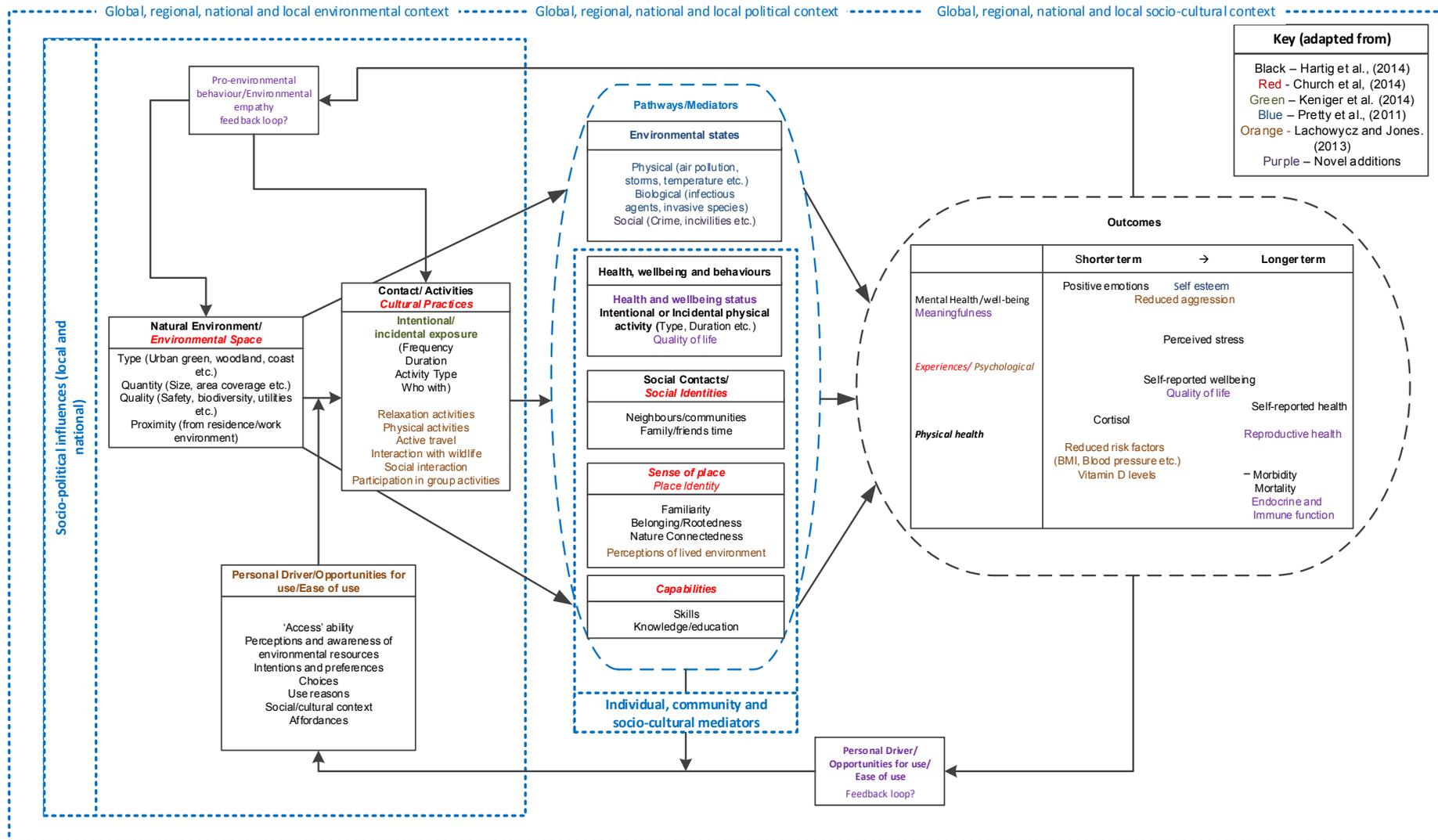
The policy detailed in the previous section is, to some degree, built on a growing body of evidence which is beginning to demonstrate the linkages between natural environments and multiple health outcomes, and of the value(s) this can have to society and individuals.

### 3.1 Conceptual understanding of the links between natural environments and health

In the past ten years there has been an increase of research activity in relation to the links between natural environments and health. The research has now matured to such a degree so as to support focused systematic syntheses of findings in relation to specific outcomes, exposures or processes. A sample of existing systematic reviews is provided in Appendix 2.

Evidence has been produced by researchers working within the epistemologies of such diverse disciplines as epidemiology, cultural geography, environmental psychology, ecology, sociology, economics, and political sciences. The pathways between the natural environment and a range of health outcomes have, therefore, been conceived of and operationalised in a number of different ways. Figure 2 represents a synthesis of key conceptual frameworks and attempts to bridge between disciplinary approaches and language. A model devised by Hartig et al. [6] (derived from a review of reviews and which illustrates some of the key pathways between exposure to and/or use of the natural environment and certain health outcomes) was integrated with other conceptual models to better represent the breadth of approaches taken (e.g. public health or ecosystem services conceptualisations) and the range of exposures, mechanism and outputs considered across the evidence [75-78]. Figure 2, therefore, represents a (non-systematic) synthesis of key conceptual understandings of the interconnections between environment and the types of health considered in the present work.

Figure 2. Synthesised framework of pathways between natural environments and health



## 3.2 Evidence of links between natural environments and good health

### **'Headline' association between natural environmental and health**

A recent 'review of reviews' by Hartig and colleagues [6] provides a concise, robust and reliable report of the current state of the evidence (although the authors caution that the review is not fully comprehensive; they did not consider certain outcomes and pathways and note that they took a public health perspective). The authors concluded, *'The research reviewed does indicate that contact with nature can promote health. The evidence for some benefits, such as short-term restorative effects, is already quite strong'* (p222). The nature and strength of the conclusion has been replicated in further reviews such as that by Sandifer et al. [16] and James et al. [14] who state that they found, *'greenness is protective against adverse mental health outcomes, cardiovascular disease, and mortality'* (p131). These reviews have suggested that, when taken as a whole, the evidence does support the assertion that the natural environment is an important determinant of health.

Working in collaboration with Defra a detailed and outcomes/mechanisms specific statement of the links between natural environments and health was produced [79]. The aim and scope of the statement was to review higher order evidence, of relevance to the UK context, such as peer-reviewed systematic reviews and other robust forms of evidence, in order to provide an overview of the state of evidence on the links between natural environments and key health outcomes.

For this review the natural environment was taken to be the whole of our physical and biological world, including urban green space, parks and gardens (for a typology of natural environment types see Appendix 3, the language used to refer to the specific type of environment throughout the review is that of the original study therefore a range of terms are used). The review (and this work as a whole) adopted a similarly broad definition of human health, *'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity'* [80]. The review, similarly to this report, did not focus on environmental threats and stressors such as poor air quality or zoonotic diseases. It was recognised that outcome and pathways interact and that to some degree an arbitrary distinction was drawn health promoting and health depleting factors.

Abridged results of the statement are provided here (according to outcome, pathway, and mediating factor, noting main study design, consistency and trend of outcome, and providing a short narrative summary) and in Table 2. The full review, which was conducted in 2016, includes further detail and discusses factors such as the robustness of each of the studies cited [79]. The overall 'quality' (in terms of extent and type of evidence) of the body of evidence used for each section was assessed. Descriptions of the overall 'quality' of the body of evidence used for each section are provided using the following system:

[A] Evidence drawn from a range of systematic reviews or meta-analyses, together with other supporting evidence.

- [B] Evidence drawn largely from peer-reviewed reviews or meta-analyses, together with other supporting evidence.
- [C] Mixed evidence sources, including systematic and/or other reviews, individual journal articles or peer reviewed reports, and/or sources that have not been peer reviewed.
- [D] Evidence drawn largely from individual peer-reviewed journal articles or peer reviewed reports, or sources that have not been peer reviewed.

It should be borne in mind that as the review was not exhaustive the indicator of the ‘quality’ of the evidence used for each section should be interpreted with caution.

### **Evidence for global and indirect links between natural environments and specific health outcomes**

#### *Ecosystem services, biodiversity and health*

Many studies (predominantly syntheses, observational, intervention, qualitative) with variation in direction and strength of outcome. [B]

Human health and wellbeing depends on air, food, shelter and water, all partly or fully derived from the natural environment [66, 81]. Although the mechanisms and scales of the relationships are not well understood, it is evident that biodiversity underpins ecosystem functioning and the delivery of goods and services that are essential to human health and wellbeing [66, 82]. In many cases human health and wellbeing is increased as a result of the use and, in many cases, degradation and depletion of natural resources [83].

#### *Landscape and ecosystem scale linkages*

Many studies (predominantly syntheses, observational, intervention, qualitative) with some variation in direction and strength of outcome. [A]

At an intermediary level a growing body of evidence demonstrates the interlinkages between landscape scale processes and human health outcomes. Green infrastructure within cities, for example, offer a range of indirect health related services including reductions to noise, ozone levels, personal exposure to particulates, and mitigation of some of the harmful effects of air pollution [14].

### **Evidence for direct links between natural environments and specific health outcomes**

#### *Mental health outcomes*

Significant volume of studies (predominantly syntheses, experimental, observational, intervention, qualitative) mostly consistent in direction of outcome. [A]

There is relatively strong evidence for mental health and wellbeing benefits arising from exposure to natural environments, including reductions in psychological stress, fatigue, anxiety and depression, together with evidence that these benefits may be most significant for marginalised groups [6]. Gascon et al. [7] found some evidence of a causal relationship

between surrounding greenness and mental health in adults, but the evidence for children was as of yet inadequate to draw reliable conclusions. Socioeconomic inequality in mental well-being has been shown to be 40% narrower among those who report good access to green/recreational areas, compared with those with poorer access [6-8].

### *Self-rated and self-perceived health status*

Many studies (predominantly syntheses, observational, intervention, qualitative) mostly consistent in outcomes but with some variation according to demographics, Socio-Economic Status (SES) etc. [D]

Analysis of both large-scale datasets and application of robust measures in smaller scale studies have consistently shown that there are positive associations between natural environments and self-rated physical and mental health status [9, 10]. A robust systematic review of epidemiological studies linking exposure to natural environments and a variety of health outcomes found ‘moderate’ evidence of a positive link with self-perceived health [9].

### *Mortality*

Some studies (predominantly syntheses and observational) mostly consistent in outcomes but with some variation according to demographics, SES etc. [C]

An extensive and robust body of evidence suggests that living in greener environments (e.g. greater percentage of natural features around the residence) is associated with reduced cardiovascular and all-cause mortality [11, 12]. Analysis of death records from across England showed higher rates of mortality in the groups exposed the least amount of greenspace around the home [8]. However, there is some variation in the outcomes of individual studies. Richardson and Mitchell [13], for example, showed that after controlling for relevant confounders cardiovascular disease and respiratory disease mortality rates decreased with increasing green space amongst men, but no significant associations were found for women.

### *Maternal, foetal and cognitive development in childhood*

Some studies (predominantly syntheses and observational) mostly consistent in outcomes but with some variation according to demographics SES etc. [C]

Exposure to green space during pregnancy is associated with foetal growth and good birth weight outcomes and a number of cognitive development indicators [14, 15]. Quantitative studies, such as that the cohort study by Markyevch et al. [84], consistently show that residential greenness results in more positive birth outcomes (time of delivery and birth weight) and that this relationship is often strongest in more deprived populations. A review of the cognitive impacts of exposure to natural environments found positive impacts to memory, attention, concentration, impulse inhibition, and mood across a range of socio-demographic populations [85]. Natural spaces in and around the school environment is also associated with cognitive development in children; one study found that high levels of exposure to green

spaces was associated with a 5% improvement in working memory, 6% increase in superior working memory, and a 1% reduction in inattentiveness [6, 86].

### *Internal biome, immunological and inflammatory response*

Few studies (predominantly observational) but consistent in outcomes. [B]

There is robust evidence of a causal relationship between exposure to natural environments and the maintenance of a healthy immune system and reduction of inflammatory-based diseases [16-18]. Rook [17] concluded that the requirement for microbial input from the environment to drive immune-regulation is a major component of the beneficial effect of green space. However, the evidence as to any link with allergies is not clear with both negative and positive relationships to greener living environments found [87, 88].

### *Obesity*

Some studies (predominantly syntheses, intervention and observational) mostly consistent in outcomes but with some variation according to demographics SES etc. [C]

There is evidence to suggest that rates of obesity tend to be lower in populations living in greener environments. A recent systematic review found the majority of studies showed a positive association between natural environment exposure and obesity related outcomes [19]. The authors found that i) increased vegetation was associated with reduced weight among young people living in high population densities, ii) increased greenspace was associated with less weight gain over 2 years and iii) across 8 European cities, people were 40% less likely to be obese in the greenest areas.

A UK study found that the people who lived closest to urban parks were most likely to achieve the national physical activity recommendations and least likely to be overweight or obese [89]. There is also some evidence that the actual use of natural environments (as opposed to just a measure of living near greenspaces) is associated with lower rates of overweight and obesity. An English study showed that those who used local greenspaces less than once a week were significantly more likely to be overweight or obese even after rates of physical activity were considered [90]. It has been suggested that physical activity might be an important pathway between natural environments and weight status [89]. However a number of studies, including longitudinal analyses from the UK, have failed to find positive associations between use of greenspaces and weight status [91].

### *Other physiological outcomes*

Many studies (predominantly syntheses, intervention and observational) mostly consistent in outcomes but with some variation according to demographics SES etc. [C]

Increased exposure to natural environments has been linked with lower rates of diabetes type 2 and more favourable heart rate, blood pressure, vitamin D levels, recuperation rates and cortisol levels [6, 20, 21]. There is limited evidence to suggest that greener living environments is associated with better musculoskeletal outcomes [22]. There is some

evidence that greener living environments are associated with the reduced rates of respiratory disease [11].

## **Evidence for direct links between natural environments and factors or behaviours which influence health**

### *Physical activity*

Many studies (predominantly syntheses, observational, intervention, qualitative) with some variation in direction and strength of outcome and according to study design, scale, demographics SES etc. [A]

Although the evidence is mixed and occasionally inconsistent, natural environments are associated with and may support higher levels of physical activity, however it appears that physical activity does not explain the apparent health benefits of natural environments. Lachowycz and Jones [19] found 20 studies (representing 40 percent of the total included in the review) which reported an ‘unambiguous’ positive relationship between green space and levels of physical activity. Studies have found that specific natural environments such as coastal areas are associated with increased likelihood of meeting the daily activity recommendations [92], and that gardens, parks, grassland and farmland, are supportive of vigorous activity [6, 19]. A review by Thompson Coon et al. [24] found some evidence that exercising in natural environments was associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger, and depression, and increased energy compared with indoor exercise. There were also more positive perceptions of the activity including greater enjoyment and satisfaction and participants expressed a greater intent to repeat the activity at a later date.

### *Social contact and community cohesion*

Some studies (predominantly syntheses, intervention, qualitative and observational) mostly consistent in outcomes but with some variation according to environment type, demographics SES etc. [D]

Hartig et al.’s systematic review [6] concluded that there are positive relationships between social cohesion and natural environments with, for example, residents living in areas with more trees and grass tending to display less aggressive behaviour and enjoying lower crime levels. Other studies have shown that green spaces (particular in urban areas) offer a meeting space which help reduce likelihood of loneliness and offer opportunities to build social support systems [25].

## **Factors which influence the links between natural environments and health**

### *Social, cultural and demographic group*

Factors considered in significant volume of studies but directly addressed by few studies, some variation in associations. [D]

There is substantial evidence which suggests that there is variation in the outcomes of exposure to or use of the natural environment according to social or demographic groupings (e.g. age or employment) or health status (including disability), however these patterns are not always consistent. Two key studies to have investigated the differential in outcomes are from the UK. First, Mitchell and Popham [10] showed that although there was a general association between greener living environments and perceived health status, in suburban lower income areas a higher proportion of greenspace was associated with worse health. Second, Astell-Burt et al.'s [93] longitudinal analysis of the British Household Panel Survey (1996–2004) found variation in the association between green space and mental health according to life stage and by gender. Their results showed that for men, the benefit of more green space emerged in early to mid-adulthood. Among older women, a curvilinear association materialised where those with a moderate availability of green space had better mental health.

Typically, communities and individuals with lower socio-economic status are also the most deprived with regard to availability of good quality, accessible green spaces such as public parks [27, 28]. Use of natural environments is lower amongst older people, those with poor health, Black, Asian and other minority ethnic groups, and lower socio-economic groups [26]. Some groups are not interested in the natural environment, and may be fearful of such spaces [94]. The evidence suggests that there may be significant barriers to greater engagement with the natural environment for many different groups. Whilst these may be physical or economic constraints they are often related to socio-cultural norms [95]. See Section 3.5 for further discussion).

### *Environmental quality*

Some studies (predominantly syntheses, intervention, qualitative and observational) mostly consistent in outcomes but with some variation according to environment type, demographics, SES etc. [C]

A small body of evidence, while often inconsistent, suggest that the *ecological* quality of the natural environment may influence health outcomes and behaviours. A systematic review of a relatively small number of studies concluded that there is some evidence to suggest that biodiverse natural environments may be associated with good health and wellbeing [35]. Benefits were manifest in a number of ways, from better mental health outcomes following exposure, to associations with increased health promoting behaviours. Wheeler et al.'s [96] analysis of large scale datasets also found evidence of an association between ecological state and health, with an association between the density of protected/designated areas and bird species richness (an indicator of local biodiversity) and prevalence of good health. There is growing evidence that health is negatively affected by ecologically degraded environments [97].

The *state* or *maintenance* of natural environments (in terms of litter and other incivilities) has also been shown to be related to the wellbeing, and in some cases health [98]. Mitchell and Popham [10] hypothesised that their finding that a greater proportion of greenspace in the living environment for lower socio-economic groups was related to worse health was likely

to be due to the poor state of those spaces. McCormack et al.'s [99] review supported this hypothesis and suggested that attributes including safety, aesthetics, amenities, and maintenance of urban parks are important determinants of use.

### *Environment type*

Few studies (predominantly syntheses, intervention, qualitative and observational) mostly consistent in outcomes but with some variation according to study design, demographics SES etc. [C]

Although the evidence base is small and somewhat patchy, a number of studies have suggested that certain environments appear to support health to a greater degree than others. Wheeler et al. [96] after adjusting for potential confounders, found positive associations between good health prevalence and the density of different landcover types, and for broadleaf woodland, arable and horticulture, improved grassland, saltwater and coastal. Similar results were found in a number of other studies considering mental health [37], walking [100] and happiness [101] outcomes. In the urban setting it appears that both 'accessible' and usable natural environments (whether public or private), such as gardens and parks as well as 'incidental' greenspaces including verges, roundabouts and other forms of green infrastructure are related to health [25]. Kardan et al. [102] (Canadian research) found that having 10 more trees on a city block, on average, improves health perception in ways comparable to an increase in annual personal income of \$10,000 and moving to a neighbourhood with \$10,000 higher median income or being 7 years younger (values are presumed to be Canadian \$).

### *Exposure mode, duration and a dose-response relationship*

Some studies (predominantly syntheses, intervention, and observational) mostly consistent in outcomes but with some variation according to environment type, demographics SES etc. [C]

Despite the majority of existing studies relying on cross-sectional approaches, there is some evidence of a dose-response relationship in the health impacts of exposure to natural environments [103]. Much of the evidence reviewed above finds that the greater *quantity* and *proximity* of the natural environment (mainly in relation to living environment) is consistently positively associated with mental and physical health and wellbeing outcomes [36]. A non-systematic review also found associations between ease of access, size of greenspace, connectivity with residences and other amenities, attractiveness, and potential for multi-use and health outcomes, particularly physical activity [104]. White et al.'s [37] analysis of the MENE dataset showed that feelings of restoration were positively associated with visit duration.

### **Evidence of the effectiveness of interventions**

There are three main types of intervention which aim to use the natural environment to improve health outcomes at an individual or population level. Table 1 provides a basic typology, synthesised for this report from the evidence, of some of the most common

environment health interventions. It is recognised that there is overlap between the categories and there may be other intervention types not covered.

**Table 1. Natural environment health intervention typology**

Intervention type	Scale	Example impact pathways	Targeted health outcomes
<b>Siting, design or maintenance of the natural environment</b>	Population and targeted communities	Greater amount of greenspace Greater physical accessibility Improved quality (ecological and/or maintenance) of environment	Indirect health Direct health Health behaviours Socio-cultural
<b>Encouragement of access, engagement and use of the natural environment</b>	Population or targeted communities (geographic or interest)	Greater and improved engagement Improved perceptions of accessibility	Direct health Health behaviours Socio-cultural
<b>Targeted health interventions using or based in the natural environment</b>	(some) Targeted communities and individual level	Greater physical activity Social contact Alternative spaces Recuperative spaces	Direct health Health behaviours Socio-cultural

### *Siting, design or maintenance of the natural environment*

Some studies (predominantly syntheses, experimental, intervention, qualitative and observational) show some consistency in nature of outcomes, variation according to environment type, demographics SES etc. [A]

Although longitudinal studies of people moving between areas with differing amounts of greenspace suggest that increasing the quantity and proximity of greenspaces may have a beneficial impact on health [105-108], direct studies of actual environmental change have mixed outcomes. Initial results from the ‘Woods In and Around Towns’ (WIAT) programme of environmental modification and social programmes, were positive. Using a controlled design, the evaluation found significant increases in indicators of quality of life, frequency of woodland use, in attitudes to woodlands as places for physical activity, and in perceptions of safety at the intervention site over time, compared with no significant changes in the comparison site [39]. The evaluation of the WIAT challenge fund found a range of positive outcomes to health related mechanisms such as increased physical activity [49]. Using controlled repeated cross-sectional design, a Dutch study of a programme of urban greening found no effect on physical activity rates or general good health status [40]. A study based in the USA of environmental change (including increased quantity of greenspaces) in an urban setting found no significant association with the weight status of older women [109].

A systematic review of interventions to promote physical activity found some evidence that changes to the built environment encouraged use and resulted in increased physical activity in urban green space [110]. A review of the factors that lead to increased park use found safety, aesthetics, amenities, maintenance and proximity were important factors [99]. ‘Greening’ of health care settings has also been shown to have positive impacts [111].

Much of the evidence discussed in the previous sections which considered environment type and quality is of relevance to this intervention pathway.

### *Encouragement of access, engagement and use of the natural environment*

Many studies (predominantly observational, intervention, qualitative) show some variation in outcomes according to intervention design, environment type, demographics, SES etc. [A]

There are now a number of studies which detail the outcomes of efforts to encourage access to and use of natural environments, some of which are linked to health outcomes. Green exercise programmes have been shown to increase activity rates and result in improved self-reported self-esteem and mood states [42, 100, 112, 113] and are increasingly commissioned by health care providers [114]. A systematic review of environmental enhancement activities found some evidence to suggest that opportunities to engage with the natural environment were key motivators for participation [45]. A meta-analysis of outdoor walking groups [41] showed a range of impacts to health. The evaluation of the Sport England led ‘Active England’ Woodland projects found increases in engagement by groups with typically low levels of engagement [42]. Other, non-health related projects and programmes such as Forest School, which provides education in the outdoors, have linked time spent in the natural environment with higher levels of physical activity [115].

### *Targeted health interventions using or based in the natural environment*

Many studies (predominantly syntheses, intervention and qualitative) with some variation in nature of outcomes according to intervention design, environment type, demographics, SES etc. [C]

There are a wealth of small scale programme and project evaluations relating to health outcomes. However these evaluations are rarely peer-reviewed or brought together and synthesized using robust replicable methods such as systematic review. A review of ‘nature based’ therapeutic interventions found some evidence of a positive effect and concluded that they should be considered to be an approach to improving public health [43]. The evaluation (not peer-reviewed) of the Lottery funded ‘Ecominds’ project led by the charity Mind [44] reported a range of beneficial impacts including significant increases in mental wellbeing. The Ecominds evaluation found that 56% of participants of the interventions were men, this is a promising finding as men account for only 36% of those attending more traditional forms of psychological therapies. A systematic review of health and wellbeing benefits associated with conservation activities, a common form of green interventions, found some positive psychological and quality of health outcomes [45].

Finally, a review of the impacts of interventions to promote physical activity in urban green space found that multifaceted interventions (e.g. combinations of environmental modification and social programmes) are likely to have a more significant impact on levels of physical activity than singular intervention strategies [8].

**Table 2. Summary of links between natural environments and health.**

<b>Global and indirect links between ecosystems, biodiversity health</b>					
<i>Exposure, pathway, mechanism</i>	<i>Main study types and 'quality' score</i>	<i>Trend of outcome</i>	<i>Consistency</i>	<i>Narrative summary</i>	<i>Key outstanding questions/issues</i>
Ecosystem services, biodiversity and health	Syntheses, observational, intervention, qualitative. B	+/o/-	Variation according to scale, demographics, SES etc.	Biodiversity and ecosystems are essential to underpin ecosystem functioning and the delivery of goods and services essential to human health and wellbeing. Loss of biodiversity likely to lead to decreases in some aspects of human health and wellbeing.	Relative impact on different health outcomes. Consistency of influence/outcome and factors such as scale.
Landscape and ecosystem scale linkages	Syntheses, observational, intervention, qualitative A	+/o	Mostly consistent	The state, diversity, composition and distribution of land cover type, ecosystem function, and biodiversity at a local level linked with health.	Relative impact on different health outcomes. Consistency of influence/outcomes and factors such as scale.
<b>Direct links between natural environments and human health at the individual and population level</b>					
<i>Exposure, pathway, mechanism</i>	<i>Main study types and 'quality' score</i>	<i>Trend of outcome</i>	<i>Consistency</i>	<i>Narrative summary</i>	<i>Key outstanding questions/issues</i>
Mental health and wellbeing	Syntheses, experimental*, observational, intervention, qualitative A	++	Consistent	Relatively strong evidence for mental health and wellbeing benefits arising from exposure to natural environments, including reductions in stress, fatigue, anxiety and depression, benefits may be most significant for marginalised groups. Some evidence of intervention impact.	Duration of impact. Interaction with other impacts and pathways influence by natural environment. Intervention effectiveness.
Self-reported health and wellbeing	Syntheses, observational, intervention A	+	Mostly consistent (some variation according to demographics, SES etc.)	Moderate evidence of a positive link with self-perceived health mostly drawn from large scale cross-sectional analyses (controlling for confounders).	Potential of additional unaccounted for confounders. Intervention effectiveness.
Mortality	Syntheses, observational C	+	Mostly consistent (some variation according to	Multiple studies using a range of study designs (mostly cross-sectional) demonstrate a positive link between exposure to natural environments and	Potential of additional unaccounted for confounders. Intervention effectiveness.

			demographics, SES etc.)	reduced cardiovascular and all-cause mortality.	
Maternal health, pregnancy outcomes and children's cognitive	Syntheses, observational C	+	Consistent (some variation according to demographics, SES etc.)	Evidence from cross sectional and cohort studies shows exposure to green space during pregnancy and early years is associated with a range of maternal, foetal and cognitive outcomes.	Key stages for exposure/use.
Internal biome, immunological and inflammatory response	Observational, experimental B	++	Consistent	Causal evidence showing exposure to diverse natural habitats is critical for development of a healthy internal biome.	Dose-response relationships, exposure pathways.
Obesity	Syntheses, observational, intervention C	+/o	Mostly consistent (some variation according to demographics, SES etc.)	Majority of evidence shows a positive (though typically weak) association between greenspace and obesity-related health indicators. Little evidence of intervention impact.	Interaction with other impacts and pathways influence by natural environment. Impact of specific obesity/environmental interventions.
Other physiological outcomes	Syntheses, experimental*, observational, intervention C	+	Mostly consistent (some variation according to demographics, SES, health status, etc.)	Mixed quality evidence drawn from a range of study designs typically showing a positive impact to heart rate, blood pressure, vitamin D, recuperation rates, musculoskeletal condition and stress responses.	Interaction with other impacts and pathways influence by natural environment. Impact of specific obesity/environmental interventions.
<b>Pathways and mediating factors</b>					
<i>Pathways and mediating factor</i>	<i>Main study types and 'quality' score</i>	<i>Trend of outcome</i>	<i>Consistency of observed outcomes</i>	<i>Narrative summary</i>	<i>Key outstanding questions/issues</i>
Physical activity	Syntheses, experimental*, observational, intervention, qualitative A	+/o	Some variation according to study design, scale, demographics, SES etc.	Inconsistent evidence regarding greener living environments and physical activity rates, however positive trend in finding relationships between use of natural environments and physical activity.	Causal role of natural environments in influencing rates, motivations, propensity for physical activity. Interaction and additive effects with other outcomes and mechanisms. Impacts of interventions.
Social contact and community cohesion	Syntheses, experimental*, observational, intervention, qualitative D	+/o	Mostly consistent (some variation according to demographics, SES, health status, etc.)	Mostly consistent evidence drawn from range of study designs shows tends to show positive association between availability of natural environments and social interaction and community cohesion. Many of the studies showing	Interaction with other social/community factors. Impacts of interventions.

				stronger outcomes for marginalised groups, with positive impacts on health inequalities.	
Factors which influence the nature and direction of the links between natural environments and health					
Factor	Main study types and 'quality' score	Trend of outcome	Consistency of observed outcomes	Narrative summary	Key outstanding questions/issues
Variation between social and demographic groups	Syntheses, experimental*, observational, intervention, qualitative D	n/a	Some variation	Strong evidence to suggest that impacts of use/exposure to natural environments varies according to SES, age, gender, ethnicity etc. Relatively consistent evidence that greener living environments associated with reduced socio-economic health inequality.	Direction of effect/s. Influence on/of other outcomes and mechanisms. Impacts of interventions.
Environmental quality	Syntheses, observational, qualitative C	+/o/-	Some variation according to study design, scale, environment type, demographics, SES etc.	Some evidence showing inconsistent associations between <i>ecological</i> quality and mainly mental health and wellbeing outcomes. Growing evidence that health is negatively affected by <i>degraded</i> environments. Established body of evidence showing <i>state</i> or <i>maintenance</i> of natural environments (e.g. litter and other incivilities) related to the wellbeing, and in some cases health.	Influence of quality and state on other impacts/mechanisms. Impacts of interventions.
The type of natural environment	Syntheses, observational, qualitative C	+/o	Some variation according to study design, scale, environment type, demographics, SES etc.	Small quantity of evidence, drawn from a range of study types, finding stronger associations between certain land cover types (inc. coastal, woods, forests, uplands, urban parks) and health outcomes.	Direction of effect/s. Influence on/of other outcomes and mechanisms.
Exposure mode, duration and a dose-response relationship	Syntheses, experimental*, observational, intervention, qualitative C	+/o	Some variation according to study design, scale, environment type, demographics, SES etc.	Some evidence showing positive dose-response relationships, however assumptions in study designs leave many questions remaining.	Direction of effect/s. Influence on/of other outcomes and mechanisms. Intervention impacts.
Intervention effectiveness					

<i>Intervention type</i>	<i>Main study types and quality score</i>	<i>Trend of outcome</i>	<i>Consistency of observed outcomes</i>	<i>Narrative summary</i>	<i>Key outstanding questions/issues</i>
Siting, design or maintenance of the natural environment	Experimental*, observational, intervention, qualitative A	+/o	Some variation according to intervention specific, study design, scale, environment type, demographics, SES etc.	Small body of evidence showing the siting, design and maintenance of natural environments may be linked to health outcomes. Relates to outcomes (physical activity) and pathways (e.g. environmental quality) as above.	Effectiveness of interventions. Cost-effectiveness. Acceptability of options. Interaction with other social, economic influences/interventions.
Encouragement of access, engagement and use of the natural environment	Observational, intervention, qualitative A	+/o	Some variation according to intervention specific, study design, scale, environment type, demographics, SES etc.	Some positive outcomes of a range of interventions to promote engagement and access, particularly for marginalised groups.	Effectiveness of interventions. Interaction with other social, economic and cultural influences/interventions.
Targeted health interventions using or based in the natural environment	Intervention, qualitative C	+/o	Some variation according to intervention specific, study design, scale, environment type, demographics, SES etc.	Some positive outcomes, but much evidence is inconclusive and not suitable to inform commissioning etc. Mechanisms shown to be plausible.	Effectiveness of interventions. Cost-effectiveness. Acceptability of options. Interaction with other social, economic influences/interventions.

#### Key

- ++ Mostly clear positive associations
- + Generally positive associations
- +/o Mix of positive and unclear associations
- +/o/- Mix of positive, negative and unclear associations
- o Unclear associations
- \* We have not discriminated between natural, quasi or fully experimental
- ‘Observational’ includes both survey and analytic designs

- [A] Evidence drawn from a range of systematic reviews or meta-analyses, together with other supporting evidence
- [B] Evidence drawn largely from peer-reviewed reviews or meta-analyses, together with other supporting evidence
- [C] Mixed evidence sources, including systematic and/or other reviews, individual journal articles or peer reviewed reports, and/or sources that have not been peer reviewed
- [D] Evidence drawn largely from individual peer-reviewed journal articles or peer reviewed reports, or sources that have not been peer reviewed

### 3.3 Influence of the natural environment on health inequalities

There is a growing body of evidence which typically shows that greener living environments are associated with reduced levels of socio-economic inequalities in multiple health outcomes. Analysis of health records from England found that income related health inequalities in all-cause mortality and mortality from circulatory diseases were lowest amongst those people living in the greenest areas [8]. Inequalities in birth outcomes have also been shown to be lowest in populations who have the greatest exposure to greenspaces, with the strongest associations for parents with the lowest rates of educational attainment and socio-economic status [116]. A study based in post-industrial North-East England concluded that the natural environment was one of a number of factors which contributed to the local communities' better than expected health status [117]. The natural environment was thought to mediate the detrimental health effects of long term deprivation. Health status appears to moderate the impacts of natural environments on mental health outcomes [118]. The restorative impacts of walking in natural environments was shown to be most beneficial for those with poor health (in comparison to those with better health) [118].

Socio-demographic characteristics appear to influence the use of natural environments for physical activity [119]. Studies repeatedly show that certain socio-demographic groups are consistently less likely to use the natural environment for physical activity [26, 120]. However, a Scottish study found no evidence that income-related inequalities in physical activity within green space were narrower in greener areas [121].

### 3.4 Monetised health values of the natural environment

Monetary valuation has been described as the *'practice of converting measures of social and biophysical impacts into monetary units and is used to determine the economic value of non-market goods, i.e. goods for which no market exists. It is applied in cost benefit analysis to enable the cross-comparison between different impacts and/or with other economic costs and benefits.'* [122]. A monetary expression of the value of the natural environment to people has long been identified through house price differentials [123]. Often the higher values in greener neighbourhoods are partly ascribed to the greater quality of life and wellbeing in such areas [124]. Similarly the various outdoor leisure and recreation surveys, such as the Monitor of Engagement with the Natural Environment [26], have sought to place a value on the trips to natural environments, though these have more typically related to visit and travel expenditure and benefits to local economies. Otherwise the economic valuation of benefits derived from (urban) nature elements has largely been undertaken in the fields of environmental and natural resource economics and are rarely related to health outcomes [47]. Woolf and Robbins suggest the lack of economic and monetary values may partly be due to the point that *'methods and measures are diverse in concept and implementation, presenting important concerns and challenges for monetary translation'* [47 p395].

There are few studies, however which have sought to specifically value direct health benefits of exposure to, or use of, natural environments on health outcomes. Recent activity, by academics, consultancies and a number of public or third sector organisations, has begun to explore potential monetary values. Urban open spaces and elements create many positive externalities that have gone largely ignored, including the benefits of active living, physical healing, and mental restoration, among others.

This is a developing area and it should be noted that some of the values presented below (summarised from the Defra evidence Statement [79]) are exploratory and couched in a number of assumptions. This is predominantly related to the quality of the existing evidence base and extent of datasets. Of particular importance is the lack of understanding on the impacts of environmental change or of intervention options, and in relation to causal mechanisms. A useful discussion of the broader difficulties of monetarily valuation of the health benefits of natural environments is provided by Natural England's 'Microeconomic Evidence for the Benefits of Investment in the Environment 2' report [46] (also see [47]).

### *Values associated with physical activity in natural environments*

In 2009 Natural England [48] estimated that an annual saving of £2.1 billion would be achieved through averted health costs if everyone in England had equal '*good perceived and/or actual access to green space*'. This figure is derived from research which showed that where people have good access to green space they are 24 percent more likely to be physically active [90]. This figure needs to be treated with some caution because the direct causal links between the availability of natural environments and physical activity rates is still unclear [19]). The estimated values of a *proposed* expanded Walking the Way to Health programme (typically the walks make use of natural environments such as urban parks, the programme is now owned by the Ramblers and Macmillan<sup>10</sup>) were found to be 2817 Quality Adjusted Life Years (QALY) delivered at a cost of £4008.98 per QALY. This was estimated to be a potential saving to the health service of £81,167,864 (based on life-cost averted) at a cost-benefit ratio of 1:7.18 [48].

Cavil et al. [50] used the WHO's Health Economic Assessment Tool (HEAT) to undertake an economic assessment of the health benefits of walking on the Wales Coast Path. Data from path counters and user surveys showed that an estimated 23,688 people walked the path every week for an average of 4.38 miles. This equates to the prevention of 7 deaths per year among the walking population and an economic value of £18.3m per year of which £3.5m of benefit per year could be directly attributed to the Wales Coast Path.

Others have used the averted costs to the health service of adequate rates of physical activity to indicate the *potential* value of natural environments to health. Pretty et al. [78], for example, noted that if only 1 percent of the sedentary population adopted a more healthy pattern of activity, 1,063 lives and £1.44 million would be saved each year. Pretty et al. acknowledge and state clearly that there is no guarantee of take up, but nevertheless argue this evidence indicates significant benefits and savings *could* arise from modest

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<sup>10</sup> [Walking for Health](#)

improvements in access to green space and/or behaviour change. Analysis carried out in 2005 supports this assertion and highlights that greenspace interventions are likely to be cost-effective because they would avoid the capital expenditure associated with others forms of physical activity infrastructure such as gyms [125].

Papathanasopoulou et al. [126] examined how outdoor aquatic physical activities can be valued through the health gains represented by QALYs and, therefore, ascribed value in monetary terms. The authors showed that (using a conservative estimation) the total value of aquatic physical activity to the study sample of 76 adults was £33,750 for the year. The authors explain that *'This value represents the benefit the economy would gain in monetary terms due to people staying healthy, active and improving their quality of life; i.e. it is the amount of money that would otherwise need to have been spent in an economy to gain the same health benefits through the health care system'*. They take the analysis further to estimate these values across the population, finding that the total population QALY gain from aquatic physical activity is estimated to be 24,853 QALYs with an average QALY gain per person of 0.062 for the year which equates to a saving of £176,721,512 through avoided health care expenditure.

Bateman et al. [127] report tentative values for a range of health benefits derived from ecosystems. For example, a study undertaken by Mourato et al. [124] estimated the health benefits associated with having a view of green space from home to have a value of £135-452 per person per year and the health benefits of having your own garden were estimated to have a value of £171-575 per person per year.

Buck and Gregory [128] cite research which assessed the economic values of Birmingham's city-wide Be Active programme. A return on investment analysis suggested that approximately £23 was recouped for every £1 spent, these values related to higher quality of life, reduced NHS use, increased productivity, as well as other gains to local authorities. The authors suggest that such interventions are a more cost-effective way of improving health through physical activity when compared with most medical interventions.

### *Values of environmental health interventions*

Ambrose-Oji et al. [49] estimated the economic value of increased physical activity which resulted from the Forestry Commission's Woods In and Around Towns Challenge Fund. They found that the post intervention value of the additional health benefits of the WIAT Challenge Fund woodlands was approximately £0.36m per year.

The New Economics Foundation [51] (nef) estimated the value of the Ecominds programme (nature based health interventions for mental health) finding that for five 'typical' Ecominds participants, savings of £35,413 in one year (an average of £7,082 each, see Figure 3) were achieved through reduced NHS costs, benefits reductions and increased tax contributions. Using a formula of cost savings developed by nef, Mind estimated that, for just one year, the programme would result in savings of £1.46m for the 246 people who found full-time work.

### **Figure 3. Annual economic benefits for an individual participant of an Ecominds project**

Benefits	Value (£)
Avoided prescription costs	258.27
Avoided medical consultation costs	408.92
Avoided community psychiatric nurse costs	6,968.00
Avoided Jobseeker's Allowance	2,953.60
Avoided disability allowance	1,092.00
Increased tax contribution	572.90
Increased National Insurance contribution	545.94
<b>Total</b>	<b>12,799.63</b>

Valuation of the impacts of the Scottish 'Branching Out' programme (patients with mental health issues are prescribed a series of formal led woodland activities) found that based on 335 service users per year, the cost per QALY was £8600 [129]. The authors note that in relation to the NICE cost-effectiveness threshold of £30,000 per QALY, the Branching Out programme is cost-effective.

Social return on investment assessments undertaken by Greenspace Scotland [104] in conjunction with public and 3rd sector organisations found a range of favourable cost-benefit ratios of health related natural environment interventions, they included:

- 'Bums Off Seats' found that every £1 invested in a single health walk would generate around £5 of benefit.
- Edinburgh and Lothian Greenspace Trust found that every £1 invested in a summer bike club at Hailes Quarry Park would generate around £6 of benefit.
- Friends of Sunnybank Park found that every £1 invested in delivering a programme of regular community events in the park would generate around £8 of benefit.
- North Ayrshire Council found that every £1 invested in supporting volunteers to reinstate the Coronation Gardens at Spier's Old School Ground would generate around £20 of benefit.
- Woods for Health Steering Group found that every £1 invested in structured outdoor activities on Kinnoull Hill for individuals with mental health problems would generate around £9 of benefits.
- Scottish Wildlife Trust found that every £1 invested in the Glen Mile Mountain Bike Trail would generate around £3 of benefits.

An evaluation of the economic contribution of The Mersey Forest (one of England's 12 original Community Forests) Objective 1 funded programme (total funding £7million) found it resulted in an estimated total monetised benefit of £5.5million per year [130]. The health and wellbeing benefits were broken down by type and estimated that the Gross Value Added of exercise was £20,000 annual net additional benefit and the cost savings of physical activity amounted to £13,000 annual net additional benefit.

### 3.5 How different groups perceive of the health benefits of the natural environment

As documented above there is now a considerable body of research which has demonstrated that the use of and exposure to natural environments has an impact on health and wellbeing. However, these impacts are not distributed evenly through society, with some groups benefiting (or otherwise) to a greater or lesser degree [10, 131]. There appears to be variation in the type and magnitude of impacts within sub-groups according to the socio-cultural, geographic or temporal context. Indeed, Richardson and Mitchell [13] noted that it is important not to assume uniform health benefits of natural environments for all population subgroups. There have been recent calls for a greater exploration of the reasons for these disparities, with a particular emphasis on understanding the variation in impact for groups experiencing various forms of deprivation and marginalisation [132].

The causes of the variation in impact (both positive and negative) between social groups is likely to be multi-factorial in nature. The synthesized conceptual model (Figure 2) demonstrates the complexity and inter-related linkages between, for example, geography, socio-cultural, and individual level factors, all of which may be involved, to varying degrees, in the relationships between natural environments and the health impacts experienced by different sub-groups of the population.

There has been surprisingly little systematic exploration of the mechanisms which influence whether social groups benefit from exposure to or use of the natural environment, nor is it clear as to how consistent these relationships may be across and between social groups, through time, or according to socio-cultural context. Potential factors which impact on ability to benefit from natural areas might include perceptions of safety and suitability of available areas, conflicting uses, and levels of social capital and cohesion. A further set of drivers relate to the ways in which different social groups perceive of the natural environment as a determinant or resource for the promotion of health, and cultural norms regarding use of natural areas.

The latter set of influences (values and cultural norms) have been highlighted as of particular importance. The Cultural Ecosystem Services chapter of the UK National Ecosystem Assessment (UK NEA) [133] suggested we need a far better '*understanding of the complex ways in which individuals and groups of people engage with environmental settings, and the social and cultural benefits that may arise*' (p638). Natural England recently identified a key evidence need around '*...the deeply held personal values and perceptions that influence motivations and self-reported barriers to visiting the natural environment*' [134 p6].

There are many reasons why a greater understanding of the dynamics and distribution of the values people hold regarding the importance of the natural environment to health is needed, these include helping refine Natural Capital models or ensuring that interventions are acceptable and appropriate. As the IPBES guide to values notes, without understanding how

values are conceived, formed, expressed and represented effective decision making will be limited [95, 135]. Another crucial justification is the potential that ill-informed interventions and decisions have the potential to do harm (beyond wasted resources of ineffective policies and programmes), for instance by widening the health inequality gap. Although the use of natural spaces is argued to potentially be of use in reducing health inequalities, it may be the case they are associated with increasing inequity amongst deprived and marginalised groups [69]. A good understanding of how values differ between social groups would help ensure decision making is effective.

### Review methodology

A narrative review was undertaken to help better understand the ways in which different social groups value the natural environment as a resource for health. A description of the methodology of the review can be found in Appendix 4.

A deliberately inclusive approach was taken to the review of the literature, with broad conceptions of health and the ways in which understandings and perceptions of the importance of the natural environment to health have been expressed, studied and understood.

### Results

A brief discussion of the nature of the evidence identified (in terms of methods etc.) can be found in Appendix 4. Information from approximately 100 studies, which had considered how the natural environment is valued for health, was extracted. Evidence from the UK, Western Europe, US/Canada and Australia/New Zealand was prioritised.

#### *How do people value the natural environment in relation to health?*

There is clear evidence that people, in general, value natural environments for their (potential or achieved) benefits to health. There is evidence of the value of natural environment to the individual:

*“I like to pop into the wood for 10 min or so when I get back from work. It helps me to unwind. It’s very relaxing you know. Much better than just going for a walk somewhere. I have got a gate out from the garden straight into the wood, so I can go in anytime. If I do not feel like it, I can just sit in my armchair and watch the trees and birds from my lounge. It is just the job. That is why I bought this house.”* (Male. [136])

The quote perhaps provides some qualitative explanation for the higher house prices in greener areas as noted in the previous section. People also value the health potential of natural environment as a social good which should be equitably distributed:

*“We have a car so we can get there....I think that it's a bit sad that other families haven't got a car and they can't go to it [the beach]”* (Boy aged 8 [137])

*“... I am lucky that I've got the park out there, I think if I was in a, enclosed area with lots of houses in rows and rows and rows then psychologically I would be a lot worse off... other people don't get a chance to go out that have no money and you can see that it's damaging*

*people, that the whole view of life is getting smaller and smaller and very squashed"* (East city female, intermediate class, white [138])

The ways in which people value the natural environment appear to be instrumental (i.e. as a place to undertake activities), relational (i.e. interaction with the natural world), intergenerational (i.e. as a good for future generations), or inherent (i.e. the natural environment is fundamental to health, e.g. provision of fresh air [139]). People ascribe health value to the environment in an abstract sense, but also on specific (often) local, places. There was some suggestion that the natural environment is valued because it is more 'authentic' and 'naturally' healthy than the 'artificial' built environment [140, 141]. In her study of wildlife enthusiasts, Curtin [142] noted '*The natural world provides a point of reference and support in an affluent, consumer-orientated society where wildlife and nature present a refuge and escape from the pressures of urban environments and daily routines*'.

Value direction (positive or negative) appears to interact with environmental scale and the behaviours of others. For instance, people value the distant global, national or 'general' environment in that it provides a resource and context for everybody's good health through the provision of clean air, food and so on. These values are, arguably, enhanced by the negative action of 'others', i.e. a threat to the environment appears to enhance, or at least bring the value into focus. At the 'local' level, the health values of natural environments can be degraded through the very expression of other people's (similar) values, for instance a once little used woodland, highly valued for health benefits to locals, can be eroded through greater use by others [143].

In terms of direct health benefits, values in relation to recreation and leisure dominate the narrative (this may reflect a strong academic tradition related to these topics). There is evidence relating to values associated with direct contact with the natural environment through formal activities, projects and programmes such as environmental volunteering, walking groups and tourism [142, 144, 145].

Specific articulation of how natural environments related *directly* to physical and or mental health outcomes was relatively rare. There were some examples; for instance, in their study of the importance of beaches to families' sense of health and wellbeing, Ashbullby et al. [70] reported that one father highlighted the value of the setting for his child's developmental health:

*"The physical development obviously is something they really benefit from, not just cardiovascular but skills and spatial awareness and stuff."*

Irvine et al. [145] used qualitative methods to understand the motivations and experiences of urban park users, finding that health related outcomes were of particular importance. Usually values were expressed in terms of broader conceptions of wellbeing, quality of life and lived experiences (though these were often bound together under the use of the term 'health'):

*“If I'm kind of upset about anything or if I just need to get away for a bit, I find that being by water and just staring at the waves crashing in kind of washes your emotions away ... you can get lost in that” [146].*

This reflects wider research around the meaning and relevance of the concept of the term 'health'. For many people 'health' is often packaged as part of broader sense of 'wellbeing' which includes ideas of quality of life, capabilities and so on, and this is reflected in some research studies. Dines et al. [147], for example, used the 'social model' of health in their research on public spaces in south London. Dinnie et al. [148], who also used a similar conception of health, made the link with wellbeing, *‘Wellbeing defined in this way means that relationships between health, and places and spaces which are part of people’s experiences of health are paramount’* (p2). Cairns-Nagi et al. [117] linked the cultural value of natural environment surrounding an economical depressed area of the North-East to a pocket of health resilience, *‘The natural environment emerged as another aspect of Chevington that was prominent in the minds of local residents when considering their health and wellbeing. This is related to the nostalgia of the past and local heritage, the therapeutic element of being around nature, and their sense of belonging and place attachment as already discussed’*. For the older people who participated in Day’s [139] study the environment was valued because it facilitated *‘regular contact and allowed people to grow and maintain relationships, and also to notice if someone was in poor health.’*

It must be noted that not all the evidence demonstrated an unambiguous and positive value pathway [94, 149-151]. Some people appear neutral towards the natural environment and it’s potential to support their health, while others see the natural environment as a threat [143, 152]. There are also a small number of studies which have attempted to understand how natural environments may facilitate, and be valued for providing a venue for (potentially) health damaging behaviours (such as smoking, underage sex and drug use). A Canadian study of young marijuana users, for example, demonstrated this interesting dynamic [153]. Moffat et al. found that young people thought that smoking marijuana outdoors was a healthier option than smoking it indoors, partly because marijuana use outdoors was often accompanied by an activity such as walking. For others, it was the opportunity for peace:

*“If I want to get away from all the noise in town, I know there it's quiet, it's just peaceful. There's nothing happening out there. And I find that [smoking marijuana outdoors] tranquil, very quiet, peaceful and it puts me in a good mood. It always puts a smile on my face to be able to just go walk in the woods.” [Male, age 18]*

### *How constant are values?*

There was relatively little evidence which explicitly addressed or considered how values shift through time or according to changing individual or group context, needs, and circumstances. This is an importance evidence gap. As Swanick [154] noted the values people hold in relation to the natural environment are not static and that they shift through the life course, *‘most people need to access and enjoy different types of landscape at different times and for different purposes. accessing what has been called a 'portfolio of places' that is particular to each person’*.

Bell et al.'s [146, 155] research into the therapeutic potential of the natural environment also highlighted how values, and the expression of those values, shift through the life course. Young adults, becoming parents for the first time see and value the natural environment in new ways, from feeling an increased need to protect the environment for their children, to heightened awareness of potential environmental threats. Some new parents value the restorative potential of the natural environment and as a resource to support their child's healthy development [137]. Advancing age can limit older adults' capacity to act upon the values they hold regarding the environment causing frustration and unhappiness [146].

### *How do values differ between social groups?*

Although the heterogeneity of the evidence base makes a systematic assessment difficult, the ways in the natural environment is valued for health differed between social groups, as Pinder et al. noted *'there are several ways of being human, and the outdoors does not necessarily have the same salience in all'* ([156] p354). The evidence suggests that one should not assume uniform values, and, as Hitchings noted, *'though various forms of human restoration appear to come from green space experience, whether different groups are inclined to submit to the processes that result in this restoration is another matter entirely'* [95].

There is some evidence of the irrelevance of the natural environment to health for some groups, for instance among British Asian youths [157]. In the UK ethnicity has been strongly linked to lower likelihood of positive perceptions of natural environments. MacNaghten and Urry [85] linked the 'Englishness' of the countryside with urban Asian's lack of interest in woodlands (unless used as a setting for adventure sports). This group apparently saw little value in the natural environment, and indeed saw it as a problem (e.g. leaves in the autumn making a mess). Some, especially young female Asians, saw woods as *'dark, dirty and scary places, places of bodily threat'* (p175). Other studies have found more positive values. The Asian participants in Dinnie et al.'s [148] study of urban parks in Dundee, Scotland, showed that value was ascribed to the *'sense of empathy between different users'* which contributed to a sense of wellbeing:

*"You see everyone. You see old people, people just taking their dogs for a walk, and everyone is generally giving a little smile to each other"* (Pakistani mother)

Perceptions have also been shown to be related to age groups, however the patterns are not consistent and may be context or activity dependant [158]. Bell et al. [151] found negative attitudes amongst children and young people in Scotland:

*"The countryside is boring"* (15 year-old girl, Lennoxton)

Similar attitudes have been found amongst other groups of young people [159]. Other studies, however, found young people had strong opinions on the links between environments and health [160]. Some placed a high value on natural environments, *'The 'outside' environment for these youth represented a metaphor for health itself in that youth associated 'good health' as "being outside" in a safe, clean, green, and livable space. Safe environment referred to*

*the space where youth could participate in outside activities and play safely; green meant the presence of trees, plants, and flowers; clean spaces had no litter and garbage’ [161].*

The values of the natural environment to the health of people suffering from ill health (mental or physical), experiencing social isolation and other forms of marginalisation have been explored in a number of studies [162, 163]. Typically, people reported that the natural environment was of significant value; offering respite, restoration and recuperative opportunities:

*“I walk around this wood a lot, sometimes to meet my mates but usually on my own. I cannot get a job and I am fed up. Walking around here helps me to get my head together. I do not really do anything, I just walk around. I like the peace and quiet.” (A man aged about 17 years [136])*

A Korean study found that visits to forests helped alcoholics recognise the value of their existence and promoted an *‘aspiration to live’* [164].

No studies were found which explicitly examined whether rural populations valued the natural environment differently to those living in urban areas (there are studies of nature preferences which have sought to examine this). Despite the oft quoted ‘disconnection’ of urban groups with nature, which is argued to lead to reduced wellbeing, many of the studies included in this section describe the deeply held values of urban living people. O’Brien [165], for instance, includes a quote from a young urban female:

*“It’s like a connection with nature ‘cos we are part of nature. It’s part of us because if it weren’t for trees we wouldn’t be here because they provide our oxygen, so there has to be some sort of connection. And when I walk in the park it really makes me feel like it improves my wellbeing” (Female 20 – 35, Liverpool).*

As has been noted elsewhere in this section, health values appear to be tied to the activity affordances of the natural environment and are, indeed, difficult to unpick from the values of the activities themselves. King and Church’s exploration of the environmental values of young mountain bikers demonstrates this dynamic, the authors note, *‘relationships with the nature of these spaces was based upon an appreciation of the landscape through function or what others refer to as the ‘affordances’ that an environment supports and the activities that environment invites’* [166].

A small number of studies can be used to help better understand how employment type might be associated with the perceived health values of natural environments. For example Bingley [167], writing about woodlands as working spaces, found that for the older generation of workers any health and wellbeing values were only ever referred to ‘obliquely’. She relates this to the unvarnished realities of the work, *‘Nearly every older coppicer had a tale to tell of ether themselves or other fellow workers losing fingers to saws or injuries from billhook cuts, timber rolling onto wagon loaders and so on.’* However, Bingley found variation between the generations of workers, *‘In comparison to the pragmatism of historic coppicers, the new generation narratives tend toward greater idealism, and perhaps unsurprisingly given the*

*growing awareness of the proclaimed benefits of woodland, there is more obvious acknowledgment of the restorative qualities of woodland work.'*

### *How are values formed and what influences those values?*

It is clear that to understand whether people value the environment for health it is crucial to also understand how and why values come about, what factors influence those values, and the contexts in which people develop/act on the values. However, there is, as of yet, relatively little information on how values, behaviours and so on are developed.

Past experience of the natural environment may be an important determinant of if and how people value the space for their health and wellbeing. One example of this dynamic has been explored through retrospective studies of childhood experiences and how these relate to adult perceptions [55]. Milligan and Bingley's [152] qualitative work with young people in the North West of England found that the participants who had positive experiences and recalled little parental anxiety during childhood, had noticeably less negative associations with woods than those who had less positive experiences. Self-identification with nature and concepts of 'nature connectedness' may also be important determinants of how people value natural environments for health [149, 168].

The perceived value of a natural environment to health is often socially determined (or negotiated). Dinne et al. [148] note that it is often impossible to unravel the 'social' and the 'natural' as they are so closely intertwined. The issue of crowding (presence of others in the landscape) is one manifestation of this [143], with some of the expressed value (opportunities for solitude) in natural environment disrupted by the presence of others. Writing about the urban context Dinnie et al. [148] warn, *'The behaviour of strong groups can result in social norms developing which may enhance the well-being benefits for some groups but exclude, or marginalise other groups'* (p110). However it is not only a negative association, contact with others can enhance the perceived health values of natural environments [169].

The issue of contested uses of the natural environment has a profound impact on the realisation of health values for some groups. Bell et al. found that, *'even if adults affirmed their children's need for healthy fun in 'nature', drawing from their own childhood experiences, they worried about their safety'* [151]. These parents (and indeed their children) were concerned about anti-social behaviours of others, particularly that of older children and teenagers.

The presence of 'others' (strangers, non-locals, tourists etc.), even if not engaging in contested, dangerous or threatening behaviours, can erode the values some hold about particular environments [143]. Dog walking, while one of the primary drivers for people's engagement with the natural environment [26] and valued as such for health outcomes, also has the potential to reduce the health values associated with particular places for others, particularly non-dog owners [170].

The approach taken to environmental management may also influence how people value the natural environment for health. Several papers relating to the Forestry Commission's

plantations in the South Wales Valleys highlight how communities can be alienated from a potential health resource, *'the imposed forest is seen by many as a physical barrier to accessing the 'real' natures associated with the mountains, the views and the valley sides'* [149]. The issue of 'ownership' also influences the realisation of health values, Marsden et al. [149] found, *'The surrounding forest natures that engulf Gwynfi are seen by residents as natural spaces which have been both historically imposed and externally managed from afar'*.

Feelings of 'appropriateness' [151] and of not belonging [159] impact on the ways certain population sub-groups value the natural environment for health. Bell et al. [151] suggested that the low value placed on natural environments by young girls was related to their (socially derived) perception that, *'it was not the done thing for them to go to the woods'*. Morris and O'Brien's review of barriers to accessing and using woodlands [159] showed that some disabled people felt awkward in woodlands, partly because they perceived that they did not 'belong' in woodlands. Similar views were found in the studies of disabled people's use of the natural environment by Burns et al. [171-173]. However, this is not to say that the health benefits of natural environments were not valued by people with disabilities, *'Like their non-disabled peers, they anticipate experiencing rest, recreation, recuperation and revitalisation from being in outdoors spaces. Many of our participants viewed being in/using the countryside for leisure as a desirable and a positive thing in terms of wellbeing'* [172].

#### *How do values relate to intervention options?*

Pinder et al.'s [156] study of the Thames Chase Community Forest highlighted that changes to the availability of accessible natural environments did not necessarily follow a consistent, linear impact. Whilst, for many, the intervention did relate to a change in behaviour and greater use of local natural environments, some residents, however, remained un-interested. The authors suggested that the natural environment had little 'salience' for this group. Hitchings' [95] study of inner city workers echoed these findings. Although the nearby greenspace was valued, predominantly for its health benefits and it was thought necessary to financially support them for such reasons, it was not used by the workers. Hitchings' interviews with the workers revealed that two processes were at play; first, going outdoors was not part of the culture of the workplace, and second, relaxing during the working day was inappropriate and, *'for this reason, green spaces were sometimes deemed places that were best avoided in the course of the working day'* [95].

There is very little information on how the values people hold would relate to the acceptability of different intervention options, and in particular the use of the natural environment through social prescribing, or the modification of the natural environment to promote health. This kind of information is needed to understand the potential acceptability of the natural environment as setting for health promotion. Similarly, no evidence was found regarding how acceptable people find the 'medicalisation' of nature (concept, process or outcomes). It is conceivable that the over-emphasis of the health aspects, the 'medicalisation of nature' [140], may well act as a deterrent for some, particularly those who view natural environments as a refuge from the stresses and strains of everyday life and the need to 'perform' healthy behaviours.

### *How do different professional groups value the health benefits of natural environments?*

Evidence relating to the values held by professional groups was also sought through the review. However, there appears to have been little formal exploration of if or how the values of the natural environment to health are, or are not recognised by relevant professionals (for example doctors, health commissioners, land managers and so on). This is an important evidence gap and is discussed in section 3.6.

The small amount of evidence that was found related to environmental professionals. Scott et al. [174] in their study of public perceptions of landscapes quoted a land manager who suggested his work related not only to the management for the land for economic gain but also for the benefit of the local communities:

*“I mean we produced a longer-term vision for the estate and that for me was the first step toward trying to integrate all the different things we do. We have objectives obviously for environmental improvement but also to ensure that our farmers can make a good living and balancing the whole sort of property portfolio of the estate and also trying to benefit the local community. So there is the beginnings of trying to have an integrated and holistic approach to everything we do here that tries to create, I suppose, in some way a healthy community, people and a good relationship with the landscape around.”*

Scott et al. also quoted a landscape planner:

*“Nobody is going to die if we get it wrong. It is not hugely essential, but it is, all of these things add up a lot to improve on the general quality of life and there is huge amounts of research that say how important that is. The difference it can make to people’s lives really. So yeah, it is not rocket science, it is not essential, but it helps. My god that’s enough philosophy!”* [174]

Similar sentiments were found in a study of forestry in the South Wales Valleys [175]. Whilst the production of trees for timber and profit was paramount, maintaining the forest as a healthy and safe environment, which is accessible to the general population was also increasingly important. However, there was reluctance among some of the Forestry staff to involve themselves too heavily in health:

*“But we are not Social Workers — we are professional foresters and we like to think that we know what to do”* (FCW, male: 34–40).

### **Review conclusion**

This brief review has demonstrated that people do value natural environments for health, that the values are expressed in many different ways and appear to differ according to life stage, activity and in relation to both internal (to the individual) and external factors such as the socio-cultural context. There is still a need to better understand the values people hold because, *‘understanding how values are conceived, formed, expressed and represented is crucial for good decision-making. Across the world there exists diverse understandings and conceptualizations of the values of nature, nature’s benefit to people and a good quality of*

*life. These different worldviews, cultural beliefs and norms influence the predominant types of values and the ways in which they are articulated. Values are also informed by the context in which they develop including one's environment, socio-cultural norms.'* ([135] p5).

### 3.6 Limitations of the current evidence base and evidence gaps

Through the production of the evidence statement [79], the review of values, policy and practice, and the prioritisation events (see Appendix 4 - Appendix 6) a number of limitations and gaps in the evidence base have been identified.

#### Limitations of existing evidence

Much of the existing evidence regarding the links between exposure to or use of the natural environment on health outcomes is derived from studies which are not able to reveal causal pathways and is subject to a range of methodological weaknesses [6, 20]. However, despite the weaknesses discussed in the following section, Sandifer et al [16] state that it is 'exceptionally important' to note that the overwhelming evidence in this area finds a wide range of positive health responses to natural environments.

Church et al. (2011) note that there has been relatively little use of longitudinal data, though there are increasing examples (for example [93, 105, 106]). The lack of studies using longitudinal data is likely due to the lack of available datasets and the prohibitive cost of developing new cohorts. Natural experimental designs have also been rarely used to examine the impacts of changes in policy and practice (for instance the creation of the South Downs National Park could have been explored as an interesting natural experiment in access). There are further issues regarding the robustness of the evidence base. Sandifer et al. [16] and others have noted that many studies lacked adequate controls, sample sizes and duration, and often rely on self-reported information rather than objective data.

Many epidemiological studies rely on a small number of datasets which detail visits to the natural environment. While these data are enormously valuable there are limitations that are under explored. For instance Mulder et al. [176] found that demand for access to natural environments and 'countryside recreation' amongst young people was closely linked to supply, meaning that if there were accessible countryside facilities close by then young people would tend to use them.

There is substantial evidence which suggests that there is variation in the outcomes of exposure to or use of the natural environment according to social or demographic group, however these patterns are not always consistent. This inconsistency may be partially related to subtle differences in how the i) environment or health was conceived and approached and ii) how evidence was gathered or analysed [6, 35]. A more systematic approach may be needed to better inform decision making processes.

Currently the evidence base is limited by a lack of studies which have been specifically designed to inform the development of policy and interventions. Both Shanahan et al. [38] and Hartig et al. [16] highlight the need to support environmental policy and delivery more effectively by improving assessments of what nature can and cannot do for human health and wellbeing. A particular issue relates to the potential, due to the limited evidence base and research capacity, to miss or miss-understand effective intervention options. Rutter and others have argued that there is a risk to the over-reliance on RCTs and evidence of the cost-effectiveness of individual interventions (particularly where the evidence has been divorced from the context in which it was produced), suggesting it may devalue the potential contributory and cumulative effective of suites of activity within a system [177-179]. Further, by only considering commissioning or using interventions for which there is cost-effectiveness evidence we may overlook plausible and potentially effective activities.

On the other hand, there is a large volume of small-scale evaluative activity which could enhance our understanding of the ways in which the environment is or could be used to benefit health. However, evaluations are often not of a quality suitable to inform policy and practice and are rarely disseminated and shared effectively. There is a need to develop practical ways in which to support cost-effective but robust evaluations, and to gather and synthesise this evidence [69]. The use of evaluability assessments [180] would help target and refine evaluation activity.

Currently the evidence regarding the monetary values of natural environments for health outcomes is limited and couched in caveats. Additional valuation evidence is needed, including work to better understand and account for the variation in health values associated with the natural environment and the benefits and cost effectiveness of different policy and intervention options.

Although the evidence base is cross-disciplinary it appears to be rarely inter- or trans-disciplinary [52]. Further cross-sectoral and inter- or trans-disciplinary evidence is required. For example, Sandifer et al. [181 p1] highlight the need for '*a new coalition of ecologists, health and social scientists and planners to conduct research and develop policies that promote human interaction with nature and biodiversity*'. Alongside quantitative data, collection of qualitative evidence should also be supported as it can provide valuable information to help understand and inform the design of interventions for particular target groups [95, 99]. The linkages between natural environments and health are complex and likely to impact on a number of health, social, cultural and educational outcomes. Despite this, current research and evaluation approaches often fail to effectively identify the breadth of impact. A better understanding of the complexity of outcomes may help support valuation activity and more integrated policy and delivery.

### **Evidence gaps and needs**

There is a lack of evidence regarding i) how the values of the natural environment are understood and acted upon by professionals or within institutions, ii) the acceptability of

green prescription type approaches, and iii) how acceptability may vary by social group or according to health outcome targeted or approach taken.

There is also a need for a greater understanding of the socio-cultural factors – specifically those related to the social and cultural norms and values, living context, demographics, and a number of the moderators and mediators listed in Figure 2 – in determining the health and wellbeing impacts observed. This need was identified by Popay et al. [182] who argued that, specifically in relation to place based effects on health inequalities, there has been, *‘...inadequate attention paid to the role of social organisations, processes and relationships...and to the development of concepts which will help explain why individuals and groups behave in the way they do in the context of wider social structures’* (p627).

Whilst there are several systematic reviews of related topics ([99, 170, 183-190] and see Appendix 2) none of the reviews relating to natural environments have explored the socio-cultural contextual mechanisms which may influence particular demographic groups’ use, access or potential to benefit from natural environments. Behavioural sciences may, by building on the segmentation studies undertaken [158], help elucidate how to develop and package messages more effectively for different social groups [191]. There is also a need to examine further how values shift through time or according to individual/group context, needs and circumstances [192]{Bell, 2016 #25390}. This is an important evidence gap as it may help explain some of the variation in direct health outcomes that have been observed in several studies.

Wolf and Robbins [47] and others [192] have suggested that, *‘there is a clear need for development of valuation methodologies and new approaches to understanding the potential economic outcomes of the benefits’* (p395). They argue that there may be value in developing a *‘platform of common assessment that standardizes benefit measurement and nature units. Future research on benefits could then generate comparable findings as values for policy inputs across communities and metro areas’* (p395).

Specific gaps in our understanding of impacts and in realising the benefits of exposure to the natural environment include:

- What factors or interventions are effective in encouraging health related use of the natural environment?
- What are the necessary conditions for natural environments to be effective in promoting health?
- At what life stage are interventions to promote the health benefits of natural environments most effective?
- Which interventions are most effective for different health conditions?
- How can benefits to population health be achieved through environmental interventions without exacerbating health inequalities?
- What role does the natural environment have in promoting individual or community health related resilience (particularly in relation to multiple deprivation)?

## 3.7 Conclusions

### What do we know?

Although there are a number of issues regarding the consistency, robustness and reliability of the evidence base, natural environments are important contributory determinants of health.

The ways in which we design, site and maintain natural environments have impacts on our health. Typically living in greener environments has a range of positive health outcomes, to mental and physical health, which are relatively consistent. Some interventions which aim to increase engagement or use of the environment, or which use the environment to improve specific health outcomes have been shown to have some potential.

People value the natural environment for its role in contributing to or improving health. However, this differs according to socio-cultural group, geographical and political context and through the life course. As Dines et al. [147] stated, experiences and perceptions, *'can be both negative and positive (and often contradictory), unconscious and conscious, and are mediated by people's multiple and evolving social identities, such as age, gender, social class and ethnicity'*.

### What don't we know?

There are several key research gaps and needs, these include: the mechanisms which lead to health gain; little understanding of the factors which are most effective in encouraging health related use of the natural environment; the necessary conditions for health promoting natural environments; the life stages to target with specific interventions; and how better population health can be achieved through environmental interventions without exacerbating health inequalities. Little is known about institutional perceptions or the acceptability of different intervention options.

### What does this mean for policy and decision making?

The weight of the evidence suggests that those with responsibility for managing the natural environment (including Defra and the other departments) should recognise these relevance of the natural environment for health and integrate/consider these relationships in future decision making. The most convincing evidence suggests that creating and maintaining good quality *green places* (e.g. living environments) is most strongly associated with health, however there is also good evidence that (discrete) *green spaces* are of value. Policy makers should be cognizant of the impacts of environmental management and perceptions of ownership on the values of natural places in relation to health.

The evidence base is, however, limited in utility for policy and decision making. One particular issue is that impacts differ across spatial, temporal and social-cultural contexts and scales, and that they are not absolute nor static, shifting *'according to local and global events and to changing individual or social circumstances, the external environment and new information'* [135]. This makes gathering representative scalable evidence, suitable to inform

decision making, difficult. Furthermore, the systematic collation and appraisal of the evidence on effective policy and delivery options is currently lacking.

## 4 Extent of natural environment and health activity

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There is currently considerable activity focusing on promoting, demonstrating and harnessing the potential of the natural environment in achieving good health outcomes. Whilst a comprehensive survey was outside of the time and resources available to this project the extent of the range of programmes, projects and initiatives underway is demonstrated.

Throughout this section four case studies are used to illustrate, in more detail, the experiences of particular organisations or networks, or the (potential) application of key mechanisms. The case studies were selected so as to illustrate the range of activity and types of approaches taken to linking natural environments to health, to allow for a more in-depth examination of prominent decision-making processes, and to relate to activity at a range of scales. The topics of the case studies are:

Case study 1. Health intervention delivery on Exmoor and Dartmoor (page 64)

Case study 2. Coordinating health intervention activity in the Liverpool region (page 69)

Case study 3. Collaboration between a Local Authority and academic institution (page 78)

Case study 4. The Natural Capital agenda (page 86).

### 4.1 Who is involved?

There are many organisations involved in activity which aims to recognise, promote or harness the health potential of the natural environment, including governmental departments, research institutions, funding bodies, 3<sup>rd</sup> sector and civil society organisations, and the private and commercial sector.

At the departmental delivery level (England), whilst activity is limited, it is clear that the relevance of the natural environment to health are considered. Health is a key theme within the activities of Defra's Local Nature Partnerships (LNPs) and the health impacts of new pocket parks were considered by the Department for Communities and Local Government<sup>11</sup>. Agencies of departments, such as Natural England and the Forestry Commission (in the case of Defra), are, arguably, more active in considering health. The Forestry Commission used the woodland grants system to target health [193] and Natural England has addressed health (and wider outcomes) through many of its activities including the outdoor learning and accessible environments programmes. Within DH Public Health England has a Healthy Places, Health People programme<sup>12</sup>.

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<sup>11</sup> [Pocket Parks](#)

<sup>12</sup> [Healthy Places, Healthy People](#) PHE

At a local level many Local Authorities commission, deliver or support activity which aims to harness the health values of natural environments. A variety of LA departments are involved, typically initiatives or programmes will be led by planning, environment, public health, and/or Health and Wellbeing Boards. In some cases, these activities are coordinated through Local Nature Partnerships. Northampton LNP, for example, has produced a ‘Health and Wellbeing in the Environment Proposition Paper’. The document aims to support the commissioning of services by illustrating the value of the natural environment as a resource to promote and maintain health and by providing details of a range of projects and programmes.

The vast majority of activity identified appears to be being driven by the Non-Governmental Organisations (NGOs) such as the RSPB and Wildlife Trusts (WT). Again, these are often linked to Local Nature Partnerships or other locally focused networks, however many are specific to the organisation. There is a small amount of environmental focused social prescription activity happening within primary health care settings. Typically, a doctor or other health professional refers a patient to a formal programme of activity such as health walks or environmental volunteering [194, 195]. These programmes are often provided by NGOs or trained environmental therapists). A survey undertaken in 2010 [114] of Scottish ‘Green Interventions’ found over 170 formal programmes where patients were referred to schemes which used the natural environment as a context for supported physical activity. Natural England have undertaken a similar review of the use of green care prescriptions [194, 195].

There are a number of cross-sectoral organisations, professional bodies and networks who aim to support activity:

- The Ecosystem Knowledge Network.<sup>13</sup>
- Natural England’s Outdoors for All groups.<sup>14</sup>
- The Living With Environmental Change<sup>15</sup> network.
- The Landscape Institute<sup>16</sup> and Town and Country Planning Institute.<sup>17</sup>
- The Green Infrastructure Partnership.<sup>18</sup>
- Healthy Environment Network (Scotland)<sup>19</sup>
- Wales Environmental Research Hub.<sup>20</sup>
- Green Exercise Hub (Scotland).<sup>21</sup>
- The Green Exercise Partnership (Wales).<sup>22</sup>

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<sup>13</sup> [EKN](#)

<sup>14</sup> [Natural England OFA](#)

<sup>15</sup> [LWEC](#)

<sup>16</sup> [Landscape Institute](#)

<sup>17</sup> [TCPA](#)

<sup>18</sup> [Green infrastructure partnership](#)

<sup>19</sup> [HEN](#)

<sup>20</sup> [Wales Environment Research Hub](#)

<sup>21</sup> [SNH Green Exercise Hub](#)

<sup>22</sup> [Green Exercise Partnership](#), Wales

- The Scottish Green Exercise Partnership.<sup>23</sup>

## 4.2 Who funds the activities?

Funding mechanisms vary according to the activity. Mechanisms include:

- Central funding from Governmental departments and Local Authorities
- EU structural and investment funds
- Environmental grants (CAP, Forestry Commission etc.)
- Funding awards from charitable bodies such as Big Lottery, Heritage Lottery fund, Esme Fairbairn
- Corporate sponsorship
- Social impact bonds
- Local subscription (e.g. Rethinking Parks)
- Health care intervention funding
- Health and social care commissioning
- Section 106 (a mechanism which aims to make development proposals more acceptable)

## 4.3 Examples of activity

As noted previously there is a wealth of practical activity linking the natural environment to health. Following the typology of intervention types (see Table 1 page 36) in relation to the siting, design or maintenance of the natural environment the activity ranges from national scale efforts to improving public access to the coast to the Royal Horticultural Society's promotion of the greater consideration of the values of gardens and other managed natural environments to health. At a more local scale many county councils are considering how to configure their natural spaces to benefit health (as well as the environment). Surrey County Council, for example, undertook an assessment of the availability and accessibility of greenspaces using the Accessible Natural Green Space Standard (ANGSt) framework. In terms of management, the Green Flag award, the benchmark national standard for parks and green spaces in the UK, considers potential for improved health and equity of access in the judging criteria (also see Case study 3 Section 4.9).

There is also much activity which seeks to improve and encourage access, engagement with and use of the natural environment, some of which is specifically linked to health outcomes. The 'Mosaic' project, for example, led by the Campaign for National Parks, aimed to encourage and enable black and minority ethnic groups to engage with National Parks. Similar activities are run by other landowners and managers, and particularly by 3<sup>rd</sup> sector organisations such as the National Trust.

There has also been a growth in targeted health interventions using or based in the natural environment. A key example of this is The Conservation Volunteer's (TCV) 'Green Gym' programme. This is a well-established programme where volunteers or people referred to the

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<sup>23</sup> [Green Exercise Partnership](#), Scotland

activities undertake a range of environmental improvement. In late 2014 TCV received funding from NESTA to scale-up activity and further develop the sustainability of delivery and in 2015 it was awarded an award by the Royal Society for Public Health. In Scotland, the ‘Branching Out’ project, led by Forestry Commission Scotland in association with several NHS Boards, takes a social prescribing approach to address poor health amongst marginalised groups. Similar approaches are being developed in numerous other areas; in Cornwall, for example, the ‘Dose of Nature’ project uses psycho-therapy in the natural environment. The ‘Natural Health Service’ for Weymouth and Portland project (which evolved from a GP led initiative) aims to deliver a programme of activities in the natural environment to everyone in the Weymouth and Portland area with low risk mental health or physical health. The Dorset Coast Forum leads the work, with funding from the Dorset Clinical Commissioning Group and Dorset County Council, RSPB and the Olympic Legacy Fund.

A comprehensive audit of the breadth of activity would be useful and would inform future decision making. To some degree this is underway [194, 195][196] . However, there is potential that the information will be patchy and further work will be needed to bring the results together and to ensure the information is current.

## 4.4 Case study 1. Health intervention delivery on Exmoor and Dartmoor

Case study 1 focuses on The Naturally Healthy Project which uses social prescribing methodologies to increase engagement with Dartmoor and Exmoor National Parks for health gain.

### **Intervention type/s:**

*Encouragement of access, engagement and use of the natural environment*

*Targeted health interventions using or based in the natural environment*

### **Who’s involved?**

Devon County Council (Public Health, Health and Wellbeing Board, Ecology), Dartmoor and Exmoor National Parks Authorities, Devon LNP and LEP, local health care practitioners

### **What is the activity?**

The ‘Naturally Healthy Project’, supported by Devon LNP and Health and Wellbeing Board (HWbW) and the two National Parks Authorities, aims to achieve improvements to mental and emotional wellbeing and physical health through interaction and engagement with the landscapes, wildlife, habitats and the recreational opportunities of Dartmoor and Exmoor National Park. Naturally Healthy project officers are working to bring together environmental and countryside practitioners with health, wellbeing and social care

professionals. They aim to foster meaningful long-term engagement with the National Parks amongst local people with a range of health and wellbeing problems, low levels of engagement, or suffering various forms of marginalisation.

The projects are funded by the LAs and NPAs (therefore funds relate to DCLG, DH and Defra).

The two Naturally Healthy projects, whilst both under the same banner, have taken different approaches. The Exmoor project has focused on facilitating access amongst under-represented groups and taking a ‘health-by-stealth’ approach. The Dartmoor project has taken a community development approach to facilitate access for those disengaged from using their local natural environment. Both projects have a strong health focus (not least because of the involvement of Devon/Somerset Public Health etc.) and are focusing on engaging those with poor mental and physical health. The project officers aim to eventually work with local GPs to deliver or facilitate ‘green prescription’ type activity. In the early stages of the work the project officers scoped the needs and desires of both the local health and care sector and of the patients regarding the approaches for the green prescriptions. Topics addressed included identifying the most suitable leadership, activities, conditions to focus on, and mechanisms for actually getting people outdoors (e.g. GPS prescriptions, facilitated, self-directed etc.). The various projects, informed by this consultation, are then piloted with small groups identified through GP’s practices, support groups and other pathways.

The Naturally Healthy projects contribute to Devon LNP’s vision<sup>24</sup> that *‘Everyone in Devon has the opportunity, and the confidence, to be ‘naturally active’ in order to improve their health and wellbeing’*. The LNP has focused considerable effort on engaging with health and recognises the potential of the natural environment to contribute to health challenges. The natural environment is considered to be a valuable asset, *‘Improving access is a must if we’re to harness Devon’s natural benefits and reduce inequalities in health. Devon provides endless opportunities for being ‘naturally active’, but many of us don’t benefit from the environment, particularly those over 65, those on low pay or unemployed, members of minority groups and people with disabilities or long-term illness’*<sup>25</sup>

An evidence based approach was taken from the start. It was decided that the preparation of a comprehensive and reliable report, detailing current evidence, intervention opportunities and methods of engagement, would be of greater value than several (very small) pilot activities [197]. The report was funded by district Public Health grant money, with a small contribution from the LNP. The aims of the document were to help direct the Naturally Healthy projects (and LNP theme), but also to act as a resource for others. The intention was to produce a report which would support a long term and sustainable strategy, that would benefit people’s health, the environment sector and which was balanced with national scale reliable evidence but had relevance to local communities. A ‘business case’

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<sup>24</sup> Natural Devon, [Naturally Healthy](#) Devon

<sup>25</sup> Natural Devon, [Naturally Healthy](#) Devon

was also prepared and made available on the Devon LNP website<sup>26</sup>. The report includes generic evidence that indicates the strength of the environment-health links (especially who benefits and in what ways), potential implications for specific conditions, and current knowledge regarding access and the factors that can act as barriers. Data from MENE was used to complete this activity. The authors did not prioritise quantitative or economic evidence in the report and specifically sought out qualitative and process evidence to help understand the factors which prevent people engaging with the natural environment. Some primary research was carried out (using a focus group approach, partly because they were the most effective way of completing the research in the time and resources they had). They did not carry out a Cost Benefit Analysis because the intention was already there to undertake the project. Much of the resource used in the development stages was indirect and represented officer time during the exploratory stages.

### **What will be the outcomes?**

The project officers are undertaking action research with all those involved to better understand the barriers and facilitators of success and will undertake an assessment of the health outcomes of those engaged with the project (using standardised measures). Plymouth University has undertaken an evaluation of the project.

Both projects will attempt to identify what works (and what doesn't) in engaging local people with the natural environment for health gain. There is a particular focus on ensuring the sustainability of the interventions, however there are significant barriers to overcome, for instance despite an ambition to help the groups become self-supporting young carers don't want to take on further responsibility in leading groups themselves.

### **What factors facilitated the activity?**

Various factors appear to have facilitated the Naturally Health projects, these range from from the opportunities offered by the LNPs to the enthusiasm of individuals.

The situating of certain health responsibilities within the Local Authorities, for example the Health and Wellbeing Board, gave staff some independence from working within the NHS system, extra management capacity, and flexibility in the types of activities they are able to consider. This was thought to be an important factor in facilitating the project.

The 'Naturally Healthy' theme and the LNP's interest in upstream interventions helped create the context in which the projects were considered and funded. The structure and membership of the LNPs, for example Devon CC leads one of the local LNPs, also helped facilitate the environment-health projects. The opportunities for knowledge sharing and awareness of other organisations' interests and activities provided by the cross-sectoral nature of the LNPs was also contributory. It was suggested that without the LNP the join-up of the separate projects happening in the council, National Parks, and NGOs might not

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<sup>26</sup> [Naturally Health Devon business case](#)

have happened. The links between the Health and Wellbeing Boards and National Parks etc. at LNP board level has also given direction to the LNP's health activities.

The legacy of activity around the Dartmoor site was a further factor which facilitated the projects. For instance, in one town the GP Practice manager was known to be open to the potential of 'non-traditional' health promotion activity and was receptive to the idea when approached. Similarly, legacy was an important factor in supporting Exmoor National Park's involvement. Exmoor National Park's had a good track record of working with key groups under-represented in using the moor including black and minority ethnic groups,, younger people, youth at risk and so on, through the 'Mosaic' project.

Further factors which were thought to have facilitated the activity included:

- Legacy of related activity and previous interventions (e.g. walking for health programmes)
- Perceived competency across the partners
- The desire for creative activity to address key conditions (e.g. poor mental health) and preventing the worsening of certain conditions, particularly focusing on mid-life care, targeting those conditions that present during this period in an effort to reduce impact later in life.
- Focus on prevention
- Integration of social care
- Individuals enthusiasm and knowledge

### **Will the activity be sustainable?**

The LNP's health related activity will continue, the intention is to make linkages with the green infrastructure agenda and section 106 opportunities. This may include incorporating features such as play parks and 'trim trails' into local plans. However, the future of the Naturally Healthy projects is less certain, partially due to the tightening of Public Health budgets.

Potential barriers to future follow-on activity related to the financial constraints of the Local Authority settlement and the risk of needing to dealing with crises (for example, one local CCG was at the time undergoing financial difficulties making interaction and meaningful engagement to explore this type of activity more difficult).

The links formed between individuals, or between institutions such as Devon CC and Somerset CC, and other organisations will contribute to the potential sustainability of the projects, however this is often dependant on the personalities and interests of key people in key positions.

The health sector's prevention agenda may also help ensure the longer term sustainability of the activities. However, there is a potential that these types of activities will be edged

out by the need to focus on core, statutory obligations. Due to the cross-cutting nature of the activities, it is not clear who would have ‘ownership’ in the long term.

## 4.5 Decision making processes

Unsurprisingly, due to the range of organisations who have some interest in the potential of the natural environment to promote health, there are many decision-making processes through which values are, or could be, recognised and integrated.

The range of decision making processes where the health values of natural environments may be considered include:

- government departmental policy and strategy (this ranges from national level activity, for instance inclusion of health-environment considerations in white papers [5, 198] through to departmental led or supported activity at a local level such as pilot schemes);
- the commissioning procedures of CCGs and local Public Health teams;
- Joint Strategic Needs Assessments within Local Authorities;
- Environmental and Health Impact Assessments
- spatial and built planning decisions;
- environmental management (parks etc.); and
- funding award mechanisms (public/private).

Similarly there are a number of specific frameworks which are designed to inform, support and guide decision making; the Environmental Public Health Approach [199]; Ecosystem Services (including the modified EDPSEA [200]); Natural Capital (see Section 4.10); and Green Infrastructure approaches. Novel models have been developed in certain sectors, for instance Knowsley Council (Liverpool region) have produced a Public Health model to illustrate the resource needs and outcomes of increasing participation in outdoor activity.

Although there are notable exceptions (see, for example, Case Study 2 (Section 4.6) and [201]), it appears that there is relatively little systematic decision making and, therefore, coordinated activity happening. Whilst it is recognised that the devolution agenda, the development of the LNPs and the links they were encouraged to develop with Health and Wellbeing Boards (and beyond) did represent an attempt to create a context in which more strategic and cross-sectoral decision making could take place, the review of the extent of activity (see section 4.3 and Appendix 4) and three of the case studies (Sections 4.4, 4.6, and 4.9) showed that much is local, often ad-hoc and opportunistic. Many decisions relate to activities which are short term and not part of larger sustained programmes of action. Whilst this is not necessarily an issue or weakness (and it is recognised that significant efforts are made to ensure that activities are part of sustainable and coherent programmes), it does potentially result in a number of lost opportunities. Chiefly, there is the risk that considerable amounts of knowledge can be lost; this knowledge may relate to how the particular policy or programme was initiated, supported or developed (an issue compounded by the low number

of process evaluations undertaken). Opportunities to identify and capture cross-programme best-practice may also be missed. The fragmented nature of current activity means that there are also difficulties in collating and synthesising programme outcomes in a manner suitable to inform future policy and practice.

## 4.6 Case study 2. Coordinating health intervention activity in the Liverpool region

Case study 2 focuses on the integrated activity and evidence production in relation to a range of coordinated activities linking natural environments to health in the Liverpool City region.

### Intervention type/s:

*Siting, design or maintenance of the natural environment*

*Encouragement of access, engagement and use of the natural environment*

*Targeted health interventions using or based in the natural environment*

### Who's involved?

'Nature Connected' Local Nature Partnership for Liverpool City Region, the Mersey Forest, Liverpool region LEP, Liverpool City Council, Knowsley Council, Liverpool CCG, Liverpool Primary Care Trust, North West Academic Health Services Network, Liverpool and Liverpool John Moores Universities, Natural England and many others.

### What is the activity?

Liverpool has poor levels of population health, with particular issues around childhood obesity, mental health and widening health inequalities. It has considerable and diverse natural resource; approximately 80% of the region is classified as blue or green space. There are concerns that the social and environmental 'values' of the blue/green spaces are of low priority, for instance in early 2015 a plan to sell Sefton Park Meadows, 11 acres of land that adjoin Sefton Park, to developers was considered.

Despite this, Liverpool city region could be argued to be at the forefront of activity which links local environmental resources with health promotion. There is a relatively strong and coherent network of individuals and organisations (universities, governmental and 3<sup>rd</sup> sector) who have worked together for some time to promote and enable the realisation of the health values of the diverse natural environments in and around Liverpool. In addition to high quality delivery, many of the activities have focused on improving decision making, promoting and facilitating projects, and better evaluating outcomes. Key activities have included:

- The Liverpool Green Infrastructure Strategy, commissioned by Liverpool City Council Planning Business Unit and Liverpool Primary Care Trust and prepared by The Mersey Forest. The Strategy resulted in:
  - *Joint working between Liverpool City Council and the health sector in the development of policies that support improved public health through the planning of green infrastructure.*
  - *Development of a robust evidence base for the Local Development Framework and other strategic plans for the city, in particular in the areas identified for housing growth.*
  - *Development of a city-wide Green Infrastructure Strategy identifying interventions that can help address environmental and socio-economic needs and capitalise on opportunities.*

The strategy is supplemented by a searchable standalone appendix which contains a review of all relevant national, regional, sub-regional and local policy and supporting evidence<sup>27</sup>.

- The ‘Natural Choices for Health and Wellbeing’ project aimed to ‘*promote health and wellbeing in Liverpool residents by utilising natural environments and the talents and interests of communities*’. The £300,000 programme was funded by the Liverpool Primary Care Trust and administered by The Mersey Forest. Thirty-eight community groups were supported in delivering health promoting activities using the Five Ways to Wellbeing framework<sup>28</sup>.
- The ‘Natural Health Service’ consortium consists of 21 organisations (including the Forestry Commission, TCV, Groundwork, Greenspace North West, and the Mersey Forest) who work together to coordinate a coherent and sustainable business (potentially to operate as a social enterprise) which will offer natural environment based ‘products’ (interventions, activities etc.) to help improve the health and wellbeing of individuals and communities. The programme has developed a range of evidence based natural environment focussed services to help tackle a range of health and wellbeing issues<sup>29</sup>. The approach of the group is to provide a simple, single point, easy access service aimed at both health commissioning bodies and individual members of the public. A business case has been prepared to detail the consortium, offer, aims and strategies<sup>30</sup>.
- The ‘Nature4Health’ project, funded by Big Lottery’s Reaching Communities programme (£419k) and led by The Mersey Forest in partnership with Academic Health Science Network, MerseyCare and Liverpool CCG, uses the natural environment to reduce health inequalities in targeted communities in Liverpool, Sefton and St. Helens. Robust evaluations of the activities (e.g. Walking for Health, Forest Schools, Horticultural Therapy) will be led by Liverpool University and Liverpool John Moores University, outcome measures will include Hospital Anxiety and Depression

<sup>27</sup> [Liverpool GI strategy](#)

<sup>28</sup> [nef 5 ways to wellbeing](#)

<sup>29</sup> [The Natural Health Service](#)

<sup>30</sup> [Natural Health Service business case](#)

scale, Warwick-Edinburgh Mental Well-being Scale and reduced use of anti-depression type medication.

- Linked to the Natural Health Service (above) is the ‘Natural Health Service Research Centre of Excellence’. The Centre of Excellence will bring together health and clinical experts, universities, researchers, environmental and health focused NGO's to *‘develop a financially sustainable, Natural Health Service to promote physical and mental wellbeing and enable good health through high quality research and natural environment based products and services. This will be achieved through robust programmes and evidence-based research’*. The aim is to build cross-sectorial legitimacy in the use of the natural environment for health outcomes.
- Knowsley Council explicitly consider and integrate the health values of their natural spaces in decision making processes. Following 45% cuts to the environment budget, the Council undertook an asset assessment which included functionality scores for each space. These scores, when integrated with other forms of data (such as health status of local communities) are helping them prioritise their spending. A parks survey, which included head counts and user surveys to understand who, how and when the spaces were used was undertaken. They found that some parks were heavily used for active commuting, helping them to understand which local businesses they should try and engage with. Reliable standardised tools, such as WEMWBs and IPAQ scales and accelerometers (to assess activity rates), were used to compare health outcomes between the parks. Local Public Health have funded programmes of health promoting projects using the local natural spaces, these target various specific health conditions or marginalised groups.
- Nature Connected, the Liverpool region (Liverpool, Knowsley, Halton, Sefton, St Helens and Wirral) LNP aims to promote and value the natural environment, demonstrate the health benefits of healthy natural environments, and create an evidence base in support of good decisions in regeneration, planning, health, and environmental management. Liverpool LNP is strongly linked to other relevant initiatives such as the Mersey Forest and the LEP and Health and Wellbeing Board. There are good links between the LNP and LEP, particularly around the EU funded Blue Green Advisory group. However, it has not been straightforward, with a perception that it has been a ‘battle’ to get the LEPs to understand and recognise the value of the environment. There was a perception of similar struggles in engaging with the Health and Wellbeing Boards and local Public Health teams, with a need to constantly remind them about the potential environmental resource available. There appears to be a fear that the environment is not fully considered, for instance a recent physical activity strategy did not meaningfully include the outdoors.

### **What were the outcomes of the activities?**

Much effort is made to evaluate and conduct rigorous research on the impacts of the activity in the Liverpool region. As noted previously, there are strong links between the

activity providers, local universities and key knowledge transfer partners (such as the North West Academic Health Science Network).

An evaluation of the ‘Natural Choices for Health and Wellbeing’ (see above) activities (using a measures agreed upon with the health sector) highlighted a number of positive outcomes to the 3,274 participants who engaged with the 1,243 different events, including finding that the wellbeing scores of people who completed one particular project, increased by an average of 16% [201].

### **What factors facilitate or act as barriers to activity?**

Factors which have facilitated the activity are similar to those highlighted in Case Study 1 (Section 4.4).

There was a perception that individual relationships are driving much of the activity in the region rather than the institutional structures. This was especially effective where there are good links at board level between the LNP, LEP and AHSN etc. A motivated GP supported by informal networks was also thought to be a key factor in successful delivery. The health and environment sectors are considered to be quite compartmentalised and the structures put in place by the previous administration such as the LNPs and LEP did facilitate strategic interactions.

The Social Value Act is being used help make arguments for alternative forms of delivery and to find resource for more equitable approaches.

Clearly there is much successful and pioneering activity in the Liverpool region however there is a perception that there are still difficulties. It was argued that although they have everything in place (a good track record, networks of practitioners, delivery, research and so on) in Liverpool, they are still struggling to get activities commissioned by the health care sector. The reorganisation from PCT to CCG disrupted earlier advocacy processes. There was a perception that most CCGs did not understand or value the potential of the natural environment and environmental based activities, and even if commissioned the CCGs saw the activity as ‘pilots’. In one case a CCG was reportedly not sure if they are ‘allowed’ or ‘able’ to commission these kinds of activities.

There was a perception that the environment is not fully embraced by local Public Health teams. Where engagement has happened there have been stumbling blocks around the types of evidence required to justify investment or commissioning. Additionally, Public Health was thought to want a unified approach in offer and delivery (a need which is being addressed through various projects). However, there is a difficulty in keeping the link between intervention, delivery and research. Two PhDs were funded to research the health impacts of the various environmental programmes and to identify the financial incentives that are likely to increase the likelihood that the environmental interventions are commissioned but which are not in the system at the moment. They will consider outcomes of interest to the health sector such as proxy measures for avoided costs.

The lack of resource for the LNP was also felt to be a barrier to further coordinated decision making and activity. There was a perception that much of the success of the LNP is due to existing relationships and the legacy of earlier activity in the region. Despite this the LNP is considered to be important. The direct involvement of LAs, Defra and so on gives it a semi-authoritative status and provides the environment-health agenda with some level of legitimacy.

The current evidence base was felt to be both supportive and a barrier (mirroring the wider communities' perceptions as illustrated in Figure 4). Robust evidence was thought to be too general, whilst more specific evidence relating to particular interventions, health outcomes and so on, was found to be too limited in scope and extent. Further issues related to the difficulties in placing robust 'values' on the resources, activities and outcomes, and meaningful evaluation of the myriad of small scale projects. Academic time frames often did not fit with those of project delivery meaning opportunities for collaborative research were missed.

### **What is needed to ensure the activity is sustainable?**

Sustainable enduring partnerships are thought to be crucial to creating programmes that can be commissioned. The Nature4Health project, for instance, will set up a support network to include website, peer support network, information and signposting to inform and support beneficiaries.

It was argued that national piloting of key environment and health activities would help promote and lend legitimacy to the approaches they have been developing in the Liverpool region.

A further key component of sustainable programmes related to the reputation of those involved. It was argued that often the authority of the messenger was very important, for instance, an 'insider' such as the GP William Bird is able to talk plausibly with CCGs and other GPs groups.

## **4.7 Common facilitators or constraints of activity**

In drawing together the experiences documented in the Case Studies and highlighted through the discussion with the community (see Appendix 4) there are a number of common (non-evidence related) factors which appear to act as facilitators or constraints to environment-health activity.

### **Facilitators**

- Ministerial or high-level leadership drive.
- Key linkages at strategic points (e.g. between chairs of HWBs and LNPs/NPAs).
- Interest from key funders (e.g. Big Lottery).

- Change points (for instance in relation to the devolution agenda)
- Legitimacy (i.e. local action backed by national policy).
- Persuasive (not necessarily evidenced) ‘arguments’ and narratives (for instance the Nature Deficit Disorder).
- Responding to ‘big issues’ such as childhood obesity, the increases in incidences of Diabetes Type II or mental ill-health.
- Effective networks with engagement of people with strategic influence.

### **Barriers and constraints to activity**

Some of the key constraints, to the greater consideration and/or use of the natural environment for health, appear to be similar to those faced by other cross-departmental and complex issues. Many are structural and relate to the organisation of Government (Local and National). For instance, there are issues where the benefits of an activity fall outside of the departments providing the resources and with the disconnection between the tiers of local government (e.g. public health at county level but planning at a district level) in some areas. Other constraints relate to perceived ‘siloes thinking’, a lack of imagination, and an apparent failure to realise opportunities of bringing together small budgets from different areas.

As noted earlier, there is a sense that the health values of the natural environment are peripheral to the activity and concerns of both the health and environment sector. This is compounded by lack of sectoral leadership and policy drivers from Central Government.

Reorganisations and the loss of networks and knowledge may also be factors which act as barriers to establishing activity. For instance, the reorganisation from Primary Care Trusts to Clinical Commissioning Groups (CCGs) disrupted the advocacy process (see Case Study 2). Likewise changes in policy and funding structures interrupts the support for and momentum of activities.

The environmental sector appears to struggle to find and then engage with people in the health system (DoH, PFE, CCGs etc.) with sufficient interest in the use of the environment to advocate for the approach. Environmental representatives may feel ill-equipped to engage with the health sector and often lack resources to follow up and make best use of any existing opportunities to link with health bodies.

Difficulties with demonstrating impact may also constrain activity. The time frames of any health improvement as a result of environmental interventions make activity hard to justify to uncertain audiences; for instance, there is likely to be a significant time lag in demonstrating health change, such as reduced rates of obesity, through investment in urban greenspaces.

Constrained budgets are clearly a significant factor, it was argued that there is a focus on directing scarce resources to demonstrably effective treatments of disease and to statutory duties. There are also concerns that there is less resource is directed towards prevention and health promotion.

Health care systems can be rigid; it can be difficult to demonstrate, using appropriate metrics or language, that using the outdoors for health promoting activities is a feasible, cost and resource effective approach. Many CCGs are focussed on specific outcomes such as reducing unplanned admissions in-year and question whether there is evidence which shows that the natural environment could contribute to addressing these types of acute issues. Even if a CCG or other commissioning body is interested they may have difficulties in knowing who (e.g. natural environment managers, resource and intervention providers) to approach. The plurality of the 'offer' from the environment sector may be preventing uptake of therapeutic interventions; GPs, for example, may need clear guidance on who to refer patients to. Health staff (such as General Practitioners (GPs)) may feel ill-equipped to 'use' the outdoors and some may also have a lack of confidence to push for the commissioning of externally provided nature-health activities.

## 4.8 Evidence in the decision-making process

Evidence (of outcome, association, efficacy, effectiveness, or process) is (just) one of the factors which supports decision making in any policy or practice area [202]. In relation to the health values of natural environments it appears that evidence is used in multiple ways. In some situations, the perceived social or 'moral' value of the natural environment' contribution to good health has driven activity with actual evidence of any beneficial effect playing a very minor role. In other cases, it appears that the body of evidence is driving the agenda.

### Use of evidence in guidance and policy documents

There are now a considerable number of policy, position and strategy documents, from across a number of governmental departments (e.g. environment, health, and cross-departmental), Local Authorities, initiatives (such as Local Nature Partnerships), and key NGOs (for example the Conservation Volunteers, RSPB and Wildlife Trusts) which have used the evidence to support or justify arguments regarding the need to consider the health values of natural environments.

Key pieces of evidence appear to have been hugely influential, these include papers by Mitchell and colleagues at the Universities of Glasgow and Edinburgh [8, 10, 203-205]. Mitchell and Popham's two early epidemiological papers, which showed linear associations (in the most part) between the 'green-ness' of the living environment and health outcomes are cited in a great many of the documents [8, 10]. The publication of one of the papers in medical journal *The Lancet* (of which many people have heard) may have added further credibility to the evidence. The 'Green Exercise' publications originating from the team led by Jules Pretty at the University of Essex are also well represented [112]. Pretty and colleagues' messages on the dose-response appear to have resonated well [206]. This maybe because they provide an easy to understand and communicate message about the direct benefits of the natural world to health. The early (non-systematic) reviews by William Bird, a GP who created the 'Green Gym', for the RSPB are also cited regularly [207, 208]. As mentioned previously, Dr Bird is a GP and this may lend credibility to the publications.

Otherwise there are numerous uses of studies from a number from key researchers in the Netherlands and Scandinavia.

Reflecting the available evidence, epidemiological research is highly cited, as is the psychological literature. There is some use of the qualitative studies, the Woodlands for Health document [209], for instance, cites O'Brien's [210] study of people's experiences of woodlands in northwest and southeast England. The qualitative research tends to be used to add explanatory depth and to help articulate the less tangible values. Planning research is also relatively well used, this may reflect the point that many of the documents advocate for greener living environments. In later documents, the recent systematic reviews such as Bowler et al.'s [23] review of the benefits of exposure to nature are well used.

There is little health related economic or monetised evidence used in these documents (other monetised values are used, for instance in relation to higher house prices in greener areas and some willingness to pay evidence). This is not entirely unexpected as relatively few monetary values have been produced (see section 43).

The focus of the evidence used can be grouped according to: key issues ('disengagement' with nature, obesity epidemic, and increase in non-communicable disease); key outcomes (health inequalities, better quality of life and social cohesion, and reduced obesity and mental ill-health); and key mechanisms (physical activity, social contact, and 're-engagement' with nature). Popular, but perhaps under-evidenced, theories (Biophilia [211] and Nature Deficit Disorder [212]) are used to frame positions and to illustrate (particularly in the case the latter theory) and emphasise the 'problem' that needs to be addressed.

There does not appear to be any systematic differences in which types of evidence (methodology, topic) were used by different sectors (e.g. health, environmental, planning or other) or in the different types of documents. The breadth and extent of the totality of evidence available (relative to when they were produced) is not represented in the documents, a relatively narrow section of studies are included. This may have meant that the complexity of the relationships is not accurately represented. This raises questions as to whether this is symptom of poorly disseminated studies and a lack of effective knowledge mobilisation or perhaps due to the bewildering amount of research which often seems to report results that are contradictory to previous studies. Hitchings [95] commented on the limitations of the ubiquity of the certain strands of evidence in policy documents, noting that certain types of evidence, *'seek to establish how people, frequently understood as a relatively undifferentiated category, experience these environments. This makes for persuasive advocacy because, when benefits appear to be derived by everyone, it becomes much harder to argue against facilitating them. Yet one downside to this style of research is that it necessarily side-lines important cultural factors associated with how different groups have come to live and what this means for whether they will really avail themselves of these benefits. Put simply, though various forms of human restoration appear to come from green space experience, whether different groups are inclined to submit to the processes that result in this restoration is another matter entirely.'*

There is relatively little reflection of the nuance or disagreement in the evidence base. This was particularly evident in relation to the uncertainty between the role of greenspace in facilitating or encouraging higher physical activity rates. In many of the documents a clear pathway was articulated between the provision of a greater amount or access to natural spaces and greater levels of physical activity. Typically, evidence was used un-critically and on occasion ‘conceptual leaps’ were made. For example, where evidence has demonstrated an association between greater exposure to natural environments and better health, this was, occasionally, interpreted or reported as a causal link.

Although this review of the types of evidence used in policy, position and guidance documents does not illuminate which evidence is *actually* used in specific decision-making contexts, it is useful to understand which types of evidence key bodies are at least aware of. This is indicative of influence and of which evidence may have traction.

### **Accessing, interpreting and using evidence**

Whilst there now exists a useful body of evidence, some of which has been used to support decision making (see previous section) there appear to be issues with the accessibility and interpretation of evidence.

An enormous amount of evidence is published every year and it is unrealistic to expect policy makers and practitioners (or indeed academics) to maintain up-to-date knowledge on the current state of understanding in relation the breadth of factors associated with the health values of natural environments. However, a number of activities mitigate some of the associated issues. First, many of the networks mentioned in Section 4.1 have produced summaries of the evidence and toolkits which have packaged evidence according to user groups’ needs (an interesting example was produced by the United States Environmental Protection Agency<sup>31</sup>). These summaries and tools are often of most use where they are defined and produced in collaboration with the user community using participatory methods. Second, there now exist a number of systematic reviews (see Appendix 2) through which experts have systematically identified, appraised and synthesised evidence in relation to a given topic. These are hugely valuable resources. Third, many Research Councils fund ‘Knowledge Exchange’ activities (see, for example, Case study 3, Section 4.9) and Fellowships which aim to provide a bridge between academic knowledge and practitioner needs. Finally, fellowships (typically where an individual moves (in either direction) between an academic or professional context and policy or practice organisation), such as this one funded by Defra, and others through, for example, the Centre for Sustainable Health<sup>32</sup>, provide further routes through which knowledge and expertise can be translated for decision makers.

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<sup>31</sup> [EPA browser](#)

<sup>32</sup> [Sustainable health care](#)

## 4.9 Case study 3. Collaboration between a Local Authority and academic institution

Case study 3 considers ongoing interaction between Cornwall County Council and the University of Exeter (which includes R Lovell) the aim of which is to enhance evidence based decision making and to take account of the health values of natural environments in Cornwall.

### Intervention type/s:

*Siting, design or maintenance of the natural environment*

*Encouragement of access, engagement and use of the natural environment*

*Targeted health interventions using or based in the natural environment*

### Who's involved?

Cornwall Council (Environment, Sustainability, Planning departments), University of Exeter (Medical School, Environment and Sustainability Institute, College of Life Sciences, Knowledge Transfer Partnerships, NERC knowledge exchange fellow), Cornwall and Isles of Scilly LNP. Funded by the Economic and Social Research Council.

### What is the activity?

Representatives of Cornwall County Council (predominantly environment and sustainability services) and University of Exeter took part in a series of workshops, funded by the ESRC through the Impact Acceleration Accounts, to work collaboratively towards informed decision making which takes account of the health values of the natural environment. Cornwall Council wanted to know how to better balance environmental benefits (and costs) with social benefits (and costs).

Cornwall Council is responsible for managing a large amount of public open space across Cornwall. The Council aims to preserve and enhance natural habitats and biodiversity, but also recognises that the natural environment is a crucial resource to help address the relatively high levels of poor health in the county. The council needs to find approaches which allows it to be consistent across its diverse assets (which range from urban parks to beaches and RAMSAR sites), maintain effective planning responses, address identified policy gaps, better understand the scale of the assets they manage, and deal with a maintenance backlog. The Council is also keen to persuade Public Health of the value of natural environments to health. Whilst no public health representatives joined the meetings, the environment and sustainability departments were keen to find credible arguments that helped them to communicate with health. There is a strong sense that articulating and documenting the value (importantly, both monetary and non-monetary values) of natural environments to health would help form a persuasive argument to i) protect biodiversity, and ii) get people out into and appreciating their local areas. The Council also need to

know what local communities want, how they value the environment, and how they view and appreciate the need to balance the differing priorities.

However, the Council's budget is decreasing (and changing due to devolution) and it is expected to deliver 'more for less'. This has meant that it has less capacity to i) research potential management options, ii) find evidence to support arguments around the potential health benefits of protecting and enhancing natural environments, and iii) meaningfully prioritise options.

The Council identified an opportunity to work with the University of Exeter to develop evidence informed policies and practice in relation to the potential health outcomes of different maintenance and improvement options for the natural environmental assets it manages. The ESRC funds were used to:

1. Build a network between University of Exeter researchers and Cornwall Council linking evidence and policy on biodiversity, health and wellbeing, and public open space
2. Enhance dissemination and improve the relevance of the University of Exeter's research findings for end-users such as Cornwall Council. Decision making points were mapped and a Cornwall specific evidence summary relating to key questions prepared.
3. Support development of Cornwall Council policies (for instance the 'Open Space Strategy' required through the National Planning Policy Framework) which balance the protection of public open spaces for both biodiversity and population health and wellbeing.

### **What are the outcomes of the activity?**

The outcomes of the project were multi-dimensional and related to increased knowledge (for all partners) and an application for the continuation of the work.

The University of Exeter representatives advised the Council on the extent, nuance and limitations of the evidence currently available to address some of the key questions raised (this included a matrix of policy, practice and research evidence). The Council helped the researchers better understand the types of evidence needed to inform the policy and practice needs. A key knowledge gap in relation to the points at which different types of evidence are most influential (and to whom) was identified, this will be addressed in the next stage of the work.

Cornwall Council are using the outcomes of the project to help to inform the development of key Council policies such as their Open Space Strategy and Open Space Service Standards. The enhanced understating of the links between the natural environment and health will inform Section 106 decision making and have supported a successful application to the European Structural and Investment Fund programme.

### How sustainable is the activity?

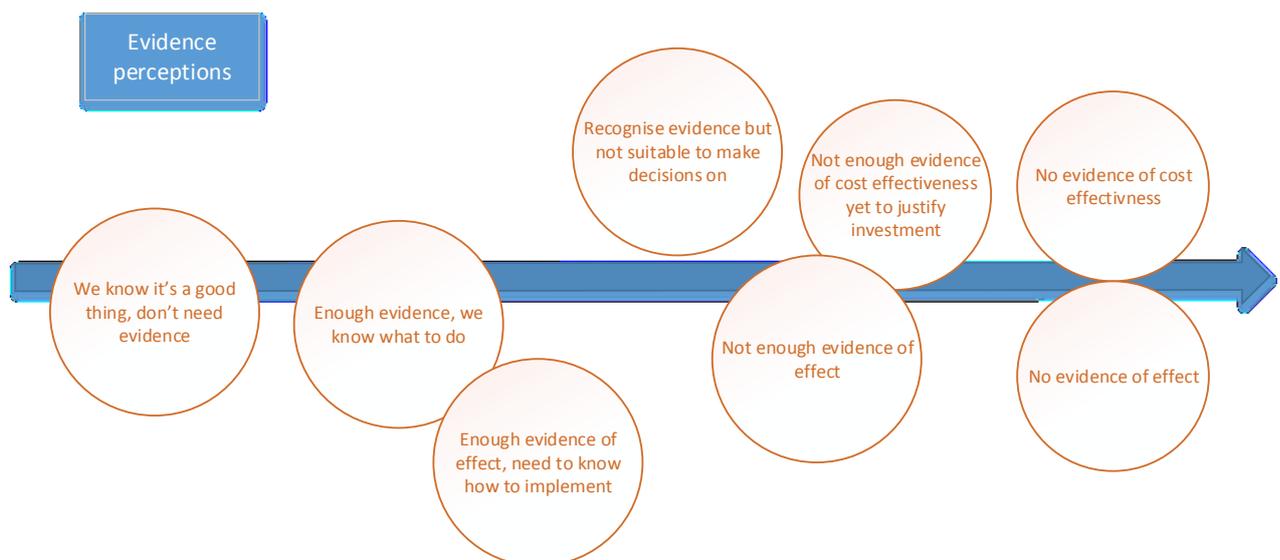
Whilst good links exist between Cornwall Council and the University of Exeter (and Cornwall and Isle of Scilly LNP) this activity was partly dependant on short term, small scale funding from a research council. The approach taken was quite time intensive (3 ½ day workshops for ~12-15 people). This is not a sustainable way to share knowledge to inform decision making (whether in term of research priorities or strategies, or in terms of Council policy and practice).

Whilst Health representatives were invited to the meetings there were unable to come. This is perhaps indicative of a wider issue. The silo-ing of departments within the single tier authority (a point which challenges the perception that two tier are any less effective) may be a barrier to sustainable coherent action. It was argued that strategy, commissioning and delivery is silo-ed within teams which often don't work well together. There is not a culture of shared assets or benefits. This may partly be due to management approaches dominant in this, and many other, LAs.

### (Perceived) Reliability and robustness of different forms of evidence

It is clear that there is a considerable range of perceptions regarding the state, value and utility of the current evidence base. Figure 4 illustrates the continuum of perceptions - from there being no need to generate (further) evidence though to there being no reliable, robust evidence of linkages - encountered through the data collection undertaken for this project.

Figure 4. Perceptions of evidence amongst policy makers and practitioners



Whilst it is recognised that decisions (at all scales) are based on many factors and, indeed, types of evidence, it was suggested (for instance by LA public health and CCG members) that the types of evidence that are prioritised (in the health sector and beyond) are those which are quantified and, where possible, monetised. It was felt that whilst other types of evidence

(including socio-cultural, non-monetary values) are useful in providing the narrative, key decision makers such as Directors of Public Health will eventually, if they can, turn to quantified clinical outcomes and, where possible, monetised evidence. However, whilst monetary valuation, and in particular in relation to health outcomes, was argued to be the most persuasive approach to demonstrating value, there was also a perception that a) important factors cannot (and, for some, should not) be monetarily valued, b) there is uncertainty and ambiguity as to the assigning of monetary values, c) there are questions regarding the extent of data suitable for use in such approaches, and d) there is a lack of reliable monetised values which is acting as a barrier to activity.

A persuasive argument could be made that it is in fact socio-cultural values and concerns that have driven much of the recent activity. An example is the perceived value of experience of the natural world to children's development and concerns that children have little opportunity to go outdoors (a concern which is manifest in the 'Nature Deficit Disorder' [212]). Articulation of this commonly held view (which is surprisingly under-evidenced) has been used to justify policy statements and activity such as Forest Schools. As the brief review of the types of evidence used in guidance documents and so on, as detailed in Section 4.8, highlights it is often the evidence which presents, or responds to a compelling narrative as to the benefits and values of the natural environment to health which is cited. What is not clear is how effective in bringing about change (in attitude, policy or service delivery) that evidence actually is.

Despite the apparent influence of non-monetary values, such evidence has, in some contexts less persuasive power than monetised evidence. There is a perception that non-monetary evidence (particularly that produced by the social sciences) is often marginalised or discounted as not being 'robust enough evidence' (often because of concerns about generalisability and reliability) for inclusion in decision making. These issues are endemic throughout the research process, for instance a recent qualitative paper was rejected from the British Medical Journal precisely because the method was an 'extremely low priority' for the journal [213]. This is not specific to the topic of this work, the general marginalisation of social science evidence in valuation and decision making was highlighted by the House of Lords Science and Technology Committee, which advocated the promotion of social science techniques in policy making [173]. In relation to the health values of natural environments, this marginalisation has led to perceived 'deficit' in these forms of evidence, with a lack of nuanced understanding suitable to *inform* decision making [192].

### **Integration of different forms of values evidence**

Where non-monetary forms of evidence are considered acceptable, there are methodological and practical questions as to how such evidence can be integrated (including with other forms of evidence) and used effectively in decision making. The BRIDGES project, funded through the first stage of the Valuing Nature Programme (VNP)<sup>33</sup>, investigated the user communities' needs and desires regarding different forms of evidence and how different ecosystem values

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<sup>33</sup> VNP [Bridges](#)

(the topic of the BRIDGES project) could be integrated into governance and decision making. Through a process of deliberative engagement with stakeholders the project highlighted key questions relating to i) understandings of values and how these differ between contexts and ways of knowing, ii) understanding the dynamic nature of the values, iii) accessing those values, and iv) matching value evidence generation and uptake by decision makers. Gomez-Baggeth et al. [214] made similar points (again in relation to ecosystem services) and highlighted the challenges of integration of different types of values in decision making which ‘*extends beyond values to other relevant information aspects, including the integration of i) disciplinary domains, ii) knowledge systems, iii) qualitative and quantitative information, iv) values emerging at different levels of societal organization, and v) value articulating institutions*’ (p18). As has been discussed previously, these are similar issues to those faced specifically by decision makers in relation to environments and health. The lack of commonly recognised (i.e. cross-sectoral) methodologies for the successful integration of monetary and non-monetary valuations (despite the activity mentioned above) is likely to be an important barrier to the use of such evidence in current health-environment decision making.

Although evidence of different value types or expressions are often produced using methodologies which are underpinned by specific (and occasionally incompatible) epistemologies and ontologies, there are methodologies and tools to identify, account for and integrate non-monetary values in decision making [215]. Raymond et al. argued for a pragmatic ‘paradigm’ which allows for the integration of the qualities of different epistemological positions [215]. Fish et al [216] produced guidance on the identification of values using participative and deliberative methodologies, noting that they are particularly effective in ‘*helping to structure the issue being addressed; informing assessments of service provision in particular a decision situation; as well as examining why, and to whom, these services matter*’ (p7). Such approaches make use of a range of methodologies including surveys, questionnaires and focus groups, group debate, and shared learning or deliberation to robustly access non-monetary values. Similar work was undertaken by Kenter [217] who discussed the different types of values produced using different methodologies and then went on to examine how analytical-deliberative methodologies could be integrated with formal decision support tools. Kenter notes that deliberative monetary valuation and multi-criteria analysis approaches offer methodologies through which different forms of values are integrated.

Maxwell et al.’s [218] discussion of the integration of non-monetary evidence in valuation and appraisal (in relation to the wellbeing and social impacts of policy options) advocates an approach which has five elements:

1. Use of a multi-criteria analysis framework (the authors note that this is the most robust method as identified in the Government’s Green Book<sup>34</sup> for assessing non-monetary evidence).

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<sup>34</sup> Government [Green Book](#)

2. The identification of key social impacts and wellbeing domains and indicators relevant in the specific policy context, including those beyond the immediate policy area.
3. A more systematic and integrated use of quantitative and qualitative evidence.
4. Enhanced stakeholder participation and deliberation.
5. A proportional approach, including light touch techniques.

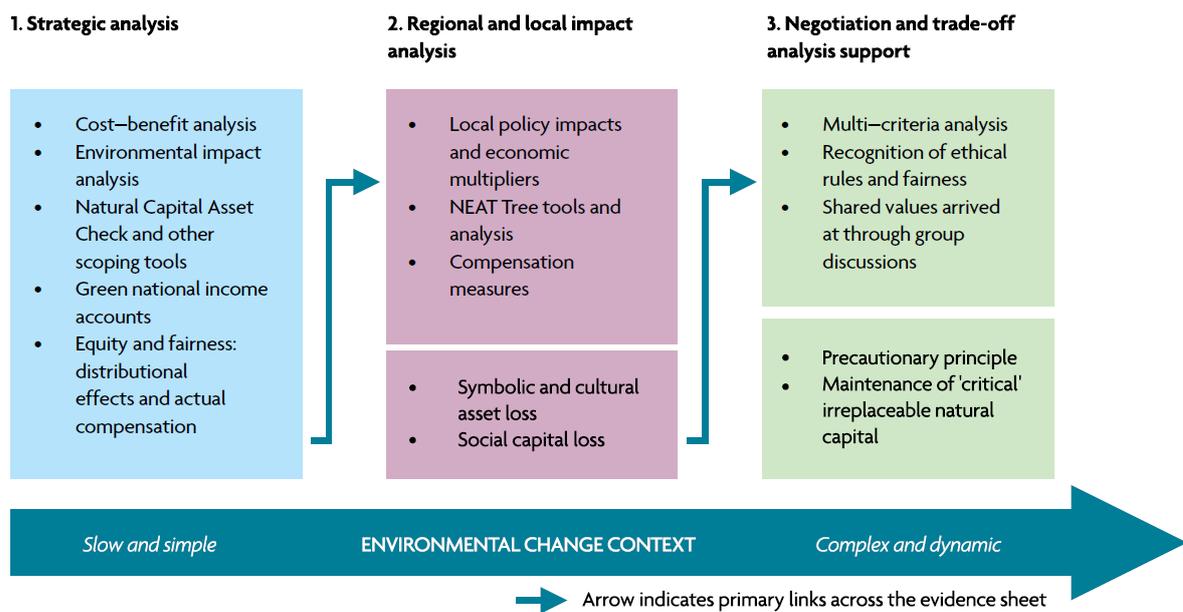
The authors review the strengths and weaknesses of various analytic-deliberative valuation and appraisal techniques and highlight the value of qualitative methodologies. The use of logic models is argued to be of particular value in framing the policy objective and the likelihood of achieving the types of outcomes anticipated. This relates well to guidance on complex health interventions produced by the Medical Research Council which also advocates the use of theoretical frameworks to guide intervention design and evaluation [219].

The OpenNess project has produced useful working papers which discuss non-monetary techniques for the valuation of ecosystem services [220] and the integrated valuation of ecosystem services [214] (see also [216-218, 221-223]). Gomez-Baggethun et al. [214] discuss integrated valuation and suggest that *'integrated valuation should support decisions on the basis of a consistent integration of multiple types of value (e.g. ecological, cultural and monetary) to inform decision making processes'* (p17). An integrated valuation approach, they suggest, must consider associated trade-offs. This is of fundamental importance when appraising health options, particularly where resources are finite and interventions are within a wider complex system. The authors note that *'Defining conditions and contexts where different values may (or may not) be compressed into single units, and defining epistemological boundaries within which different valuation approaches can be consistently combined in a single framework, are critical tasks for the research agenda on integrated ecosystem services valuation'* (p18). Five key aspects of integrated valuation are defined (p17-20), it should:

1. Involve an interdisciplinary effort comprising multiple expert domains from both the social and the natural sciences. Interdisciplinarity, transdisciplinarity, and methodological pluralism are key elements in integrated ecosystem services valuation.
2. Draw upon different knowledge systems.
3. Make use of both qualitative and quantitative information.
4. Recognise values emerging at different levels of societal organization, from individuals, to communities, to nations.
5. Accommodate different valuation rationalities.

The 'Balance Sheet Approach', developed for the UK National Ecosystem Service Assessment Follow on stage [224], provides a mechanism through which different policy options can be understood and weighed against each other. The approach encourages decision makers to collate, analyse and present data and evidence appropriate to the complexity of the policy question. The flexibility of the tool allows for the inclusion of both monetary and non-monetary values and its incremental and multi-scalar nature facilitates the consideration of trade-offs and equity of impacts (see Figure 5 reproduced from [224]).

### Figure 5. The Balance Sheet Approach



The URBES project<sup>35</sup> (funded by BiodivERsA and led by Stockholm Resilience Centre) produced options for integrating different value types in decision making processes and the next stages of the VNP will also result in health-environment specific integration methodologies. Finally, The Economics of Ecosystems and Biodiversity (TEEB) approach to ‘recognizing, demonstrating and capturing value’, while designed in relation to economic values of ecosystem services, has also been suggested to represent a simple and pragmatic approach to integrating different value types to a practical degree within a particular decision-making context (Figure 6).

**Figure 6. The Economics of Ecosystems and Biodiversity approach**

**TEEB: Recognizing, demonstrating and capturing value<sup>36</sup>.**

*Recognizing value:* in ecosystems, landscapes, species and other aspects of biodiversity is a feature of all human societies and communities, and is sometimes sufficient to ensure conservation and sustainable use. This may be the case especially where the spiritual or cultural values of nature are strong.

*Demonstrating value:* in qualitative and quantitative terms is, nevertheless, often useful for policymakers and others, such as businesses, in reaching decisions that consider the full costs and benefits of a proposed use of an ecosystem, rather than just those costs or values that enter markets in the form of private goods.

*Capturing value:* involves the introduction of mechanisms that incorporate the values of ecosystems into decision making, through policy incentives and price signals.

<sup>35</sup> [URBES](#)

<sup>36</sup> [TEEB](#)

Whilst there are clearly developing (and in some cases well-established) methodologies for the integration of different forms of values evidence in decision making (though mostly in relation to ecosystem services), there is very little discussion of application of such methods in relation to health and environment decision making contexts. The four relevant Valuing Nature Programme (a cross research council initiative) projects<sup>37</sup> go some way to addressing this deficit and will develop suitable methodologies in relation to urban greenspaces and health outcomes. There are, however, a number of specific issues related to the production and use of non-monetised evidence (some of which were addressed in Section 3.6) which will need to be addressed, these relate to the:

- Availability, suitability and extent of data.
- Consistency of socio-cultural values between social groups, environments and through time.
- The potential costs of, and expertise needed in producing place/time/issue specific data.
- The presentation of the results of socio-cultural, non-monetary valuation processes – often lacks the immediate impact of a monetary comparison and (it has been argued) requires the reader to work harder to ‘engage’ with the results.
- Unclear terminology and blurred boundaries in value meaning [220].
- The context-specific applicability of non-monetary methods [220].

As the production of reliable monetised evidence regarding the health values of natural environments is a similarly slow process and likely to be hampered by the lack of appropriate data and is of questionable utility in certain situations, the development of integrative non-monetary methodologies applicable in the myriad of decision making contexts (see section 4.5) is also crucial.

### **Limitations to the applicability of the evidence base**

Beyond the differing perceptions of value of the different forms of evidence and difficulties associated with integration within decision making contexts, a number of specific issues regarding the nature of ongoing research activity and in relation to the applicability of the existing evidence base were identified.

A key issue relates to the perception that current research activity is decoupled from any decision-making processes, with few research studies explicitly making it clear how the results will be useful and what they will add to decision makers’ knowledge. For instance, a key evidence gap has repeatedly been identified in relation to ‘where do we invest for greatest benefit?’ yet there is still very little evidence which can be used to address this question. However, it was also argued, by those working in academia, that it can be difficult to engage meaningfully, particularly in the early stages of research development or in the final stages following publication of results, with policy and decision makers. There are also

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<sup>37</sup> [VNP health projects](#)

recognised problems with anticipating or identifying the types of evidence that will be needed in future decision making.

There is a perceived lack of large scale datasets (relating to health, wellbeing, and other non-monetised and socio-cultural values) suitable to inform decision making processes or for use in analyses such as that promoted by the Natural Capital Committee (see Case Study 4, Section 4.10). Whilst the Monitor of Engagement with the Natural Environment survey (and its equivalents in the devolved administrations) is recognised to be an invaluable resource, there are certain limitations to its utility. These relate to small numbers at local level, lack of longitudinal elements, poor linkage between activity/exposure and outcome, and the (perceived) lack of relevance for medical or clinical needs. There is also a perception that it takes a relative narrow approach to environment-health mechanisms, focusing predominantly on recreation.

While aggregated models are influential it was argued they have limited utility at a local level as it is often the case that one cannot disaggregate outcomes/associations to the local situation. On the other hand, the lack of consistency between research methods, approaches (including the populations/environments studied) and outcomes means that opportunities to aggregate, synthesise and learn lessons from cases in different contexts is missed.

The time scale and resources needed for recognisably robust health research is also an issue. Whilst there is acknowledgement that evidence drawn from robust and reliable experimental designs is persuasive in decision making, the time and resource it takes to work through such research processes is often unrealistic (and potentially problematic for some public health interventions). Even where much effort has been taken to reliably evaluate interventions the time periods and outcomes used are sometimes inadequate, leading to concerns that the impacts are missed, poorly understood or potentially misleading. To ensure uptake within the health sector (and beyond), future evidence will need to relate to clinical outcomes, or use standard evaluation frameworks<sup>38</sup>.

Case studies provide opportunities to examine a particular policy or example of activity in considerable depth, however there is uncertainty as to whether it is legitimate and of any value to use such evidence to inform practice (case study designs are often to be found at the bottom of some types of hierarchies of evidence reliability<sup>39</sup>). Furthermore, concerns are raised regarding the transferability and relatability of local case study evidence to the ‘big picture’.

Finally, there is a need to find ‘routes’ between the different ‘academic cultures’. Particularly between social, environmental and medical sciences.

## 4.10 Case study 4. The Natural Capital agenda

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<sup>38</sup> [NOO standard evaluation framework](#)

<sup>39</sup> For an example see [ebnp](#)

Case study 4 addresses the Natural Capital Agenda

### Intervention type/s:

*Siting, design or maintenance of the natural environment (Primarily)*

*(but also) Encouragement of access, engagement and use of the natural environment and Targeted health interventions using or based in the natural environment*

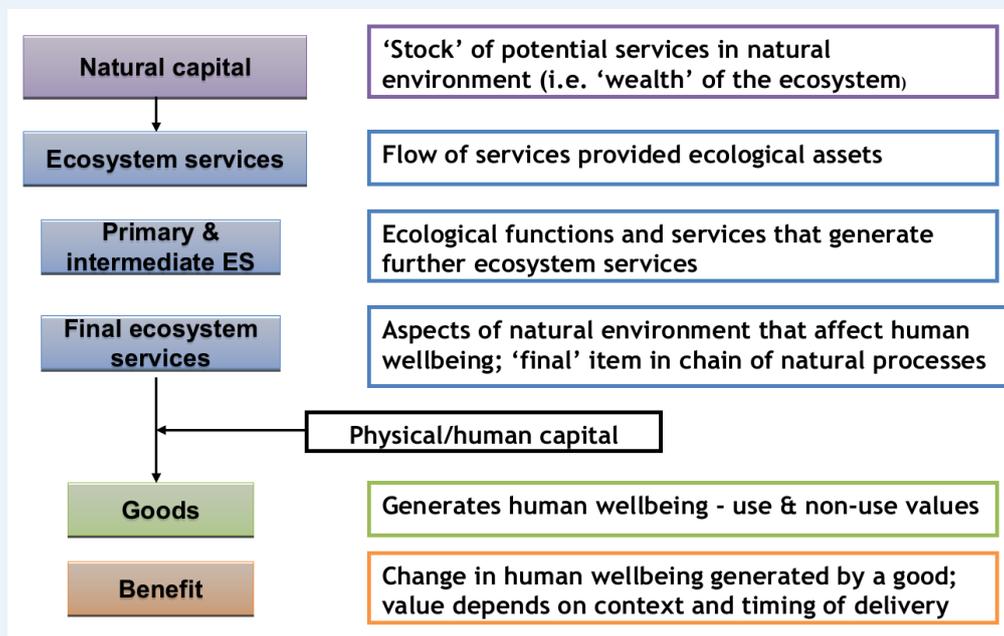
### Who's involved?

Government departments (Defra), Local Authorities, LNPs, LEPs, academic institutions, Private and 3rd sector, Natural Capital Committee/Coalition/Initiative

### What is Natural Capital and how is it linked to health?

Natural Capital is defined as referring to *'the living and non-living components of ecosystems - other than people and what they manufacture - that contribute to the generation of goods and services of value for people'* [225]. Natural Capital underpins other forms of 'capital' such as social and economic capital. Figure 7 (reproduced from Snowden 2014 [226]) illustrates the relationships between natural capital, ecosystem services, good and benefits, and other forms of capital.

**Figure 7. Natural Capital**



The Millennium Ecosystem Service Assessment highlighted the dependency of human wellbeing (and therefore) health on the natural environment. However it is clear that the state of the natural environment is declining, this has reduced capacity of ecosystems to provide the service and benefits (as articulated through the Ecosystem Service frameworks [133]) we depend on. As the Natural Capital Committee's first report noted *'Most environmental trends, both globally and nationally, paint a picture of overall decline,*

*particularly over the last 50 years... The evidence that exists indicates that the rate at which we are consuming our natural capital assets is unprecedented'* ([227] p6). Natural Capital approaches aim to take better account of the value of nature and ensure that this value fully informs decision-making [228, 229]. It is hoped that greater recognition of Natural Capital will help *'reframe debate on importance of natural environment to economy and society'*<sup>40</sup>.

There is considerable current interest in Natural Capital concepts and approaches, both nationally within government strategy, but also locally, for instance at regional or city level environmental management. Defra supports the Natural Capital Committee which aims to *'put natural capital at the centre of economic thinking; and at the heart of the way we measure economic progress'*, Scotland has produced a 'Natural Capital Asset Index' which documents relative change in the extent and condition of each of seven ecosystems [230], Birmingham City Council has developed a 'Natural Capital City model'<sup>41</sup>, and Surrey Local Nature Partnership has produced a Natural Capital Investment Strategy. North Pennines LNP produced a Natural Capital Investment Plan for LNPs<sup>42</sup>.

Different approaches to Natural Capital have been used in different places, for instance an accountancy approach has been taken by Defra and the Natural Capital Committee, while Scottish Natural Heritage has taken an asset based approach. However, it is commonly argued that the concept of Natural Capital needs to be integrated in decision making at a range of scales, *'Placing natural capital and ecosystem services into a broader decision-making context is necessary to effect large-scale transformations in policies, practices, and investments. Such considerations are not only relevant to natural resource and conservation decisions, but also for health, agriculture, energy, water security, infrastructure, urban development, finance, and national security: arenas that extend well beyond classic conservation'* ([225] p3).

There are concerns regarding how Natural Capital is valued and linked to indicators of human wellbeing (indeed there are many who are profoundly uneasy about placing a monetary value on nature [225]). Some of those who were contacted for this fellowship were reluctant to *'go down the Natural Capital'* route. This was primarily because of a concern that there are difficulties in ascribing a monetary value to many important outcomes or processes, and that techniques to integrate other forms of valuation evidence are as of yet not well accepted. Difficulties in considering factors such as equality (which are addressed by other methodologies such as the Ecosystem Approach) were also a concern [231]. Others, while accepting that there is a need to better account for the state and use of the natural environment, argued that the approach has yet to be demonstrated to be successful and stress the need for the use of logic models and/or theories of change. However, as the Environmental Audit Committee recently concluded that although *'natural capital is currently inadequately measured. There are risks from measuring it,*

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<sup>40</sup> [Hottop Natural Capital presentation](#)

<sup>41</sup> [Birmingham City Council Natural Capital model](#)

<sup>42</sup> Wild Oxfordshire [Natural capital investment plans](#)

*that in doing so it becomes something that can be monetised and traded off against other 'capitals' (including economic capital). But we share the NCC's assessment that not to do so presents the greater risks, as the NCC put it, that "what is not measured is usually ignored" [232].*

Links between health and Natural Capital (and associated concepts) have been recognised through various activities. Health was addressed by the UKNEA [133] as a multi-dimensional ecosystem service, and links between Natural Capital and environmental risk related health outcomes such as poor air quality, climate change and pathogens have been addressed. The Natural Capital Initiative have drawn attention to the linkages between Natural Capital, ecosystem services and health through publications and workshops<sup>43</sup> [233] however again much of the language used relates to ecosystems services.

The work undertaken by Nick Greyson and colleagues at Birmingham City Council does use Natural Capital language to explicitly link and demonstrate the value of the city's natural assets to health, and social and economic wellbeing (see for instance the use of spatial data to illustrate opportunities<sup>44</sup>). Using a balance sheet approach to assess i) value of the natural capital asset, ii) changes in value from its reference year, and iii) ongoing costs 'liabilities' of maintaining the value, they were able to demonstrate a net positive gain if they looked after their natural capital adequately. The approach highlighted the disassociation between the resources and the beneficiary and was especially useful to demonstrate to other departments (beyond environment) in the council that there were benefits to their bottom line flowing from the resource for which they had no responsibility. Further there are anticipated benefits from using the approach if Birmingham gets devolved powers and budget, as there is a perception it may be easier to argue for a fraction of a % of the budget to go to environment to address the multiple risk factors. Future work will link the Natural Capital assessments with the Active Parks programme (managed by the Health and Wellbeing board).

The work undertaken by Bateman et al. and reported in the 3<sup>rd</sup> Natural Capital Committee report also provides a link with health through recreational outcomes [234]. The Committee concluded that investment in urban Natural Capital *'can provide enormous recreation values, benefiting millions of people in our towns and cities. They also offer significant potential for improvements in physical and mental health which in turn will reduce health expenditures and improve labour productivity. Reduced health treatment costs alone of £2.1 billion have been estimated'* [234].

Despite the range of activity noted above there appears to have been relatively little explicit consideration of the role of the natural environment as an influence or resource for good health in relation to Natural Capital activity.

### **Challenges and opportunities**

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<sup>43</sup> [Natural Capital Initiative health workshop 2013](#)

<sup>44</sup> [Natural Capital Birmingham City Council](#)

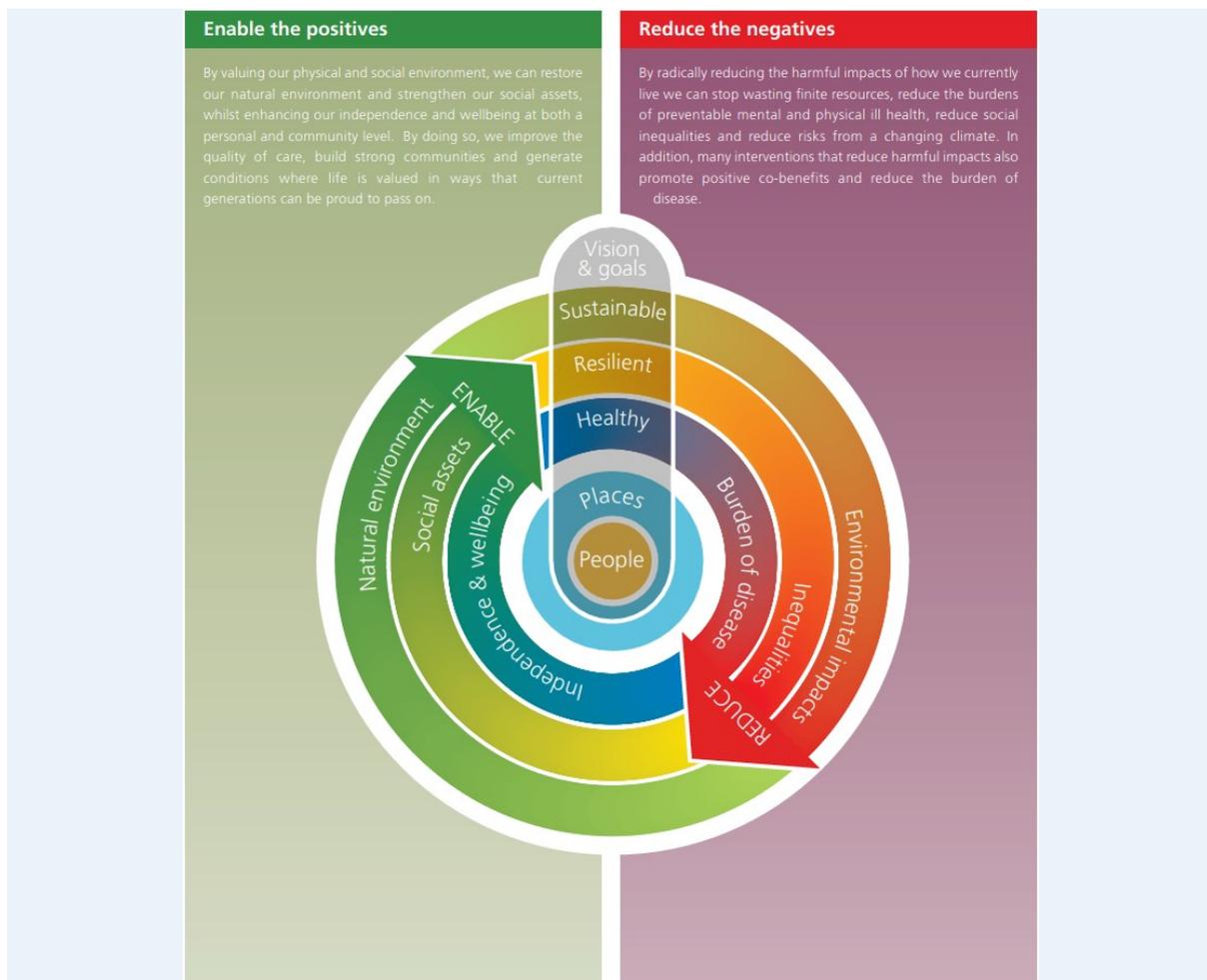
Health may provide a tangible and publicly accessible outcome for Natural Capital *'Health issues are also a major public concern, frequently motivating public action and protest, and often representing a significant portion of household budgets. Health and health care delivery are also some of the most significant areas of national, regional and local government activity and expenditure, with national primary and secondary care services typically commanding on average 9% of GDP in EU states, and are a major focus of cost-cutting measures in several countries as part of efforts to address budget deficits'* [235]. Some have argued that health needs to be considered explicitly and disaggregated from more general wellbeing in ecosystem and natural capital valuations [235]. However, there are concerns that the complexity of health outcomes (and related mechanisms) are difficult to balance with the utility of any tool or assessment outcomes. This complexity may be one of the most serious challenges, for instance as Oldfield noted (in relation to the value of urban parks) the *'individual perspective of value as notably distinct from those levelled at other scales, such as the firm or community, as it emphasised that, from this perspective, the value of a resource must be rethought as a relational property created in the interaction between people and their environment, rather than an absolute property assigned to a space'* [236].

As was highlighted in the NEA Follow On stages there is a need to identify and use language which is meaningful and persuasive to key audiences [224]. The terminology of 'Natural Capital' is not well recognised within the health sector. This may be an issue if the Natural Capital Committee's recommendation that *'In order to make progress on the delivery of greenspaces... the Department of Health, Public Health England and the National Health Service [need] to play a significantly greater role than they do at present'* ([234] p43). There is, however, some recognition of the Ecosystem Service and Green Infrastructure concepts. Although The Sustainable Development Unit's conceptual framework (Figure 8) does not use the language of 'Natural Capital' it illustrates the circularity of the linkages between environmental resources or states and health outcomes [237]. There are clear parallels between the approaches and it has been presented to a LNP as broadly in agreement with Natural Capital concepts<sup>45</sup>.

**Figure 8. Creating sustainable, resilient, healthy places and people**

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<sup>45</sup> Nature Connected presentation, [Natural capital](#)



There is similar concern that the approach has little traction within DCLG, where Green Infrastructure language and frameworks are more common. Chimbwandira (writing from the perspective of the Surrey Wildlife Trust chief executive) commented, ‘*There is very little point in developing a detailed, scientifically robust understanding of our natural capital assets in Surrey if we are not able to make this information relevant to the wide range of people who need to use it. The information needs to be used in an everyday way when decisions are being taken within the business world, by health & well-being professionals and many others*’<sup>46</sup>. Much of the language of Natural Capital is difficult for the non-expert. However Natural Capital language does potentially provide a framework of a common language for engagement with LEPs.

One of the key challenges to further consideration of health in Natural Capital assessments is the lack of suitable data for use in the dominant methodologies. As noted by Woodley-Stuart ‘*Good data is at the heart of this process*’<sup>47</sup>. Whilst there is now an extensive evidence base linking natural environment to health, it lacks the extent and consistency to be applicable using the Natural Capital approaches used in England and elsewhere. Most fundamentally there is little causal evidence or information on the type of health impacts,

<sup>46</sup> [Natural Capital Initiative](#)

<sup>47</sup> Wild Oxfordshire [Natural capital investment plan](#)

of relevance to this work, which come about as a result of environmental change (of any type). Guerry et al. [225] noted *'Although recent work has begun to describe the varied ways in which natural systems affect human health and well-being the paucity of models and tools for exploring regulating and cultural services and connecting them to human health and well-being metrics is a critical research gap'* (p3-4). Increasing interest in linking and using existing datasets (from both the environmental and health) may address some of these concerns.

As the evidence review highlighted, there is still relatively little monetisation of the health outcomes of different environmental intervention options and particularly in relation to the *siting, design or maintenance of the natural environment* (see Table 1).

The need to promote and support the collation and analysis of data relating to the linkages between health and natural environments was highlighted in the recent Natural Capital Committee advice to government on research priorities [228]. The Committee noted two key questions:

1. *As part of this how do we value the non-market, health, non-use, socio-cultural and wider benefits of natural capital and the services it provides using economic and other decision compatible measures of wellbeing?*
2. *How should we incorporate the complexity of social and cultural factors underpinning preferences within values?*

Arguably the use of a more pluralistic methodological approach and the integration of other value types (using methodologies discussed in section 4.8) would help address the questions raised above (by the Natural Capital Committee [228]). A systematic and more extensive examination of the importance of the values people hold of the natural environment to health and how this influences engagement and health outcomes is necessary to inform Natural Capital decision making. Finally, the use of logic models and theories of change would help frame linkages between Natural Capital and health and would focus future efforts.

## 4.11 Conclusions

### What is happening?

The relevance of the natural environment to health is recognised in existing practice, with examples of activity seen across departments, sectors and scales. However, no department or sector has 'ownership' or is providing the type of leadership which galvanises sustained activity. There are concerns that activity is disjointed, sectors are siloed and don't know how to 'talk' to each other, and opportunities to maximise (shrinking) budgets across/between departments are being missed.

The plurality of different frameworks and conceptualisations of the ways in which we understand the relationships between the natural environment and health, such as Ecosystem Services or Natural Capital, do not translate well between sectors. Despite this they provide valuable mechanisms to articulate the potential gains to be made through a greater consideration of the value of natural environments to health.

### **What is the role of different forms of evidence?**

The role of evidence in supporting and contributing to decision making varies greatly. In some circumstances, the evidence has supported activity and has helped make the case for action, in other situations the evidence has failed to convince decision makers that activity is justified.

Whilst decision makers often report that they typically prioritise monetised values and evidence, there is still a demand for other forms of evidence particularly that which helps understand motivations, acceptability and processes.

### **What is needed next?**

It is clear that, whilst there are a number of constraints, there is considerable interest in better understanding and harnessing the multiple ways in which the natural environment can promote better health. There is a tangible recognition that the environment represents an underutilised resource. Further, there is multi-sectorial interest in finding ways to better represent i) the potential of the natural environment to promote health and ii) the multiple values people hold, in future health-environment decision making.

## 5 Identifying opportunities and options

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In this final section of the document opportunities and options to develop and support decision making, practice and policies, which take better account of the potential of the natural environment to promote health, are discussed.

### 5.1 Complex adaptive systems?

*‘Complex issues in environmental public health require to be considered with reference to all the factors that bear upon them and in a way that links to policy. This demands a robust, flexible, but above all holistic, problem-framing approach’ [199].*

This exploration of policy and practice in relation to the health values of natural environments suggest that the current situation displays characteristics of ‘whole systems’ and ‘complex adaptive systems’. The following are key features of complex adaptive systems (taken from Garside et al. [238] p57):

- *systems are complex networks of interdependent entities*
- *systems and interactions are not fixed, but continually evolve in response to stimuli*
- *self-regulation occurs within systems*
- *complex, rather than linear, outcomes can arise, with magnifying (positive feedback) and diminishing (negative feedback) impacts possible*
- *while some uncertainty may be inevitable, nevertheless, ordered patterns of outcomes may be seen*
- *formal and informal relationships make up systems and these are central to stimulating change*
- *interactions among system components can produce new capabilities that are not inherent in the individual components (synergy)*
- *where systems are allowed to self-regulate, creativity and novelty may flourish*

Complex adaptive systems thinking has previously been applied to situations where decision making to achieve particular objectives is likely to demand the involvement of multiple partners, policy instruments and delivery methods at a variety of scales. A key example is the effort to tackle obesity [238, 239]. Whole systems thinking has informed the development of the prioritised opportunities and options detailed in the next section. Figure 9 is an adaptation of the Hawkes et al.’s [239] model which depicted the complexity of actions which could be taken by a variety of actors, from governments to individuals, to reduce obesity. The adapted version attempts to illustrate the many and varied ways in which the potential of the natural environment to contribute to improved health outcomes could be better recognised and acted upon (the density is deliberate).



## 5.2 Prioritised opportunities and options

As Figure 9 illustrates there are many ways in which we can better recognise, account for and act on potential of the natural environment to contribute to improved health outcomes in policy and practice. However, it is not feasible to recommend all such actions, there is therefore a need to identify the most effective, practical and pragmatic options.

A series of meetings and workshops were held towards the end of the project to help determine the priorities, actions and strategies to improve decision making which takes account of the relevance of the natural environment to health:

1. A meeting of academics based on the South West who focus on ecosystem services.
2. A meeting with Cornwall Council (sustainability, environment, planning, public health), and the local voluntary sector.
3. A meeting with health sector representatives.
4. A prioritisation workshop with a range of health and environmental professionals and academics.
5. An event with the Ecosystem Knowledge Network, Pennine Prospects, and 2 North-Western LNPs on environmental approaches to tackling childhood obesity.
6. A meeting with academics and policy/practice on health values for Natural Capital.

Additional activities included a range of external events and meetings and the workshops associated with the development of Defra's 25 Year Plan for the Environment. Over 80 individuals participated in the meetings, workshops and events (excluding the 25 Year Plan workshops), and therefore contributed directly to the development of the options.

In general, each of the meetings and workshops addressed the following topics:

- a. Taking stock of existing knowledge regarding environment-health values.
- b. Considering what evidence has had impact and why.
- c. Identifying potential emerging issues and opportunities.
- d. Considering longer-term strategic approaches, aligned with policy needs.
- e. Identifying key strategies (considering how, when, where and who).

Further details of the 6 meetings can be found in Appendix 8 (including in relation to Defra's 25 Year Plan development workshops).

Table 3 shows a synthesis of the key strategies, actions and needs to better recognise, account for and act on potential of the natural environment to contribute to improved health outcomes, that were identified at each of the six key meetings or events (not including the 25-year plan meetings). It should be noted that different topics were discussed at each of the meetings and the absence of a tick *does not* indicate that a particular topic was not thought to be important.

**Table 3. Prioritising needs, strategies and opportunities**

	Actions	ESS academics	Local Authority	Health sector	Cross-sectoral	Natural capital	Childhood obesity
<b>Structures and systems</b>	Breaking down silos, bringing communities of practice together	✓	✓		✓		✓
	Senior/National Leadership		✓	✓	✓		✓
<b>Decision making</b>	Mapping priorities across sectors/departments		✓	✓	✓		✓
	Needing confidence in long term plans		✓			✓	
	Need transformation funds and capacity		✓				✓
	Re-thinking timescales		✓				
	Re-thinking commissioning		✓		✓		✓
<b>Communication</b>	Translating priorities across systems and departments		✓	✓	✓		✓
	Tailoring statements of evidence (narrative, strength and robustness) appropriately to audiences	✓	✓	✓	✓	✓	✓
	Clarify what we mean by the 'Natural Environment'	✓		✓			
<b>Practice</b>	Mental health			✓	✓	✓	
	Piloting plausible interventions				✓	✓	✓
	Children		✓				✓
	Delivery mechanisms		✓	✓	✓		✓
<b>Research, evidence, data</b>	Standardised metrics (sensitive to subtle change)	✓			✓	✓	✓
	Coordinated and effective evaluative activity				✓		✓
	Clarify causality and magnitude of impacts	✓		✓	✓	✓	
	Developing, using and promoting mixed economies of evidence		✓	✓	✓		
	Clarify co-benefits	✓	✓	✓	✓	✓	✓
	More extensive social science and non-monetary values	✓	✓		✓		✓
	Developing long term and cross-sectoral measures of success		✓	✓	✓		

	Taking less reductionist approaches, understanding process and impact within context	✓		✓		✓	✓
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By drawing on the outcomes of the workshops and on the results of the review of evidence (section 3) and policy and practice (sections 2 and 4) a set of ten prioritised actions and opportunities were developed:

First, evidence and evaluation options:

1. Supporting the ongoing collation of robust, causal and explanatory evidence.
2. Effective evaluation and mixed economies of evidence.
3. Identifying what works, for whom and when, and piloting activity.

Second, in relation to policy and practice options:

1. Supporting the development of plausible mental health, physical activity and obesity interventions in key target groups.
2. Engage children with nature and foster lifelong motivations to use natural environments for healthful activities.
3. Improve the amount, quality, standards and accessibility of urban natural environments.
4. Building on the potential of National Parks and other designated spaces.
5. Developing and implementing the use of Social and Environmental Impact Bonds.

Third, options relating to structures and systems, decision making, and communication:

1. Strategic cross-sectoral and departmental working.
2. Ensuring sustainability and continuity of activity.

The opportunities and options are not exclusive and, indeed, there are many overlaps between them. They are not presented in order of importance.

## 5.3 Improving the evidence base

### **Evidence priority 1: Supporting the ongoing collation of robust, causal and explanatory evidence**

As the reviews of evidence, practice and decision making and the prioritisation activities showed there is a clear demand for evidence which can help clarify causal pathways and mechanisms. There is also a need to better understand the magnitude, duration and consistency of impacts. Such evidence would help further understanding of how natural environments could be better used to promote health. This is of particular importance if health is to be better considered in Natural Capital analyses and in order to provide a strong and coherent message to those who need (what are perceived to be) more robust forms of evidence for decision making.

There are three key strategies which may help achieve this aim: first, there needs to be greater interaction between policy/decision makers, practitioners and researchers so that opportunities for the application of more robust research designs can be identified at an early enough stage to be effective. This has happened elsewhere, for example, in relation to the evaluation of the Olympic Legacy. Funding that supports the collaborative

identification of the need for, and the creation of, useful evidence would be particularly useful. Second, as complex (including natural experiments on policy changes and so on), large scale and/or longitudinal data collection and research is expensive, there may need to be greater coordination between departments, governments (e.g. England and the devolved regions), and research councils/charitable funders to support such research initiatives. The third strategy relates to the suggestion made by Wolf and Robbins [47] who argued that *'there is a clear need for development of valuation methodologies and new approaches to understanding the potential economic outcomes of the benefits'* and that there is a need to develop a *'platform of common assessment that standardizes benefit measurement and nature units. Future research on benefits could then generate comparable findings as values for policy inputs across communities and metro areas'* (p395).

The strategies discussed elsewhere in this section would also contribute to the improvement of the strength of the evidence base; of most relevance are i) effective evaluation and mixed economies of evidence, ii) identifying what works, for whom and when, iii) piloting activity, and iv) strategic cross-sectoral or -departmental working.

### **Actions**

- Support for complex, longer term and (mixed method) longitudinal data collection/use [240].
- Development of robust and reliable indicators (health and environmental) suitable to the outcomes of interest that can be applied consistently across studies [47].
- Undertake evaluability assessments [180, 241].
- Identification of opportunities for natural experiments and other forms of robust research designs (experimental or quasi-experimental such as stepped wedge designs [242]).
- Support mechanisms which facilitate interaction between the different sectors involved at all stages of the research and implementation process.

### **Who needs to be involved?**

- Coherent networks of policy/decision makers, research, and funders who are able to identify opportunities at stages early enough in the policy/decision making cycle to take advantage of experimental or quasi-experimental research design opportunities.
- Research Councils or large charitable funders such as the Wellcome Trust.
- Pan-UK (and, where relevant, international) policy/decision makers.
- Data centres.

### **Is this already happening?**

The interest in the integration and analysis of 'big data' and data 'mash-ups' is increasing the use of large scale data, where sheer numbers (sometimes) brings greater confidence in relationships identified.

The Born in Bradford and Understanding Society longitudinal datasets are being used to examine the impacts of exposure to natural environments on health.

Use of innovative qualitative and mixed-method approaches are increasing our understanding of key mechanisms.

### **Evidence priority 2: Effective evaluation and mixed economies of evidence**

There is a need to take a more strategic approach to the evaluation of policies, projects and delivery. Many of the policies, programmes and projects are, as noted elsewhere in this document, inherently complex and there is a deficit of knowledge regarding what is effective, for whom and why. These are issues that have been addressed and reflected upon in relation to other topics, such as understanding the nature and causes of obesity.

A particular concern is the extent and effectiveness of evaluation. Despite the wealth of activity building on the links between natural environments and health there is a lack of good quality evaluative work undertaken (it is recognised that evaluation is expensive, time consuming, and difficult). This represents a significant lost opportunity. As Ogilvie et al [180] noted this issue is not specific to the environment and health field, *‘Evidence to support government programs to improve public health often is weak. Recognition of this “knowledge gap” has led to calls for more and better evaluation, but decisions about priorities for evaluation also need to be addressed in regard to financial restraint’* (p206). One element of an effort to improving the quality of evaluations is to undertake evaluability assessments, which usually depend on articulating the theory of change used for the policy, programme or project. Further, Ogilvie et al. [180] outline a number of key underpinning principles which they argue will improve our understanding of the outcomes of health related actions including i) testing theories rather than interventions themselves and ii) seeing the ‘big picture’ of the intervention. Such approaches prompt potential evaluators to consider the following questions:

- *Where is the particular intervention situated in the evolution of the overall intervention programme?*
- *How any evaluation will affect decision making?*
- *What are the plausible sizes and distribution of the interventions hypothesized impacts?*
- *How will the finding of the evaluation add to existing scientific evidence?*
- *Is it practicable to evaluate the intervention in the time (and resources) available?*

Linked to this is the need to promote the benefits of a ‘mixed economy’ of evidence and to consider novel ways of understanding and using the evidence base, *‘A key challenge for modern environmental public health in moving beyond its health protection roots concerns the need to draw upon a much wider range of qualitative and quantitative evidence. This requires a number of quite different approaches to evidence gathering to be adopted in parallel’* [199]. For instance, Bayesian approaches (which specify some prior probability, which is then updated in the light of new relevant data or evidence) offer a pragmatic

option to the maximisation of what is often a limited evidence base across a complex multi-faceted topic. Similar approaches have been utilised to understand the benefits of environmental based health interventions [45]. This approach in particular is advocated because many of the environmental interventions used to address health outcomes may result in relatively small impacts (though which may aggregate at a population level) which are difficult to accurately measure and unpick from the impacts of other influences. Further, there is a developing argument within Public Health which suggests that there may be a need to shift research efforts away from understanding the impacts of an activity in isolation and to consider supporting efforts to understand the *contribution* of activities within the wider context [179, 243].

### Actions

- Support for methods development and particularly in relation to non-monetary approaches.
- Support for ‘mixed economies of evidence’ from authoritative voices such as NICE or PHE. Advocating for the production, translation and use of a broader evidence base.
- Increase support for and capacity to undertake meaningful and robust evaluative activity (see section 5.3). Moving away from trying to understand the impacts of (complex) interventions in isolation.
- Develop and promote a standardised set of measures and tools to allow for cross-evaluative synthesis (this would also need the infrastructure to support the collation and synthesis of the evaluative activity).
- Make use of opportunities for natural experiment and robust evaluation, such as that presented by the development of the new pocket parks<sup>48</sup> or NHS Healthy New Towns<sup>49</sup>, to gather valuable evidence.

### Who needs to be involved?

- Research funders.
- Project and intervention funders.
- Evaluators.
- Delivery bodies.

### Is this already happening?

The development of a Centre for Excellence in the Liverpool region is promising and will potentially lead to more coherent and strategic evaluation and research activity.

The Good Places, Better Health programme<sup>50</sup> in Scotland has advocated for more inclusive approaches to the use of evidence.

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<sup>48</sup> [Pocket parks](#)

<sup>49</sup> [Healthy New Towns](#)

<sup>50</sup> [Good Places Better Health](#) NHS Scotland

### Evidence priority 3: Identifying what works, for whom and when

The What Works initiatives, supported by Cabinet Office, Office for National Statistics and many others, aim to *‘improve the way government and other organisations create, share and use (or ‘generate, transmit and adopt’) high quality evidence for decision-making. It supports more effective and efficient services across the public sector at national and local levels... What Works is based on the principle that good decision-making should be informed by the best available evidence. If evidence is not available, decision-makers should use high quality methods to find out what works.’*<sup>51</sup>

A key evidence gap was identified (both through the review of evidence and through the prioritisation meetings and events) in relation to knowledge of the most effective and equitable nature based health interventions. Currently our understanding of ‘what works’ is limited, with a small number of reviews which seek to bring together the existing knowledge across a complex field of activity [244].

As Carpenter noted *‘we do need better understanding of the complex ‘pathways’ involved, to be cautious about some of the more extravagant claims that are made, and work from better holistic evidence to more effective immediate and wider policies’* [141]. There is a danger that without a more systematic approach, ineffective or potentially problematic (for instance increasing health inequality) approaches will be promoted. This is not only a waste of resource, but as Macintyre and Petticrew argued in relation to public health interventions *‘good intentions and received wisdom’* are not enough [245] and that there is a *‘misconception is that social and public health interventions do not have the capacity to do harm, and that having good intentions is therefore a sufficient basis for policy making. There are enough examples of well-meaning interventions with adverse effects to suggest that this is not the case’*. It is therefore argued that there would be great value in considering supporting a what works approach, potentially integrating methodologies advocated by the realist movement, which seeks to understand contexts, mechanisms and outcomes in order to define what works, in what contexts, and for whom [246].

In addition to understanding what works, a particularly important step would be to then translate knowledge of ‘what works’ into meaningful formats suitable to inform policy and practice decision makers. Useful approaches have been developed by other What Works centres; see, for instance, the interactive online toolkit<sup>52</sup> and evidence summaries produced by the Educational Endowment Foundation<sup>53</sup>.

#### Actions

- Identify and research effective intervention options, understand how the intervention works, in what contexts and for whom.

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<sup>51</sup> [What Works network](#)

<sup>52</sup> [Educational Endowment toolkit](#)

<sup>53</sup> [Educational Endowment toolkit, outdoor education](#)

- Identify the types of information/evidence (and in what formats) which has resonance with different sectors, but particularly with health.
- Make best use of mixed economies of evidence (see previous section 5.4), as was noted by one participants of the Health Practitioners workshop, we need to be rooted in evidence, but not constrained by it.
- Undertake transferability and scalability assessments.
- Undertake cost-benefit analyses (including using social-return on investment approaches).
- Disseminate good practice.
- Support from authoritative voices such as Cabinet Office, Treasury and local leadership.

#### Who needs to be involved?

- Networks of policy-practice-research.
- Authoritative support, e.g. Defra working with Cabinet Office or DH.
- Investors (i.e. for Socio-Environmental Impact Bond approaches – see next section) and funding bodies.
- Commissioners of health-environmental interventions.

#### Is this already happening?

There is a What Works *Wellbeing* centre<sup>54</sup> which is considering the role of natural environments in supporting community level wellbeing.

The Liverpool Centre of Excellence will consider questions relating to effectiveness.

There are a number of small scale applications of the What Works approach to individual interventions or delivery processes [247].

## 5.4 Interventions and delivery

The second set of prioritised opportunities and options relate to interventions and delivery. (see Table 1. Natural environment health intervention typology for more information on intervention types). It is recognised that there is currently activity relating to each of the intervention and delivery options (for instance Natural England is leading on engaging children with natural environments and work is underway to enhance the wellbeing of offenders through care farming and horticultural activities), however each option represents or relates to either a pressing issue (e.g. costs of lost productivity through levels of stress for employees) or for which there is growing evidence of impact (e.g. increasing the quality of urban greenspaces and parks).

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<sup>54</sup> [What Works wellbeing](#)

## **Interventions and delivery priority 1: Supporting the development of plausible mental health, physical activity and obesity interventions in key target groups.**

Rates of non-communicable disease (NCDs) have been described to be at epidemic levels and are set to rise in the coming years [3]. For example, poor mental health represents the largest cause of disability in the UK, it is a contributory factor in poor physical health, difficulties in maintaining relationships, and acts as a barrier to full participation in education and the workplace. By 2025 it is estimated that over 4 million people will have diabetes, and the number of people with arthritis in the UK is expected to rise to 17 million by 2030. The costs to the health and social systems are huge, diabetes alone currently costs the NHS approximately £1.5million an hour and takes up about 10% of the total budget per annum<sup>55</sup>. Low rates of physical activity and weight status are contributory factors in risk of NCD. There is a need to find cost-effective and appropriate interventions to tackle NCDs and their contributory factors such as poor mental health, low rates of physical activity and weight status.

Although relatively small and fragmented the existing body of evidence suggests that interventions which make use the natural environment as a setting to promote health and prevent ill-health can be effective and of increasing value. Good and effective examples of activities have been developed and used by a range of providers (public and 3<sup>rd</sup> sector) including Mind, The Conservation Volunteers, and some Local Authority public health departments. Potential interventions range from walking groups, conservation activities, and therapeutic horticulture to more clinically orientated options such as eco-therapy. Often the interventions are targeted at specific groups, such as those at risk of unemployment though stress, or at risk of diabetes and other ‘lifestyle diseases’ through lack of activity and can be offered through social prescribing schemes.

There is a need to provide a context in which the ongoing and sustainable development of such interventions can be supported. Any efforts should seek to overcome the key constraints faced by those developing and delivering interventions, these include: ‘siloes thinking’ and the difficulties in cross-sectoral communications; the perceived peripherality of activities; the impacts of reorganisations and the loss of networks; and the short term and novelty driven funding landscape.

### **Intervention types**

Encouragement of access, engagement and use of the natural environment; Targeted health interventions using or based in the natural environment.

### **Actions**

- Identify effective intervention options (partly through a review of the evidence and intervention/theoretical mapping) suitable to tackle key issues such as poor mental health, low levels of physical activity and obesity.

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<sup>55</sup> The [Kings Fund](#)

- Work with providers and commissioners to establish effective routes to delivery.
- Consider sustainability of the intervention delivery and funding.
- Ensure the intervention is embedded in wider care and support structures so that it is not provided in isolation.
- Work with Cabinet Office and other departments and bodies to examine how to scale up and support successful activities.
- Make efforts to work across sectors, by articulating how environmental intervention might, for example, contribute to national or local health sector policies<sup>56</sup>.
- Work with researchers to build the evidence base as to the effectiveness of interventions.

### Who needs to be involved?

- Practitioners
- Government
- Local authority
- Commissioners of health-environmental interventions
- 3rd sector
- Research
- Funders

### Interventions and delivery priority 2: Engage children with nature and foster lifelong motivations to use natural environments for healthful activities.

Evidence suggests that whilst there is widespread agreement that experiencing nature is beneficial for children, opportunities to actually do so are decreasing. This is problematic for a number of reasons; i) the benefits of natural environments to children's health are multiple, for example it provides them with a space for activity and is strongly linked to their mental health; ii) greener living environments are associated with more positive educational and developmental outcomes [54]; and iii) patterns of engagement with the natural environment in adulthood are strongly influenced by experiences during childhood [55].

Many have called for further concerted action to ensure children do not miss out on the benefits of the natural environment. Therefore, it is suggested that Defra (and it's equivalents at a more local level) should work with other departments to find effective and equitable ways in which children can be encouraged to use their local natural environments. This would likely need to be a multi-armed strategy, working not only on the perceptions of the children themselves, but also on those of their parents and carers, and of their teachers and health professionals. Further, effective options are likely to be

<sup>56</sup> See for example '[Healthy Lives, Healthy People: A call to action on obesity in England](#)', [No Health Without Mental Health: A Cross-Government Mental Health Outcomes Strategy for People of All Ages](#),

those which take a whole systems approach and build use of the natural environment into everyday activities such as play, active travel, or even as a learning space, and create systems and contexts where going outdoors into the natural environment is possible, easy, safe and enjoyable.

Efforts to increase children's exposure to and engagement with nature, particularly through everyday activities provides opportunities to achieve multiple outcomes. Attendance of Forest Kindergarten and Forest Schools, for example, where children learn in the outdoors (rather than learning *about* the outdoors) is associated with more advanced motor skills [248] [249], higher rates of physical activity [250], positive play behaviours [251], a range of observed developmental and educational outcomes [252], and states of good mental health [253]. Although no long term research has been conducted, there is evidence to suggest that children enjoy the activities and value them highly, potentially these children will carry such positive perceptions into adulthood [250].

### **Intervention types**

Siting, design or maintenance of the natural environment; Encouragement of access, engagement and use of the natural environment.

### **Actions**

- Undertake review of intervention options, intervention (cost-) effectiveness and delivery mechanisms to identify the most promising opportunities.
- Work with academics and others to more fully understand children's, parents' and others' perception of different intervention and delivery options.
- Identify strategies to allay parental and other care giver's fears about children's safety, 'stranger danger' and other risks.
- Funding or resources should be used to support participation of those with low incomes [254] and to ensure parity between settings [255].
- Providers and commissioners should continue to reach out to underrepresented groups [256].
- Policy makers (nationally and locally) should consider how to reduce the multiple barriers (structural, economic etc.) to the use of natural environments during every day activities' such as learning and education [54].
- Planners should consider the importance of providing good quality greenspaces in residential, leisure and learning settings.

### **Who needs to be involved?**

- Government at all scales
- 3rd sector
- Practitioners
- Research bodies
- Funders of delivery and research

### **Interventions and delivery priority 3: Improve the amount, quality, standards and accessibility of urban natural environments**

Some of the strongest and most robust associations relate to the positive health outcomes of living in areas with a greater amount of good quality natural environment. Evidence suggest that people who live in the greenest neighbourhoods enjoy lower mortality [6], better mental health [23], and lower rates of obesity [56-59]. A study of several European countries found that the likelihood of obesity was around 40% lower for those living in residential environments with high levels of green features [257]. The Monitor of Engagement with Natural Environments survey indicates that local urban greenspaces are increasingly important, almost four-fifths of visits to the natural environment take places within two miles of the journey starting point (for most trips, this means home) [26]. Such spaces support or facilitate a range of activities which may be beneficial to health including play, exercise, and social contact, volunteering, and active travel. The evidence suggests that both accessible (e.g. parks) and more incidental natural environments (e.g. verges, street trees) are important. Although the impacts of greener living environments may be relatively small at an individual level, at a population level these may aggregate and may represent important cost savings to the health system.

Defra (and its equivalents at a local level) could work with other departments, and in particular those with responsibility for planning and urban composition, to encourage and support increases in (where appropriate) the i) amount, ii) quality, iii) proximity and iv) accessibility of natural environments in neighbourhoods. Existing spaces should be protected and the quality maintained or improved. Further work should be undertaken to better understand effective interventions options and delivery approaches (e.g. as suggested in Evidence priority 3).

#### **Intervention types**

Siting, design or maintenance of the natural environment; Encouragement of access, engagement and use of the natural environment.

#### **Actions**

- Aim to increase the quantity, quality and accessibility of good quality safe urban greenspaces [19].
- Work with planners to strengthen the planning recommendations regarding natural environments (public and private) in living environments [19]. Identify levers within the National Planning Policy Framework.
- Protecting minimum standards for the type and upkeep of local greenspaces.
- Work with local authorities and other environmental managers to develop standards for health promoting natural environments.
- Suitably target policies and programmes to reduce risk of enhancing health and social inequality [258].

- Consider the potential additional and interactive role urban greenspaces in delivering wider policies and programmes (e.g. health or education) environment when designing policies and programmes [259].
- Research funders could support further intervention research to understand the impacts of environmental interventions and to increase understanding more generally about who uses urban greenspaces, why, when and how.
- Ensure that interventions support the equitable use of urban parks for health and wellbeing.

#### **Who needs to be involved?**

- Networks of policy-practice-research.
- Policy at all scales; form national Government to Local authority
- 3<sup>rd</sup>, civil and private sector
- Funders of interventions and research
- Greenspace managers and contractors

#### **Interventions and delivery priority 4: Building on the potential of National Parks and other designated spaces**

Some of the most innovative work linking natural environments and health outcomes is taking place in National Parks. For instance, the Naturally Healthy projects taking place on Dartmoor and Exmoor are co-funded by the Parks Authorities and by Local Authority public health departments and aim to tackle poor mental health in people living locally (see section 4.4). It is suggested that Defra and others could work with the National Parks and other partners (from a variety of sectors - public, private and 3rd) to help realise the value of the physical resources they manage.

The evidence suggest that high quality environments are important and that special environments are highly valued [35, 142]. However, there is a need to better understand the health and wellbeing benefits that can be gained from visits to National Parks and other protected landscapes, and how these can be different from the benefits from visiting more local natural environments.

*Intervention types:* Encouragement of access, engagement and use of the natural environment; Targeted health interventions using or based in the natural environment.

#### **Actions**

- Identify the most effective ways in which National Parks can be used to promote health of those who live locally and of visitors.
- Create sustainable and enduring systems through which the National Parks can be used to deliver health related policies and programmes.
- Develop structures through which the National Parks Authorities, NGOs and health sector can work together to identify suitable interventions,

- Develop socially just methods to encourage equitable use.

#### Who needs to be involved

- National Parks Authorities, Area of Outstanding Natural Beauty
- Government
- Local authority
- 3rd sector
- Research
- Funders

#### Interventions and delivery priority 5: Developing and implementing Social and Environmental Impact Bonds

There is growing interest in the use of Social and Health Impact Bonds (or payment by results) to ‘drive more effective policies’. This was partly driven by Cabinet Office and relates to wider policy areas than just health<sup>57</sup>, however there are examples relating to the health system (predominantly relating to social prescribing). An Impact Bond is a form of contract which aims to improve specific outcomes by making funding conditional on achieving results. Investors pay at the start of the project and receive payment based on results. Rather than focusing on inputs or outputs, impact bonds are based delivery of predefined and measurable outcomes<sup>58</sup>. In Newcastle, for example, ‘Ways to Wellness’<sup>59</sup> has raised money from social investors, who then share some of the risk of developing and delivering the social prescribing solutions, before the savings and benefits work their way through the NHS commissioning framework.

There is potential to further develop the use of impact bonds as a means of delivering social, health and/or environmental outcomes. The bonds could be used to support interventions which improve both health and environmental outcomes through delivery (e.g. conservation volunteering) or through improving environmental provision (e.g., changing the location or management of environmental assets in order to maximise mental health and wellbeing benefits), and/or user-oriented interventions which make use of natural environments, but which may not directly improve environmental outcomes. The types of outcomes which may be delivered through such interventions include cash savings to the health system through reduced use of health services or medication. Figure 10 illustrates how a health and environmental bond could work in to deliver co-beneficial outcomes.

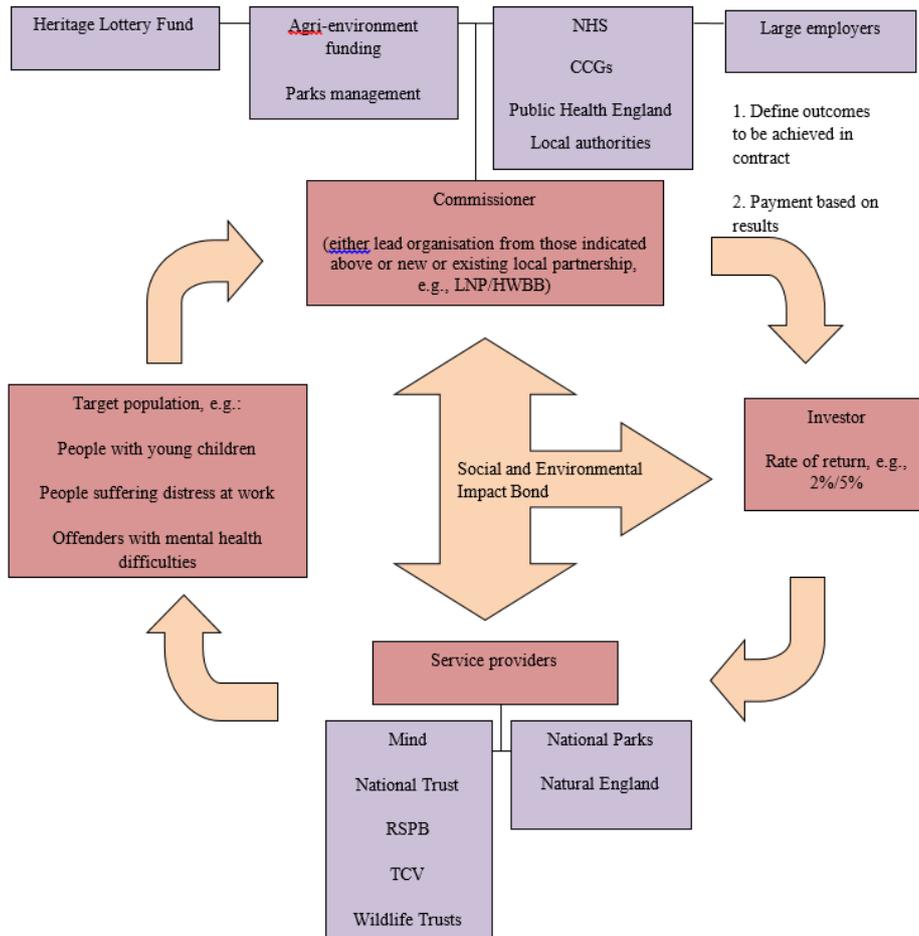
#### Figure 10. Schematic illustration of a health and environmental impact bond

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<sup>57</sup> [Social Impact Bonds](#)

<sup>58</sup> [Social Impact Bonds](#)

<sup>59</sup> [Ways to Wellness](#)



Whilst there is clearly political interest in the use of such diversified funding/delivery mechanisms, there are still questions about application, outcomes and investment modes which need clarification. In particular, many of the interventions discussed elsewhere in this document result in health change that is subtle, hard to detect or which may manifest itself over a lifetime. For impact bonds to be effective, outcomes which are measurable (so as to assess ‘success’) and meaningful (relate to the anticipated impacts of the programme) will need to be carefully selected.

*Intervention types:* Siting, design or maintenance of the natural environment; Encouragement of access, engagement and use of the natural environment; Targeted health interventions using or based in the natural environment.

### Actions

- Explore the potential of using impact bonds to support different intervention types, establish which specific interventions work best for specific groups of people and for different outcomes.

- Support further research into the types of outcomes suitable to act as markers of success. Identify unit costs of outcomes selected<sup>60</sup>.
- Pilot the use of impact bonds to support specific interventions and review outcomes and impacts more rigorously.
- Explore potential investors and their expectations. Clarify how the impact bond model adds value and would facilitate delivery of interventions more effectively than other means.
- Explore how to promote the use of impact bonds across different sectors and to appropriate commissioning bodies.

#### Who needs to be involved?

- Government and local authorities, particularly health departments.
- Commissioning bodies.
- 3rd sector and other practitioner and delivery bodies.
- Research.
- Funders, including private investors.

## 5.5 Systems and structures

The final set of prioritised opportunities relate to the systems and structures through which the potential of the natural environment to contribute to public health could be better acted upon.

### Systems and structures priority 1: Strategic cross-sectoral or -departmental working

The natural environment is an important resource which should be valued for its contribution to maintaining and promoting good health. However, there is a danger that this considerable resource is undervalued and underappreciated because no single department has ‘ownership’ (e.g. one department may have responsibility for the resource, while it may be a different department that may be concerned with the ‘issue’ or will feel the benefit of any activity). Decision making falls within the remits of number of departments including Defra, DH, DCLG and DCMS (and their equivalents at the local level) [260]. Cross-departmental (and potentially cross-governmental) activity is likely to be necessary to realise the potential benefits offered by the effective use of natural environments. Whilst it is recognised that cross-departmental activity is difficult to meaningfully achieve, there are other initiatives, such as Local Economic Partnerships, which have been jointly ‘owned’ by more than one department (in that case, BIS and DCLG).

Key strategies to achieving more synergistic working are: first, understanding and translating priorities across systems and departments. Second, valuing the potential of

<sup>60</sup> [Unit cost database](#)

collaborative working and finding methods of communication to highlight the co-benefits of cross-departmental activities; in Birmingham City Council, for example, the use of the Natural Capital methodologies (not necessarily described as such to different audiences) helped highlight how actions taken by the environment department might benefit the health department. Third, and related to the previous point, statements of the evidence need to be tailored (or packaged) appropriately for particular audiences and, in particular, for key decision makers. Fourth, identifying where the motivation and capacity for synergistic activity exists; for instance, many of the large (and small) NGOs (such as the RSPB and Wildlife Trusts) and arm's length governmental bodies such as the National Parks Authorities already see themselves as the 'National Health Service' and appear willing to contribute to societal aims such as improving population health. There needs to be an examination of how government can more effectively work with these bodies (which are significant land owners and represent enormous numbers of the public).

### **Actions**

- Support LNPs and their interaction with LEPS and Health and Wellbeing Boards
- Promote 'health in all policies' type approaches, devise an equivalent 'environment in all policies'.
- Map policies and programmes to find synergies and co-benefits
- Understand more about decision making structures and potential intervention points (particularly in relation to devolution agenda).
- Identify key frameworks (e.g. PHE's 5-5-75<sup>61</sup>) or policies and strategies to make links (also see Appendix 9 for further opportunities within the health system).
- Bring policy, practice and data together to make strong and coherent arguments
- Make the space and capacity for cross-sectoral activity and reconsideration of policy/practice (and translation of national policy to local contexts)

### **Who needs to be involved?**

- Governmental (national and/or local) departments.
- NGOs.

### **Is this happening already?**

Example of such cross-sectoral working do exist at a range of scales, from the LEPs which have central government support to the outcomes of the devolution agenda at the City/County Council scale.

There are many examples of NGOs working strategically with local partners to deliver programmes of activity.

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<sup>61</sup> 5 unhealthy behaviours (alcohol, physical inactivity, poor diet, social isolation, & smoking) that lead to 5 key communicable diseases which contribute to 75% of early death and morbidity.

## Systems and structures priority 2: Ensuring sustainability and continuity of activity

It is clear that there is a need to maintain momentum where it has been achieved and to avoid ‘reinventing the wheel’ in relation to the value of the natural environment to health.

Throughout this research it has been emphasised on multiple occasions, by a variety of actors, that there is currently considerable activity, well established networks (for example within some LNPs) and, in some areas, positive working relationships between health and environment sectors (for instance in Birmingham City Council around the Natural Capital Agenda, or Devon with the County Council/LNP/Dartmoor NPA). It appears that in these cases the existing relationships, legacies of activity, and established funding frameworks were key in facilitating activity, providing the context in which ‘joined-up’ decision making, inclusive of the range of values (of the health and environment sector as well as the general public), was possible.

However, this momentum can easily be disrupted; for example, in Liverpool the reorganisation from PCT to CCG interrupted earlier advocacy processes. Potential disruption to the Probationary service may limit the effectiveness of an ongoing feasibility assessment of the use of care farms for improving the quality of life for offenders [261]. Other disruptive factors include: the short-term nature of project/research funding; the need to develop ‘innovative’ programmes of activity; and the turnover of individuals who occupy key strategic roles. The change in government administration in 2010, and in the shifts in policy and practice that came with austerity were also experienced as disruptions, *‘Undoubtedly the current economic and expenditure crises, combined with the growing challenge posed by climate change, are significant issues. These might inhibit positive action just at the moment when the scientific evidence and effective policy instruments for an ecological health promotion strategy are gaining wider currency’* [141].

There is therefore a need to better understand the factors which have led to sustained, coherent activity and then to translate these factors into meaningful decision/policy making contexts. The 25 Year Plan for the Environment provides a structure through which more long-term strategies could be considered. An example might be to bolster support for the LNPs and to ensure their role for the long-term. This may give the confidence to embark on more ambitious projects and increase the legitimacy of the LNPs to other networks and partnerships (particularly the LEPs and Health and Wellbeing Boards). However, it is not clear why some LNPs have failed to be successful where others have flourished.

### Actions

- Learn from effective activity (see the options relating to evidence).
- Build on synergies and shared interests.
- Ensure sustainability is a pre-requisite of funded or commissioned activity.
- Sustainable and long-term support for effective initiatives and certain forms of research (e.g. longitudinal).

- Provide a context in which long term decision making is rational.

#### **Who needs to be involved?**

- Government at all scales.
- LNPs and other coordinating bodies.
- Knowledge exchange bodies (such as the EKN).
- Funding bodies (governments, charitable, commissioners etc.).
- Practitioners and delivery bodies.

#### **Is this already happening?**

Coordinated activity in the Liverpool region is focusing heavily on how to ensure the sustainability and resilience of the networks, relationships, funding and activity.

The Ecosystem Knowledge Network, and others, provide continuity of knowledge to help sustain activity.

Defra's 25 Year Plan for the Environment is taking a long term view

## **5.6 Conclusions**

There are many activities which could each contribute to the better consideration of the health promoting potential of natural environments in future decision making. Key to this is: working collaboratively and drawing on the resources, interests and needs of different sectors; identifying (effective) opportunities at a point at which meaningful gains (in terms of outcomes and research) can be achieved; and making the most of the momentum and enthusiasm that already exists.

## 6 Report conclusions

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*'In terms of "re-thinking" things as a society, we can no longer consider health, wellbeing and health systems without thinking about the environment' George Morris. 2013<sup>62</sup>*

- 1. There is growing awareness and concern about the role of the environment, and specifically the natural environment, has in determining health and wellbeing outcomes.** This is reflected, to a degree, in international, national and local policy and decision making. It is also reflected in the strategies and activities of a range of 3<sup>rd</sup> sector organisations. Often policy and strategy relates to the need to find innovative solutions to the address non-communicable disease, or relates to the need to find meaningful ways in which to express the (societal) importance of the natural environment.
- 2. Although there are a number of issues regarding the consistency, robustness and reliability of the evidence base, natural environments have been shown to influence health in a variety of ways.** There is evidence to suggest an association between living in greener environments and a range of physical, mental and developmental outcomes. The exact mechanisms which link natural environments to health are not well understood. Much of the existing evidence is descriptive of associations between natural environments and health, few studies have been conducted in a way in which they can explain any causal relationships.
- 3. People value the natural environment for its role in helping achieve and maintain better health.** In the UK the natural environment's contribution to health is culturally important. The benefits, and perceptions of those benefits, of the natural environment differ according to socio-cultural group, geographical and political context, and through the life course, however this is not well understood.
- 4. There is limited evidence relating to the outcomes of the range of environment-health policy, programmes or interventions which is suitable to inform future decision making.** Likewise, there is little monetised valuation of the linkages between natural environments and health, much of what exists relates to health through physical activity pathways. A small number of cost-effectiveness analyses of different interventions have been conducted, these tend to show the interventions are cost-effective and compare well with other options.
- 5. There is a need for strategic identification and development of further research.** Future research needs relate to: institutional perceptions and operationalisations of the health values of natural environments; socio-cultural and temporal influences on linkages; the necessary conditions for health promoting environments; and the factors which are effective in promoting healthful use of natural environments.

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<sup>62</sup> [George Morris presentation](#)

6. **The weight of the evidence suggests that those with responsibility for the natural environment or health (including Defra, departments such as DCLG and DH, and their equivalents at a more local scale) should recognise the potential of the natural environment as a resource for promoting health** (and indeed the variety and variance of those values) and should integrate/consider them in future decision making.
7. **There is considerable interest, predominantly from 3<sup>rd</sup> sector and research organisations, in finding effective ways to harness the multiple values of the natural environment for health.** This relates to a tangible recognition that the environment represents an underutilised resource.
8. **There is considerable activity building on the values of the natural environment to health, examples range from small scale health projects making use of local natural environments to regional or national scale multi-sectoral efforts to coordinate programmes of interventions.** However, existing activity is often disjointed, short term and opportunities to learn valuable lessons are missed. No department or sector has ‘ownership’ or responsibility for the issues/potential or is providing the type of leadership which galvanises sustained activity. The potential of the natural environment to contribute to health is ‘falling through the cracks’. There are concerns that sectors are siloed and don’t know how to ‘talk’ to each other, and opportunities to maximise (shrinking) budgets across/between departments are being missed.
9. **Evidence of the relevance of the natural environment to health is an important contributory factor in decision making.** Whilst decision makers often report that they typically prioritise monetised values and evidence, there is demonstrable a demand for and use of other forms of evidence particularly that which helps understand motivations, acceptability and processes. In some circumstances evidence has supported activity and has helped make the case for action. However, in other situations the types of evidence available has failed to convince decision makers that activity is justified. There are a number of limitations to the utility and applicability of existing evidence.
10. **The plurality of different frameworks and conceptualisations of the ways in which we understand the relationships between the natural environment and health, such as Socio-Ecological models, Ecosystem Services or Natural Capital, do not resonate well outside of their originating sector.** There appears to be little awareness of the latter two models in the health or educational sectors for example. Despite this, explanatory frameworks provide valuable mechanisms to articulate the potential gains to be made through a greater consideration of the value of natural environments to health.
11. **As current policy and practice display characteristics of ‘whole systems’ and ‘complex adaptive systems’, future strategies to better account for the health values of natural environments should involve multiple partners, policy instruments and**

**delivery methods at a variety of scales.** Care should be taken to reflect the variable contexts in which decisions may be taken, by whom and for what reasons.

- 12. There are a number of key actions which, if taken, could improve recognition and understanding of, and capacity to build on the potential of the natural environment to promote good health.** These include: First, evidence and evaluation options: i) supporting the ongoing collation of robust, causal and explanatory evidence; ii) effective evaluation and mixed economies of evidence and iii) identifying what works, for whom and when. Second, intervention and delivery options: iv) developing plausible mental health, physical activity and obesity interventions in key target groups; v) engage children with nature and foster lifelong motivations to use natural environments for healthful activities; vi) improve the amount, quality, standards and accessibility of urban natural environments; vii) building on the potential of National Parks and other designated spaces; and viii) developing and implementing the use of Social and Environmental Impact Bonds. Third, certain shifts in policy and delivery may help create a context in which the health potential of the natural environment could be better realised, key options include: ix) strategic cross-sectoral and departmental working; and x) ensuring sustainability and continuity of activity.

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## 8 References

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1. Barton, H. and M. Grant, *A health map for the local human habitat*. The Journal of the Royal Society for the Promotion of Health, 2006. **126**(6): p. 252-253.
2. World Health Organization. *The determinants of health*. 2014 [cited <http://www.who.int/hia/evidence/doh/en/> Accessed 2014.
3. Beaglehole, R., et al., *Priority actions for the non-communicable disease crisis*. The Lancet, 2011. **377**(9775): p. 1438-1447.
4. CBD and UNEP, *Decision adopted by the Conference of the Parties at the Convention on Biological Diversity. XII/21: Biodiversity and human health*. 2015: Pyeongchang, Republic of Korea, 6-17 October 2014.
5. Department of Health, *Healthy lives, healthy people: Our strategy for public health in England*. 2010, TSO: Norwich.
6. Hartig, T., et al., *Nature and Health*. Annual Review of Public Health, 2014. **35**(1): p. 207-228.
7. Gascon, M., et al., *Mental Health Benefits of Long-Term Exposure to Residential Green and Blue Spaces: A Systematic Review*. International Journal of Environmental Research and Public Health, 2015. **12**(4): p. 4354-4379.
8. Mitchell, R. and F. Popham, *Effect of exposure to natural environment on health inequalities: an observational population study*. Lancet, 2008. **372**(9650): p. 1655-60.
9. van den Berg, M., et al., *Health Benefits of Green Spaces in the Living Environment: A Systematic Review of Epidemiological Studies*. Urban Forestry & Urban Greening, 2015. **14**(4):p.806-816
10. Mitchell, R. and F. Popham, *Greenspace, urbanity and health: relationships in England*. Journal of Epidemiology and Community Health, 2007. **61**(8): p. 681-683.
11. Villeneuve, P.J., et al., *A cohort study relating urban green space with mortality in Ontario, Canada*. Environ Res, 2012. **115**: p. 51-8.
12. Gascon, M., et al., *Residential green spaces and mortality: A systematic review*. Environment International, 2016. **86**: p. 60-67.
13. Richardson, E.A. and R. Mitchell, *Gender differences in relationships between urban green space and health in the United Kingdom*. Social Science & Medicine, 2010. **71**(3): p. 568-575.
14. James, P., et al., *A Review of the Health Benefits of Greenness*. Current Epidemiology Reports, 2015: p. 1-12.
15. Dzhambov, A.M., D.D. Dimitrova, and E.D. Dimitrakova, *Association between residential greenness and birth weight: Systematic review and meta-analysis*. Urban Forestry & Urban Greening, 2014. **13**(4): p. 621-629.
16. Sandifer, P.A., A.E. Sutton-Grier, and B.P. Ward, *Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation*. Ecosystem Services, 2015. **12**(0): p. 1-15.
17. Rook, G.A., *Regulation of the immune system by biodiversity from the natural environment: An ecosystem service essential to health*. Proceedings of the National Academy of Sciences, 2013. **110**(46): p. 18360-18367.
18. Ruokolainen, L., et al., *Green areas around homes reduce atopic sensitization in children*. Allergy, 2015. **70**(2): p. 195-202.
19. Lachowycz, K. and A. Jones, *Greenspace and obesity: a systematic review of the evidence*. Obes. Rev., 2011. **12**: p. e183.

20. Hough, R., *Biodiversity and human health: evidence for causality?* Biodiversity and Conservation, 2014. **23**(2): p. 267-288.
21. Bodicoat, D.H., et al., *The association between neighbourhood greenspace and type 2 diabetes in a large cross-sectional study.* BMJ Open, 2014. **4**(12).
22. Maas, J., et al., *Morbidity is related to a green living environment.* Journal of Epidemiology and Community Health, 2009. **63**(12): p. 967-973.
23. Bowler, D., et al., *A systematic review of evidence for the added benefits to health of exposure to natural environments.* BMC Public Health, 2010. **10**: p. 456.
24. Thompson Coon, J., et al., *Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review.* Environ. Sci. Technol., 2011. **45**: p. 1761.
25. van Dillen, S.M.E., et al., *Greenspace in urban neighbourhoods and residents' health: adding quality to quantity.* Journal of Epidemiology and Community Health, 2011.
26. Natural England, *Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment: Annual report from the 2013 - 2014 survey*, in *Natural England Commissioned Report NECR122*. 2014: Sheffield
27. Jones, A., M. Hillsdon, and E. Coombes, *Greenspace access, use, and physical activity: Understanding the effects of area deprivation.* Preventive Medicine, 2009. **49**(6): p. 500-505.
28. O'Brien, L. and J. Morris, *Well-being for all? The social distribution of benefits gained from woodlands and forests in Britain.* Local Environment, 2013: p. 1-28.
29. Kabisch, N. and D. Haase, *Green justice or just green? Provision of urban green spaces in Berlin, Germany.* Landscape and Urban Planning, 2014. **122**: p. 129-139.
30. Cohen, M., et al., *Urban biodiversity and social inequalities in built-up cities: New evidences, next questions. The example of Paris, France.* Landscape and Urban Planning, 2012. **106**(3): p. 277-287.
31. Martin, C.A., P.S. Warren, and A.P. Kinzig, *Neighborhood socioeconomic status is a useful predictor of perennial landscape vegetation in residential neighborhoods and embedded small parks of Phoenix, AZ.* Landscape and Urban Planning, 2004. **69**(4): p. 355-368.
32. Hope, D., et al., *Socioeconomics drive urban plant diversity.* Proceedings of the National Academy of Sciences, 2003. **100**(15): p. 8788-8792.
33. Strohbach, M.W., D. Haase, and N. Kabisch, *Birds and the city: urban biodiversity, land use, and socioeconomics.* Ecology and Society, 2009. **14**(2): p. 31.
34. Kinzig, A.P., et al., *The effects of human socioeconomic status and cultural characteristics on urban patterns of biodiversity.* Ecology and Society, 2005. **10**(1): p. 23.
35. Lovell, R., et al., *A systematic review of the health and well-being benefits of biodiverse environments.* J. Toxicol. Environ. Health Part B, 2014. **17**: p. 1-20.
36. van den Berg, A.E., et al., *Green space as a buffer between stressful life events and health.* Social Science & Medicine, 2010. **70**(8): p. 1203-1210.
37. White, M.P., et al., *Feelings of restoration from recent nature visits.* Journal of Environmental Psychology, 2013. **35**(0): p. 40-51.
38. Shanahan, D.F., et al., *The Health Benefits of Urban Nature: How Much Do We Need?* BioScience, 2015. **65**(5): p. 476-485.
39. Ward Thompson, C., J. Roe, and P. Aspinall, *Woodland improvements in deprived urban communities: What impact do they have on people's activities and quality of life?* Landscape and Urban Planning, 2013. **118**: p. 79-89.
40. Droomers, M., et al., *The impact of intervening in green space in Dutch deprived neighbourhoods on physical activity and general health: results from the quasi-*

- experimental URBAN40 study*. Journal of Epidemiology and Community Health, 2015.
41. Hanson, S. and A. Jones, *Is there evidence that walking groups have health benefits? A systematic review and meta-analysis*. British Journal of Sports Medicine, 2015. **49**(11): p. 710-715.
  42. O'Brien, E. and J. Morris, *Active England: The Woodland Projects*. 2009, Forest Research Farnham
  43. Annerstedt, M. and P. Wahrborg, *Nature-assisted therapy: systematic review of controlled and observational studies*. Scandinavian Journal of Public Health, 2011. **39**(4): p. 371-88.
  44. Mind, *Feel better outside, feel better inside: Ecotherapy for mental wellbeing, resilience and recovery*. 2013: London.
  45. R Lovell, et al., *Understanding how environmental enhancement and conservation activities may benefit health and wellbeing: a systematic review*. BMC Public Health, 2015. **15**(1): p. 864.
  46. Rolls, S. and T. Sunderland, *Microeconomic Evidence for the Benefits of Investment in the Environment 2* in *Natural England Research Reports, Number 057*. 2014.
  47. Wolf, K.L. and A.S. Robbins, *Metro nature, environmental health, and economic value*. Environ Health Perspect, 2015. **123**(5): p. 390-8.
  48. Stone, D., *An estimate of the economic and health value and cost effectiveness of the expanded WHI scheme 2009*. 2009, Natural England
  49. Ambrose-Oji, B., et al., *An Evaluation of the WIAT Challenge Fund: Changing use patterns, the value of recreation and health benefits, and lessons learned 2014*, Forest Research Farnham
  50. Cavil, N., H. Rutter, and R. Gower, *Economic assessment of the health benefits of walking on the Wales Coast Path*. 2016.
  51. New Economics Foundation, *The Economic Benefits of Ecominds A case study approach*. 2013: London.
  52. Choi, B.C. and A.W. Pak, *Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness*. Clin Invest Med, 2006. **29**(6): p. 351-64.
  53. Ward, J.S., et al., *The impact of children's exposure to greenspace on physical activity, cognitive development, emotional wellbeing, and ability to appraise risk*. Health & Place, 2016. **40**: p. 44-50.
  54. Rickinson, M., et al., *A review of research on outdoor learning*. 2004, London: National Foundation for Educational Research and King's College London. 68.
  55. Ward Thompson, C., P. Aspinall, and A. Montarzino, *The Childhood Factor: Adult Visits to Green Places and the Significance of Childhood Experience*. Environment and Behavior, 2008. **40**(1): p. 111-143.
  56. Halonen, J.I., et al., *Green and blue areas as predictors of overweight and obesity in an 8-year follow-up study*. Obesity (Silver Spring), 2014. **22**(8): p. 1910-7.
  57. Pereira, G., et al., *The association between neighborhood greenness and weight status: an observational study in Perth Western Australia*. Environ Health, 2013. **12**: p. 49.
  58. Wolch, J., et al., *Childhood obesity and proximity to urban parks and recreational resources: A longitudinal cohort study*. Health & Place, 2011. **17**(1): p. 207-214.
  59. Bell, J.F., J.S. Wilson, and G.C. Liu, *Neighborhood Greenness and 2-Year Changes in Body Mass Index of Children and Youth*. American journal of preventive medicine, 2008. **35**(6): p. 547-553.

60. Dahlgren, G. and M. Whitehead, *Policies and strategies to promote social equity in health. Background document to WHO-Strategy paper for Europe*. Equity in Health. Stockholm: Institute for Future Studies, 1991.
61. Ward Thompson, C., *Linking landscape and health: The recurring theme*. Landscape and Urban Planning, 2011. **99**(3–4): p. 187-195.
62. Sullivan, W.C., et al., *Gaia meets Asclepius: Creating healthy places*. Landscape and Urban Planning, 2014. **127**(0): p. 182-184.
63. Winks, R.W., *The National Park Service Act of 1916: 'A Contradictory Mandate'?* Denver University Law Review 1997. **575**.
64. Muir, J., *John Muir : Nature Writings*. 1997: Library of America.
65. Murray, C.J.L., et al., *UK health performance: findings of the Global Burden of Disease Study 2010*. The Lancet, 2013. **381**(9871): p. 997-1020.
66. Romanelli, C., et al. *Connecting global priorities: biodiversity and human health: a state of knowledge review*. 2015. World Health Organization/Secretariat of the UN Convention on Biological Diversity.
67. World Health Organization, *Urban Green Space Interventions and Health: A review of impacts and effectiveness*. 2017: Copenhagen.
68. ten Brink, P., et al., *The Health and Social Benefits of Nature and Biodiversity Protection*. 2016: European Commission DG Environment (ENV.B.3/ETU/2014/0039).
69. Allen, J. and R. Balfour, *Natural solutions for tackling health inequalities*. 2014, UCL Institute of Health Equity.
70. Drayson, K. and G. Newey, *Green Society: Policies to improve the UK's urban green spaces*. 2014, Policy Exchange London.
71. Bedford Borough Council, *Natural environment and green spaces in Joint Strategic Needs Assessment*. 2015.
72. Benwell, R. and e. al., *A Nature and Wellbeing Act*. 2015, RSPB and Wildlife Trusts.
73. Response for Nature Partnership, *Response for Nature: England*. 2015.
74. Landscape Institute, *Public Health and Landscape. Creating healthy places Position Statement*. 2013: London.
75. Church, A., et al., *UK National Ecosystem Assessment Follow-on. Work Package Report 5: Cultural ecosystem services and indicators* 2014, UNEP-WCMC, LWEC: UK.
76. Keniger, L., et al., *What are the Benefits of Interacting with Nature?* International Journal of Environmental Research and Public Health, 2013. **10**(3): p. 913-935.
77. Lachowycz, K. and A.P. Jones, *Towards a better understanding of the relationship between greenspace and health: Development of a theoretical framework*. Landscape and Urban Planning, 2012. **118**: p. 62-69.
78. Pretty, J., *Chapter 23. Health Values from Ecosystems*, in *UK NEA*. 2011, WCMC-UNEP: Cambridge.
79. Maxwell, S. and R. Lovell, *Evidence statement on the links between natural environments and human health*. 2017, Department of Environment, Food and Rural Affairs: Nobel House, London.
80. World Health Organization, *The Ottawa Charter for Health Promotion*, in *First International Conference on Health Promotion*. 1986: Ottawa.
81. Millennium Ecosystem Assessment, *Ecosystems and Human Well-being: Synthesis*. 2005: Washington, DC.
82. Diaz, S., et al., *Biodiversity loss threatens human well-being*. Plos Biology, 2006. **4** (8): p. e277.

83. Raudsepp-Hearne, C., et al., *Untangling the Environmentalist's Paradox: Why Is Human Well-being Increasing as Ecosystem Services Degrade?* *Bioscience*, 2010. **60**(8): p. 576-589.
84. Markevych, I., et al., *Surrounding greenness and birth weight: Results from the GINIplus and LISApplus birth cohorts in Munich.* *Health & Place*, 2014. **26**: p. 39-46.
85. Bratman, G.N., J.P. Hamilton, and G.C. Daily, *The impacts of nature experience on human cognitive function and mental health.* *Annals of the New York Academy of Sciences*, 2012. **1249**(1): p. 118-136.
86. Davdand, P., et al., *Green spaces and cognitive development in primary schoolchildren.* *Proceedings of the National Academy of Sciences*, 2015. **112**(26): p. 7937-7942.
87. Fuertes, E., et al., *Greenness and allergies: evidence of differential associations in two areas in Germany.* *Journal of Epidemiology and Community Health*, 2014. **68**(8) p.787-90.
88. Davdand, P., et al., *Risks and benefits of green spaces for children: a cross-sectional study of associations with sedentary behavior, obesity, asthma, and allergy.* *Environ Health Perspect*, 2014. **122**(12): p. 1329-35.
89. Coombes, E., A.P. Jones, and M. Hillsdon, *The relationship of physical activity and overweight to objectively measured green space accessibility and use.* *Social Science & Medicine*, 2010. **70**(6): p. 816-822.
90. Hillsdon, M., A. Jones, and E. Coombes, *Green space access, green space use, physical activity and overweight*, in *Natural England Commissioned Report NECR067*. 2011.
91. Sarkar, C., J. Gallacher, and C. Webster, *Built environment configuration and change in body mass index: The Caerphilly Prospective Study (CaPS).* *Health & Place*, 2013. **19**: p. 33-44.
92. White, M.P., et al., *Coastal proximity and physical activity: Is the coast an under-appreciated public health resource?* *Prev Med*, 2014. **69**: p. 135-40.
93. Astell-Burt, T., R. Mitchell, and T. Hartig, *The association between green space and mental health varies across the lifecourse. A longitudinal study.* *Journal of Epidemiology and Community Health*, 2014. **68**(6): p. 578-583.
94. Milligan, C. and A. Bingley, *Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults.* *Health & Place*, 2007. **13**(4): p. 799-811.
95. Hitchings, R., *Studying the preoccupations that prevent people from going into green space.* *Landscape and Urban Planning*, 2013. **118**: p. 98-102.
96. Wheeler, B., et al., *Beyond greenspace: an ecological study of population general health and indicators of natural environment type and quality.* *International Journal of Health Geographics*, 2015. **14**(1): p. 17.
97. Donovan, G.H., et al., *Is tree loss associated with cardiovascular-disease risk in the Women's Health Initiative? A natural experiment.* *Health & Place*, 2015. **36**: p. 1-7.
98. Ellaway, A., et al., *Associations between health and different types of environmental incivility: A Scotland-wide study.* *Public Health*, 2009. **123**(11): p. 708-713.
99. McCormack, G.R., et al., *Characteristics of urban parks associated with park use and physical activity: A review of qualitative research.* *Health & Place*, 2010. **16**(4): p. 712-726.
100. Marselle, M.R., K.N. Irvine, and S.L. Warber, *Walking for well-being: are group walks in certain types of natural environments better for well-being than group walks in urban environments?* *Int J Environ Res Public Health*, 2013. **10**(11): p. 5603-28.

101. MacKerron, G. and S. Mourato, *Happiness is greater in natural environments*. Global Environmental Change, 2013. **23**(5): p. 992-1000.
102. Kardan, O., et al., *Neighborhood greenspace and health in a large urban center*. Scientific Reports, 2015. **5**: p. 11610.
103. Shanahan, D.F., et al., *Health Benefits from Nature Experiences Depend on Dose*. Scientific Reports, 2016. **6**: p. 28551.
104. Greenspace Scotland. *Demonstrating the links: action research on greenspaces* undated Available from: <http://www.greenspacescotland.org.uk/default.asp?page=472>.
105. Alcock, I., et al., *Longitudinal Effects on Mental Health of Moving to Greener and Less Green Urban Areas*. Environmental Science & Technology, 2014. **48**(2): p. 1247-1255.
106. Annerstedt, M., et al., *Green qualities in the neighbourhood and mental health - results from a longitudinal cohort study in Southern Sweden*. BMC Public Health, 2012. **12**: p. 337.
107. Alcock, I., et al., *What accounts for 'England's green and pleasant land'? A panel data analysis of mental health and land cover types in rural England*. Landscape and Urban Planning, 2015. **142**: p. 38-46.
108. Cohen-Cline, H., E. Turkheimer, and G.E. Duncan, *Access to green space, physical activity and mental health: a twin study*. Journal of Epidemiology and Community Health, 2015. **69**(6): p.523-9.
109. Michael, Y.L., et al., *Does change in the neighborhood environment prevent obesity in older women?* Soc Sci Med, 2014. **102**: p. 129-37.
110. Hunter, R.F., et al., *The impact of interventions to promote physical activity in urban green space: A systematic review and recommendations for future research*. Social Science & Medicine, 2015. **124**(0): p. 246-256.
111. Whear, R., et al., *What is the impact of using outdoor spaces such as gardens on the physical and mental well-being of those with dementia? A systematic review of quantitative and qualitative evidence*. J Am Med Dir Assoc, 2014. **15**(10): p. 697-705.
112. Pretty, J., et al., *Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning*. Journal of Environmental Planning and Management, 2007. **50**(2): p. 211-231.
113. O'Brien, E. and H. Snowdon, *Health and well-being in woodlands: a case study of the Chopwell Wood Health Project 2007*, Forest Research Farnham
114. Jepson, R., R. Robertson, and H. Cameron, *Green prescription schemes: mapping and current practice*. 2010, NHS Scotland Edinburgh
115. Lovell, R. and J. Roe, *Physical and mental health benefits of participation in forest school*. Countryside Recreation, 2009. **17**(1): p. 20-23.
116. Dadvand, P., et al., *Green space, health inequality and pregnancy*. Environment International, 2012. **40**: p. 110-115.
117. Cairns-Nagi, J.M. and C. Bambra, *Defying the odds: A mixed-methods study of health resilience in deprived areas of England*. Social Science & Medicine, 2013. **91**(0): p. 229-237.
118. Roe, J. and P. Aspinall, *The restorative benefits of walking in urban and rural settings in adults with good and poor mental health*. Health & Place, 2011. **17**(1): p. 103-113.
119. McCormack, G.R., et al., *Physical activity patterns in urban neighbourhood parks: insights from a multiple case study*. BMC Public Health, 2014. **14**: p. 962.
120. Ward Thompson, C. and P.A. Aspinall, *Natural Environments and their Impact on Activity, Health, and Quality of Life*. Applied Psychology: Health and Well-Being, 2011. **3**(3): p. 230-260.

121. Ord, K., R. Mitchell, and J. Pearce, *Is level of neighbourhood green space associated with physical activity in green space?* International Journal of Behavioral Nutrition and Physical Activity, 2013. **10**(1): p. 127.
122. Pizzol, M., et al., *Monetary valuation in Life Cycle Assessment: a review.* Journal of Cleaner Production, 2015. **86**: p. 170-179.
123. Sander, H.A. and C. Zhao, *Urban green and blue: Who values what and where?* Land Use Policy, 2015. **42**: p. 194-209.
124. Gibbons, S., S. Mourato, and G. Resende, *The Amenity Value of English Nature: A Hedonic Price Approach.* Environmental and Resource Economics, 2014. **57**(2): p. 175-196.
125. Willis, K. and L.M. Osman, *Economic Benefits of Accessible Green Spaces for Physical and Mental Health: Scoping Study 2005*, Forestry Commission: CJC Consulting, Oxford.
126. Papathanasopoulou, E., et al., *Valuing the health benefits of physical activities in the marine environment and their importance for marine spatial planning.* Marine Policy, 2016. **63**: p. 144-152.
127. Bateman, I.J., *Chapter 22. Economic values from Ecosystems in UK National Ecosystem Assessment.* 2011, UNEP-WCMC: Cambridge.
128. Buck, D. and S. Gregory, *Improving the public's health. A resource for local authorities.* 2013, The King's Fund: London.
129. Willis, K., et al., *Green space and health benefits: a QALY and CEA of a mental health programme.* Journal of Environmental Economics and Policy, 2015: p. 1-18.
130. Regeneris Consulting, *The Economic Contribution of The Mersey Forest's Objective One Funded Investments 2009*, Report for the Mersey Forest.
131. de Vries, S., et al., *Natural environments—healthy environments? An exploratory analysis of the relationship between greenspace and health.* Environ. Plann. A, 2003. **35**: p. 1717.
132. Brown, T. and S. Cummins, *Intervening in health: The place of urban green space.* Landscape and Urban Planning, 2013. **118**(0): p. 59-61.
133. UK National Ecosystem Assessment, *The UK National Ecosystem Assessment: Synthesis of the Key Findings.* 2011, UNEP-WCMC: Cambridge.
134. Darlow, A., *Summary of Evidence: Access and Engagement EIN003.* 2015, Natural England.
135. IPBES, *Preliminary guide regarding diverse conceptualization of multiple values of nature and its benefits, including biodiversity and ecosystem functions and services.* 2015: Bonn, Germany.
136. Coles, R.W. and S.C. Bussey, *Urban forest landscapes in the UK — progressing the social agenda.* Landscape and Urban Planning, 2000. **52**(2-3): p. 181-188.
137. Ashbullby, K.J., et al., *The beach as a setting for families' health promotion: A qualitative study with parents and children living in coastal regions in Southwest England.* Health & Place, 2013. **23**(0): p. 138-147.
138. Bolam, B., S. Murphy, and K. Gleeson, *Place-identity and geographical inequalities in health: A qualitative study.* Psychology & Health, 2006. **21**(3): p. 399-420.
139. Day, R., *Local environments and older people's health: Dimensions from a comparative qualitative study in Scotland.* Health & Place, 2008. **14**(2): p. 299-312.
140. Brown, T. and M. Bell, *Off the couch and on the move: global public health and the medicalisation of nature.* Social Science & Medicine, 2007. **64**(6): p. 1343-1354.
141. Carpenter, M., *From 'healthful exercise' to 'nature on prescription': The politics of urban green spaces and walking for health.* Landscape and Urban Planning, 2013. **118**(0): p. 120-127.

142. Curtin, S., *Wildlife tourism: the intangible, psychological benefits of human-wildlife encounters*. Current Issues in Tourism, 2009. **12**(5/6): p. 451-474.
143. Macnaghten, P. and J. Urry, *Bodies in the Woods*. Body and Society, 2000. **6**(3-4): p. 166-182.
144. O'Brien, L., M. Townsend, and M. Ebden, '*Doing Something Positive*': *Volunteers' Experiences of the Well-Being Benefits Derived from Practical Conservation Activities in Nature*. VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations, 2010. **21**(4): p. 525-545.
145. Irvine, K.N., et al., *Understanding urban green space as a health resource: a qualitative comparison of visit motivation and derived effects among park users in Sheffield, UK*. Int J Environ Res Public Health, 2013. **10**(1): p. 417-42.
146. Bell, S.L., et al., *Seeking everyday wellbeing: The coast as a therapeutic landscape*. Social Science & Medicine, 2015. **142**: p. 56-67.
147. Dines, N., et al., *Public spaces, social relations and well-being in East London*. 2006, Wolfson Institute of Preventive Medicine, Queen Mary, University of London. Joseph Rowntree Foundation: Bristol p. 56.
148. Dinnie, E., K.M. Brown, and S. Morris, *Reprint of "Community, cooperation and conflict: Negotiating the social well-being benefits of urban greenspace experiences"*. Landscape and Urban Planning, 2013. **118**(0): p. 103-111.
149. Marsden, T., et al., *Communities in Nature : The Construction and Understanding of Forest Natures*. Sociologia Ruralis, 2003. **43**(3): p. 238-256.
150. Bixler, R.D. and M.F. Floyd, *Nature is scary, disgusting, and uncomfortable*. Environment and Behavior, 1997. **29**(4): p. 443-67.
151. Bell, S., C.W. Thompson, and P. Travlou, *Contested views of freedom and control: Children, teenagers and urban fringe woodlands in Central Scotland*. Urban Forestry & Urban Greening, 2003. **2**(2): p. 87-100.
152. Milligan, C. and A. Bingley, *Restorative places or scary spaces? The impact of woodland on the mental well-being of young adults*. Health & Place. **13**(4): p. 799-811.
153. Moffat, B.M., J.L. Johnson, and J.A. Shoveller, *A gateway to nature: Teenagers' narratives on smoking marijuana outdoors*. Journal of Environmental Psychology, 2009. **29**(1): p. 86-94.
154. Swanwick, C., *Society's attitudes to and preferences for land and landscape*. Land Use Policy, 2009. **26**, Supplement 1(0): p. S62-S75.
155. Bell, S.L., et al., *Green space, health and wellbeing: making space for individual agency*. Health & Place, 2014. **30**: p. 287-292.
156. Pinder, R., et al., *Exploring perceptions of health and the environment: A qualitative study of Thames Chase Community Forest*. Health & Place, 2009. **15**(1): p. 349-356.
157. Ravenscroft, N. and N. Curry, *Constraints to Participation in Countryside Recreation in England*. Annals of Leisure Research, 2004. **7**(3-4): p. 172-187.
158. The Futures Company, *Understanding what people want from the natural environment using customer segmentation*. 2010, Report for Defra.
159. Morris, J., et al., *Access for all? Barriers to accessing woodlands and forests in Britain*. Local Environment, 2011. **16**(4): p. 375-396.
160. Day, R. and F. Wager, *Parks, streets and "just empty space": the local environmental experiences of children and young people in a Scottish study*. Local Environment, 2010. **15**(6): p. 509-523.
161. Woodgate, R.L. and O. Skarlato, *"It is about being outside": Canadian youth's perspectives of good health and the environment*. Health & Place, 2015. **31**(0): p. 100-110.

162. Plane, J. and F. Klodawsky, *Neighbourhood amenities and health: examining the significance of a local park*. Social Science and Medicine, 2013. **99**: p. 1-8.
163. Carter, C., *Offenders and Nature: helping people - helping nature*. 2007, Forest Research: Farnham, Surrey.
164. Cha, J. and S. Kim, *Healing Effects of the Forest Experience on Alcoholics*. J Korean Acad Nurs, 2009. **39**(3): p. 338-348.
165. O'Brien, E.A., *Publics\* and woodlands in England: well-being, local identity, social learning, conflict and management*. Forestry, 2005. **78**(4): p. 321-336.
166. King, K. and A. Church, '*We don't enjoy nature like that*': *Youth identity and lifestyle in the countryside*. Journal of Rural Studies, 2013. **31**(0): p. 67-76.
167. Bingley, A., *Woodland as working space: where is the restorative green idyll?* Social Science & Medicine, 2013. **91**: p. 135-40.
168. Capaldi, C.A., R.L. Dopko, and J.M. Zelenski, *The relationship between nature connectedness and happiness: a meta-analysis*. Frontiers in Psychology, 2014. **5**.
169. Milligan, C. and A. Bingley, *Climbing Trees and Building Dens: Mental health and wellbeing in young adults and the long-term effects of childhood play experience*. 2004, Institute for Health Research, Lancaster University: Lancaster
170. Toohey, A. and M. Rock, *Unleashing their potential: a critical realist scoping review of the influence of dogs on physical activity for dog-owners and non-owners*. International Journal of Behavioral Nutrition and Physical Activity, 2011. **8**(1): p. 1-9.
171. Burns, N., K. Paterson, and N. Watson, *Exploring disabled people's perceptions and use of forest recreation goods, facilities and services in Scotland, England and Wales*. 2008, Edinburgh: Forestry Research.
172. Burns, N., K. Paterson, and N. Watson, *An inclusive outdoors? Disabled people's experiences of countryside leisure services*. Leisure Studies, 2009. **28**(4): p. 403-417.
173. Burns, N., N. Watson, and K. Paterson, *Risky bodies in risky spaces: disabled people's pursuit of outdoor leisure*. Disability & Society, 2013: p. 1-15.
174. Scott, A., et al., '*Seeing is Not Everything*': *Exploring the Landscape Experiences of Different Publics*. Landscape Research, 2009. **34**(4): p. 397-424.
175. Kitchen, L., *Are Trees Always 'Good'? Urban Political Ecology and Environmental Justice in the Valleys of South Wales*. International Journal of Urban and Regional Research, 2012. **37**(6).
176. Mulder, C., S. Shibli, and J. Hale, *Young people's demand for countryside recreation: A function of supply, tastes and preferences?* Managing Leisure, 2005. **10**(2): p. 106-127.
177. Fischer, A.J., et al., *The appraisal of public health interventions: an overview*. Journal of Public Health, 2013.
178. Fischer, A., et al., *The appraisal of public health interventions*. The Lancet, 2012. **380**, Supplement 3: p. S17.
179. Rutter, H., et al., *The need for a complex systems model of evidence for public health*. The Lancet, 2017.
180. Ogilvie, D., et al., *Assessing the Evaluability of Complex Public Health Interventions: Five Questions for Researchers, Funders, and Policymakers*. Milbank Quarterly, 2011. **89**(2): p. 206-225.
181. Abercrombie, L.C., et al., *Income and Racial Disparities in Access to Public Parks and Private Recreation Facilities*. American Journal of Preventive Medicine, 2008. **34**(1): p. 9-15.
182. Popay, J., et al., *A proper place to live: health inequalities, agency and the normative dimensions of space*. Social Science & Medicine, 2003. **57**(1): p. 55-69.

183. Abraham, A., K. Sommerhalder, and T. Abel, *Landscape and well-being: a scoping study on the health-promoting impact of outdoor environments*. International Journal of Public Health, 2010. **55**(1): p. 59-69.
184. Bambra, C., et al., *Tackling the wider social determinants of health and health inequalities: evidence from systematic reviews*. Journal of Epidemiology and Community Health, 2010. **64**(4): p. 284-291.
185. Clark, C., et al., *A systematic review of the evidence on the effect of the built and physical environment on mental health*. Journal of Public Mental Health, 2007. **6**(2): p. 14-27.
186. Gentin, S., *Outdoor recreation and ethnicity in Europe—A review*. Urban Forestry & Urban Greening, 2011. **10**(3): p. 153-161.
187. Gibson, M., et al., *Housing and health inequalities: A synthesis of systematic reviews of interventions aimed at different pathways linking housing and health*. Health & Place, 2011. **17**(1): p. 175-184.
188. Lorenc, T., et al., *What types of interventions generate inequalities? Evidence from systematic reviews*. Journal of Epidemiology and Community Health, 2013. **67**(2): p. 190-193.
189. Lorenc, T., et al., *Fear of crime and the environment: systematic review of UK qualitative evidence*. BMC Public Health, 2013. **13**(1): p. 496.
190. Thomson, H., et al., *Do urban regeneration programmes improve public health and reduce health inequalities? A synthesis of the evidence from UK policy and practice (1980–2004)*. Journal of Epidemiology and Community Health, 2006. **60**(2): p. 108-115.
191. Elliott, L.R., et al., *How do brochures encourage walking in natural environments in the UK? A content analysis*. Health Promot Int, 2016.
192. Kenter, J.O., et al., *UK National Ecosystem Assessment Follow-on. Work Package Report 6: Shared, Plural and Cultural Values of Ecosystems*. 2014, UNEP-WCMC, LWEC: UK.
193. O'Brien, L., M. Greenland, and H. Snowdon, *Using woodlands and woodland grants to promote public health and wellbeing*. Scottish Forestry, 2006. **60**(2): p. 18-24.
194. Bragg, R. and G. Atkins, *A review of nature-based interventions for mental health care*. 2016, Natural England Commissioned Reports, Number 204.
195. Bragg, R. and C. Leck, *Good practice in social prescribing for mental health: The role of nature-based interventions*. Natural England Commissioned Reports, 2016.
196. Johnston, J., *Using the natural environment to deliver better health in Kent*. 2014, Kent Local Nature Partnership.
197. Temple, P., L. Snowdon, and R. Dale, *Improving Engagement with Our Natural Environment. Behaviour Change Scoping Report*. 2014, Devon Local Nature Partnership and Public Health Devon.
198. Department for Environment Food and Rural Affairs, *The Natural Choice: securing the value of nature*. 2011: London.
199. Morris, G., *Reconfiguring environmental public health for an ecological era*. Journal of Environmental Health Research 2011. **11**(2): p. Editorial
200. Reis, S., et al., *Integrating health and environmental impact analysis*. Public Health, 2015. **129**(10): p. 1383-9.
201. Wood, C., R. Bragg, and J. Barton, *Natural Choices for Health and Wellbeing 2013*, University of Essex: Report for Liverpool PCT and The Mersey Forest.
202. Hallsworth, M., S. Parker, and J. Rutter, *Policy making in the real world*. 2011, Institute for Government.

203. Richardson, E., et al., *Evidence-based selection of environmental factors and datasets for measuring multiple environmental deprivation in epidemiological research*. Environmental Health, 2009. **8**(Suppl 1): p. S18.
204. Mitchell, R., *Is physical activity in natural environments better for mental health than physical activity in other environments?* Soc Sci Med, 2013. **91**: p. 130-4.
205. Mitchell, R.J., et al., *Neighborhood Environments and Socioeconomic Inequalities in Mental Well-Being*. American Journal of Preventive Medicine, 2015. **49**(1): p. 80-84.
206. Barton, J. and J. Pretty, *What is the best dose of nature and green exercise for improving mental health? A multi-study analysis*. Environ Sci Technol, 2010. **44**(10): p. 3947-55.
207. Bird, W., *Natural fit: Can greenspace and biodiversity increase levels of physical activity?* 2004, RSPB
208. Bird, W., *Natural Thinking: Investigating the links between the Natural Environment, Biodiversity and Mental Health*. 2007, RSPB.
209. Taylor, J.H., *Woodlands for Health and Wellbeing: Why and How*. undated, Coed Lleol partnership for National Public Health Service
210. O'Brien, E., *A sort of magical place: people's experiences of woodlands in northwest and southeast England*. 2004, Forest Research: Farnham
211. Wilson, E.O., *Biophilia: The human bond with other species*. 1984, Cambridge, Mass: Harvard University Press.
212. Louv, R., *Last child in the woods* 2010: Atlantic books.
213. Greenhalgh, T., et al., *An open letter to The BMJ editors on qualitative research*. BMJ, 2016. **352**.
214. Gomez-Baggethun, E., et al., *State-of the art report on integrated valuation of ecosystem services*, in *EU FP7 OpenNESS Project Deliverable 4.1*. 2014.
215. Raymond, C.M., et al., *Comparing instrumental and deliberative paradigms underpinning the assessment of social values for cultural ecosystem services*. Ecological Economics, 2014. **107**(0): p. 145-156.
216. Fish, R., et al., *Participatory and deliberative techniques to embed an ecosystems approach into decision making: An introductory guide*. 2011, Defra: London.
217. Kenter, J., *Deliberative and non-monetary valuation: A review of methods*, in *Laurence Mee Centre for People and the Sea, Working Papers 2014 02*. 2014.
218. Maxwell, S., et al., *Social impacts and wellbeing: Multi-criteria analysis techniques for interegating non-monetary evidence in valuation and appraisal* 2011, Defra, GSR, GES and Social Impacts Taskforce London
219. Craig P., et al., *Developing and evaluating complex interventions: new guidance*. . 2008, MRC
220. Kelemen, E., et al., *Non-monetary techniques for the valuation of ecosystem service*, in *OpenNESS Reference Book. EC FP7 Grant Agreement no. 308428*. , M. Potschin and K. Jax, Editors. 2011.
221. Scott, A., et al., *UK National Ecosystem Assessment Follow-on. Work Package Report 10: Tools – Applications, Benefits and Linkages for Ecosystem Science (TABLES)*. 2014, UNEP-WCMC, LWEC.
222. Bowen, R., et al., eds. *Oceans and Human Health: Implications for Society and Well-Being*. 2014, Wiley London.
223. Welters, R. and I. Bateman, *Report from 'Improving decisions at the food, water, energy and environment nexus: Values and valuation workshop'*. 2014: London.
224. UK National Ecosystem Assessment Follow-on, *Synthesis of the Key Findings*. 2014, UNEP WCMC: Cambridge.

225. Guerry, A.D., S. Polasky, and e. al., *Natural capital and ecosystem services informing decisions: From promise to practice*. Proceedings of the National Academy of Sciences, 2015. **112**(24): p. 7348–7355
226. Snowdon, P., *Natural capital and ecosystem services 2014*, Forestry Commission.
227. Natural Capital Committee, *The State of Natural Capital*. 2013.
228. Natural Capital Committee, *Advice to Government on Research Priorities*. 2015.
229. Bateman, I.J., et al., *Bringing ecosystem services into economic decision-making: land use in the United Kingdom*. science, 2013. **341**(6141): p. 45-50.
230. Scottish Natural Heritage, *A systematic evaluation of Scotland's Natural Capital Asset Index*. 2014: Inverness.
231. Daw, T., et al., *Applying the ecosystem services concept to poverty alleviation: the need to disaggregate human well-being*. Environmental Conservation, 2011. **38**(04): p. 370-379.
232. Environmental Audit Committee, *Wellbeing*. 2014: London.
233. Natural Capital Initiative Partners, *Ecosystem services and the delivery of health benefits. Towards optimised health and environment planning in Summary report for policy makers based on a workshop held on 28th September, 2010*. 2010.
234. Natural Capital Committee, *The State of Natural Capital. Protecting and Improving Natural Capital for Prosperity and Wellbeing*. 2015.
235. Kretsch, C. and H. Keune, *Ecosystem Services and Human Health*, in *OpenNESS Reference Book*, M. Potschin and K. Jax, Editors. 2015, EC FP7 Grant Agreement no. 308428.
236. Oldfield, A., *Placing value' : reframing conceptions of the importance of the community park*, , in *Centre for Housing Research*. 2014, University of St Andrews.
237. Sustainable Development Unit, *Sustainable, resilient, healthy places & people*. 2014, NHS Engand and PHE: Cambridge
238. Garside, R., et al., *Preventing obesity using a 'whole system' approach at local and community level: PDG 1. Identifying the key elements and interactions of a whole system approach to obesity prevention*, in *Report for NICE Centre for Public Health Excellence*. 2010: University of Exeter and Plymouth.
239. Hawkes, C., et al., *Smart food policies for obesity prevention*. The Lancet, 2014. **385**(9985): p. 2410-2421.
240. Pearce, J., et al., *Life Course, Green Space and Health: Incorporating Place into Life Course Epidemiology*. International Journal of Environmental Research and Public Health, 2016. **13**(3): p. 331.
241. Ogilvie, D., et al., *Assessing the Evaluability of Complex Public Health Interventions: Five Questions for Researchers, Funders, and Policymakers*. The Milbank Quarterly, 2011. **89**(2): p. 206-225.
242. Hemming, K., et al., *The stepped wedge cluster randomised trial: rationale, design, analysis, and reporting*. BMJ, 2015. **350**.
243. Rutter, H. and K. Glonti, *Towards a new model of evidence for public health*. The Lancet, 2017. **388**: p. S7.
244. World Health Organization, *Urban Green Space Interventions and Health. A review of impacts and effectiveness*. 2017: Copenhagen
245. Macintyre, S. and M. Peticrew, *Good intentions and recieved wisdom are not enough*. Journal of Epidemiol Community Health, 2000. **54**: p. 802-803.
246. Pawson, R. and N. Tilley, *Realistic Evaluation*. 1997, London: Sage.
247. Husk, K., et al., *What approaches to social prescribing work, for whom, and in what circumstances? A protocol for a realist review*. Systematic Reviews, 2016. **5**(1): p. 1-7.

248. Scholz, U. and H. Krombholz, *A study of the physical performance ability of children from wood kindergartens and from regular kindergartens*. *Motorik* Mar, 2007. **1**: p. 17 - 22.
249. Fjørtoft, I., *Landscape as Playscape: The Effects of Natural Environments on Children's Play and Motor Development*. *Children, Youth and Environments*, 2004. **14**(2): p. 21-44.
250. Lovell, R., *An evaluation of physical activity at Forest School in School of Clinical Sciences and Community Health*. 2009, The University of Edinburgh Edinburgh p. 402.
251. Ridgers, N.D., Z.R. Knowles, and J. Sayers, *Encouraging play in the natural environment: a child-focused case study of Forest School*. *Children's Geographies*, 2012. **10**(1): p. 49-65.
252. O'Brien, L., *Learning outdoors: the Forest School approach*. *Education 3-13*, 2009. **37**(1): p. 45-60.
253. Roe, J. and P. Aspinall, *The restorative outcomes of forest school and conventional school in young people with good and poor behaviour*. *Urban Forestry & Urban Greening*, 2011. **10**(3): p. 205-212.
254. Scrutton, R.A., *Outdoor adventure education for children in Scotland: quantifying the benefits*. *Journal of Adventure Education and Outdoor Learning*, 2015. **15**(2): p. 123-137.
255. Blakesley, D., M. Rickinson, and J. Dillon, *Engaging children on the autistic spectrum with the natural environment: Teacher insight study and evidence review*. 2013.
256. Mitchell, R. and R. Shaw, *Health impacts of the John Muir Award*. undated University of Glasgow: John Muir Trust: GCPH: Glasgow.
257. Ellaway, A., S. Macintyre, and X. Bonnefoy, *Graffiti, greenery, and obesity in adults: secondary analysis of European cross sectional survey*. *BMJ*, 2005. **331**(7517): p. 611-612.
258. Sanders, T., et al., *Greener neighbourhoods, slimmer children? Evidence from 4423 participants aged 6 to 13 years in the Longitudinal Study of Australian children*. *Int J Obes (Lond)*, 2015. **39**(8): p. 1224-9.
259. Mackenbach, J.D., et al., *Obesogenic environments: a systematic review of the association between the physical environment and adult weight status, the SPOTLIGHT project*. *BMC Public Health*, 2014. **14**(1): p. 1-15.
260. Penny, R., *Public Health evidence to support green infrastructure planning*. *Town & Country Planning* 2014(November).
261. Elsey, H., et al., *Understanding the impacts of care farms on health and well-being of disadvantaged populations: a protocol of the Evaluating Community Orders (ECO) pilot study*. *BMJ Open*, 2014. **4**(10).
262. Yin, R.K., *Case study research. Design and methods*. *Applied Social Research Methods Series*. Vol. 5. 1989, London: Sage.
263. Department of Health, *Public Health in Local Government*. 2011: London.
264. Marmot, M., et al., *Fair Society, Healthy Lives. The Marmot Review*. 2010: London.
265. Langford, C., P. Baeck, and M. Hampson, *More than medicine: new services for people powered health*. 2013, Nesta: London.
266. Husk, K., et al. *Participation in environmental enhancement and conservation activities for health and well-being in adults*. *Cochrane Database of Systematic Reviews*, 2013. DOI: 10.1002/14651858.CD010351.
267. Public Health England, *A guide to community-centred approaches for health and wellbeing*. 2015: London.

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## Appendix 1. Fellowship activities and methods

The aims of the fellowship were to:

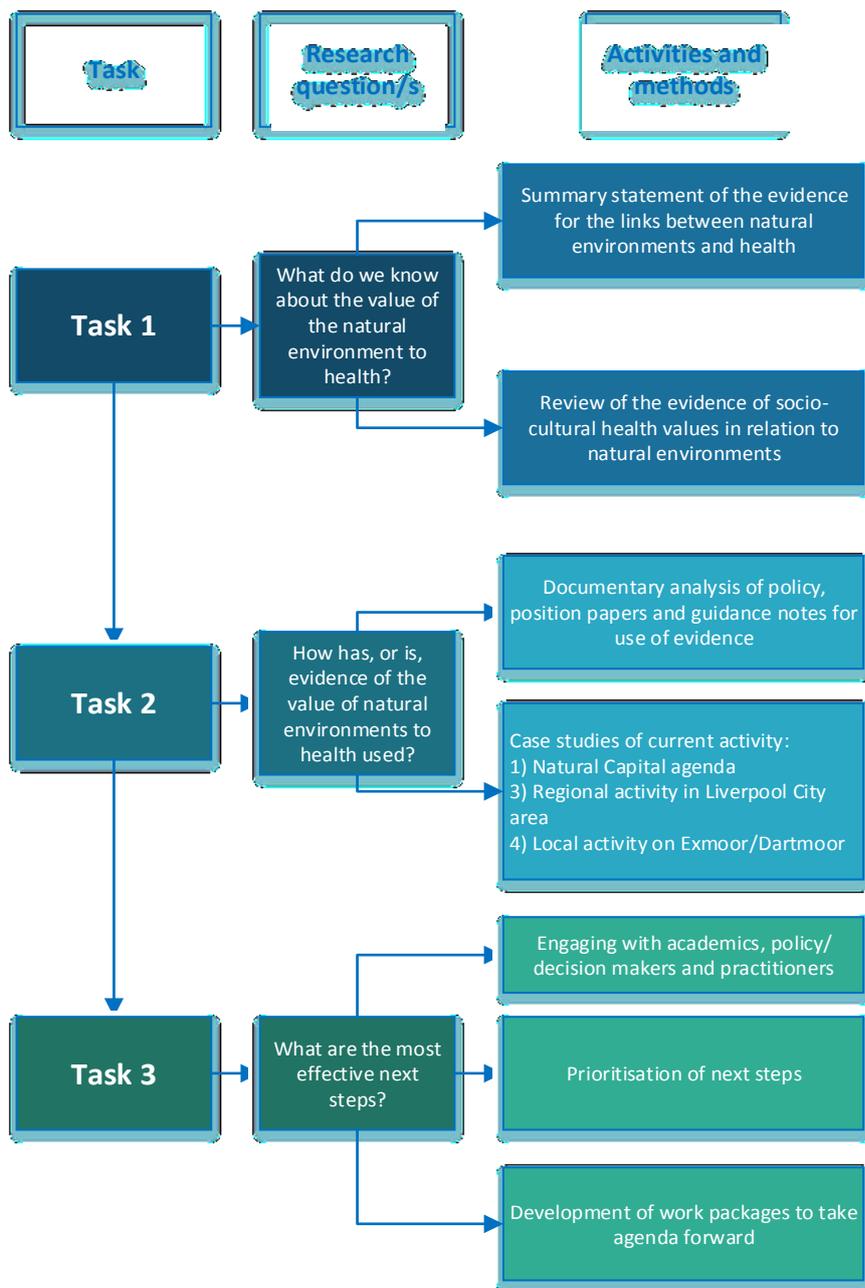
- a) Clarify what we know about the linkages between natural environments to health, to characterise how different social groups understand the health potential of the natural environment, and to examine the factors that may facilitate or prevent the realisation of those benefits.
- b) Evaluate how evidence of the value of natural environments to health, (particularly socio-cultural, non-monetary values) used, taken into account by and incorporated into existing policy and practice.
- c) Identify effective and promising opportunities to act on the values of natural environments to promote better health.

The methodologies used to complete the fellowship activities included:

- Production of a summary statement of the evidence for the relationship between natural environments and health supported by a conceptual map and articulation of the extent and strength of the current evidence linking natural environments and health. This activity relates to aims a and b (as detailed above).
- Systematic review of evidence relating the ways in which different social groups value the natural environment as a resource for health This activity relates specifically to aims a and b.
- Documentary analysis to examine how different types of evidence (and in particular that relating to socio-cultural, non-monetary values) has been used to support and inform existing health and environment relevant policies, positions and activities. This activity relates to aim b and c.
- Case studies to better understand current activity around the value of natural environments to health and to examine the role of evidence, in particular socio-cultural values, in relevant decision making. This activity relates to aim b and c.
- Attendance or participation in relevant events and consultation with a range of stakeholders (from health, environment and other relevant sectors) regarding the value of natural environments to health, the production and use of socio-cultural, non-monetary values, and in relation to decision making processes. These activities relate to all three aims.
- Participatory and deliberative methods to facilitate a collaborative identification and initial development of options for future research, policy and/or practice. These activities relate to aim b and c.
- Summative analysis of the findings of the various activities to generate the final set of future opportunities and options

Although formal and recognised methodologies were followed where possible the research was undertaken by one researcher and was non-systematic and iterative. It is recognised that this is a limitation of the work.

Figure 11. Work flow



## Appendix 2. Reviews of the influences of natural environment to health

The following is a list (not exhaustive) of reviews of primary studies of links between natural environments and health outcomes. The reviews differ in their levels of reliability and robustness; there are a small number of formal peer-reviewed systematic reviews with quantitative meta-analyses or qualitative meta-syntheses, the majority are peer reviewed systematic reviews which have taken a narrative synthesis approach. A small number of non-peer reviewed non-systematic syntheses are included.

- Annerstedt, M. and P. Währborg (2011). "Nature-assisted therapy: systematic review of controlled and observational studies." Scand. J. Public Health **39**: 371.
- Bedimo-Rung, A. L., A. J. Mowen and D. A. Cohen (2005). "The significance of parks to physical activity and public health: A conceptual model." American journal of preventive medicine **28**(2): 159-168.
- Beute, F. and Y. A. W. de Kort (2014). "Salutogenic effects of the environment: review of health protective effects of nature and daylight." Applied Psychology. Health and Well-being **6**(1): 67-95.
- Bowler, D., L. Buyung-Ali, T. Knight and A. Pullin (2010). "A systematic review of evidence for the added benefits to health of exposure to natural environments." BMC Public Health **10**: 456.
- Bowler, D. E., L. Buyung-Ali, T. M. Knight and A. S. Pullin (2010). "Urban greening to cool towns and cities: A systematic review of the empirical evidence." Landscape & Urban Planning **97**(3): 147-155.
- Bratman, G. N., J. P. Hamilton and G. C. Daily (2012). "The impacts of nature experience on human cognitive function and mental health." Annals of the New York Academy of Sciences **1249**(1): 118-136.
- Bringslimark, T., T. Hartig and G. G. Patil (2009). "The psychological benefits of indoor plants: A critical review of the experimental literature." Journal of Environmental Psychology **29**(4): 422-433.
- Capaldi, C. A., R. L. Dopko and J. M. Zelenski (2014). "The relationship between nature connectedness and happiness: a meta-analysis." Frontiers in Psychology **5**.
- Chen, X. (2016). Urban Nature's Health Effects and Monetary Valuation: A Systematic Review, NINA.
- Clark, C., R. Myron, S. Stansfeld and B. Candy (2007). "A systematic review of the evidence on the effect of the built and physical environment on mental health." Journal of Public Mental Health **6**(2): 14-27.
- Clark, C., S. A. Stansfeld and B. Candy (2006). "A Systematic Review on the Effect of The Physical Environment on Mental Health." Epidemiology **17**(6): S527.
- Clark, N. E., R. Lovell, B. W. Wheeler, S. L. Higgins, M. H. Depledge and K. Norris (2014). "Biodiversity, cultural pathways, and human health: a framework." Trends in Ecology & Evolution **29**(4): 198-204.
- Croucher, K., L. Myers and J. Bretherton (2007). The links between greenspace and health: a critical literature review. Stirling, Greenspace Scotland.
- Dean, J., K. van Dooren and P. Weinstein (2011). "Does biodiversity improve mental health in urban settings?" Medical hypotheses **76**(6): 877-880.
- de Keijzer, C., M. Gascon, M. J. Nieuwenhuijsen and P. Davvand (2016). "Long-Term Green Space Exposure and Cognition Across the Life Course: a Systematic Review." Current Environmental Health Reports **3**(4): 468-477.

- Di Nardo, F., R. Saulle and G. La Torre (2012). "Green areas and health outcomes: a systematic review of the scientific literature." Italian Journal of Public Health 7(4).
- Díaz, S., S. Demissew, J. Carabias, et al. (2015). "The IPBES Conceptual Framework — connecting nature and people." Current Opinion in Environmental Sustainability 14: 1-16.
- Dzhambov, A. M., D. D. Dimitrova and E. D. Dimitrakova (2014). "Association between residential greenness and birth weight: Systematic review and meta-analysis." Urban Forestry & Urban Greening 13(4): 621-629.
- Frumkin, H. (2003). "Healthy Places: Exploring the Evidence." American Journal of Public Health 93(9): 1451-1456.
- Gascon, M., M. Triguero-Mas, D. Martínez, P. Dadvand, D. Rojas-Rueda, A. Plasència and M. J. Nieuwenhuijsen (2016). "Residential green spaces and mortality: A systematic review." Environment International 86: 60-67.
- Gascon, M., M. Triguero-Mas, D. Martínez, P. Dadvand, J. Forns, A. Plasència and M. Nieuwenhuijsen (2015). "Mental Health Benefits of Long-Term Exposure to Residential Green and Blue Spaces: A Systematic Review." International Journal of Environmental Research and Public Health 12(4): 4354-4379.
- Gifford, R. and A. Nilsson (2014). "Personal and social factors that influence pro-environmental concern and behaviour: A review." International Journal of Psychology 49(3): 141-157.
- Haluza, D., R. Schonbauer and R. Cervinka (2014). "Green Perspectives for Public Health: A Narrative Review on the Physiological Effects of Experiencing Outdoor Nature." International Journal of environmental Research & Public Health 11(5): 5445-5461.
- Hanson, S. and A. Jones (2015). "Is there evidence that walking groups have health benefits? A systematic review and meta-analysis." British Journal of Sports Medicine 49(11): 710-715.
- Hartig, T., R. Mitchell, S. de Vries and H. Frumkin (2014). "Nature and Health." Annual Review of Public Health 35(1): 207-228.
- Hough, R. (2014). "Biodiversity and human health: evidence for causality?" Biodiversity and Conservation 23(2): 267-288.
- Hunter, A. and G. Luck (2015). "Defining and measuring the social-ecological quality of urban greenspace: a semi-systematic review." Urban Ecosystems: 1-25.
- Hunter, R. F., H. Christian, J. Veitch, T. Astell-Burt, J. A. Hipp and J. Schipperijn (2015). "The impact of interventions to promote physical activity in urban green space: A systematic review and recommendations for future research." Social Science & Medicine 124(0): 246-256.
- Husk, K., R. Lovell, C. Cooper, W. Stahl- Timmins and R. Garside (2016). "Participation in environmental enhancement and conservation activities for health and well- being in adults: a review of quantitative and qualitative evidence." The Cochrane Library 5.
- James, P., R. Banay, J. Hart and F. Laden (2015). "A Review of the Health Benefits of Greenness." Current Epidemiology Reports: 1-12.
- Kaczynski, A. and K. Henderson (2007). "Environmental correlates of physical activity: A review of evidence about parks and recreation." Leisure Sciences 29: 315 - 354.
- Keniger, L., K. Gaston, K. Irvine and R. Fuller (2013). "What are the Benefits of Interacting with Nature?" International Journal of Environmental Research and Public Health 10(3): 913-935.
- Kondo, M., E. South and C. Branas (2015). "Nature-Based Strategies for Improving Urban Health and Safety." Journal of Urban Health: 1-15.

- Lachowycz, K. and A. Jones (2011). "Greenspace and obesity: a systematic review of the evidence." Obes. Rev. **12**: e183.
- Lachowycz, K. and A. P. Jones (2012). "Towards a better understanding of the relationship between greenspace and health: Development of a theoretical framework." Landscape and Urban Planning **118**: 62-69.
- Largo-Wight, E. (2011). "Cultivating healthy places and communities: evidenced-based nature contact recommendations." International Journal of Environmental Health Research **21**(1): 41 - 61.
- Lee, I., et al. (2017). "Effects of Forest Therapy on Depressive Symptoms among Adults: A Systematic Review." International Journal of Environmental Research and Public Health **14**(3): 321.
- Lee, A. C. K. and R. Maheswaran (2010). "The health benefits of urban green spaces: a review of the evidence." Journal of Public Health.
- Lovell, R., K. Husk, C. Cooper, W. Stahl-Timmins and R. Garside (2015). "Understanding how environmental enhancement and conservation activities may benefit health and wellbeing: a systematic review." BMC Public Health **15**(1): 864.
- Lovell, R., B. W. Wheeler, S. L. Higgins, K. N. Irvine and M. H. Depledge (2014). "A systematic review of the health and well-being benefits of biodiverse environments." J. Toxicol. Environ. Health Part B **17**: 1-20.
- Maller, C., M. Townsend, L. S. Leger, C. Henderson-Wilson, A. Pryor, L. Prosser and M. Moore (2008). Healthy parks, healthy people. The health benefits of contact with nature in a park context. A review of relevant literature. Melbourne, School of Health and Social Development
- McCormack, G. R., M. Rock, A. M. Toohey and D. Hignell (2010). "Characteristics of urban parks associated with park use and physical activity: A review of qualitative research." Health & Place **16**(4): 712-726.
- McCurdy, L. E., K. E. Winterbottom, S. S. Mehta and J. R. Roberts (2010). "Using nature and outdoor activity to improve children's health." Current Problems In Pediatric And Adolescent Health Care **40**(5): 102-117.
- Newton, J. (2007). Wellbeing and the Natural Environment: A brief overview of the evidence. Bath, University of Bath for the SDU.
- NICE (2006). Physical activity and the environment: Review Three: Natural Environment. NICE Public Health Collaborating Centre – Physical activity. London, NICE.
- O'Brien, L. and P. Varley (2012). "Use of ethnographic approaches to the study of health experiences in relation to natural landscapes." Perspectives in Public Health **132**(6): 305-312.
- Ohly, H., S. Gentry, R. Wigglesworth, A. Bethel, R. Lovell and R. Garside (2016). "A systematic review of the health and well-being impacts of school gardening: synthesis of quantitative and qualitative evidence." BMC public health **16**(1): 286.
- Oosterbroek, B., et al. (2016). "Assessing ecosystem impacts on health: A tool review." Ecosystem Services **17**: 237-254.
- Pietilä, M., M. Neuvonen, K. Borodulin, K. Korpela, T. Sievänen and L. Tyrväinen "Relationships between exposure to urban green spaces, physical activity and self-rated health." Journal of Outdoor Recreation and Tourism.
- Pullin, A., M. Bangpan, S. Dalrymple, K. Dickson, N. Haddaway, J. Healey, H. Hauari, N. Hockley, J. P. G. Jones, T. Knight, C. Vigurs and S. Oliver (2013). "Human well-being impacts of terrestrial protected areas." Environmental Evidence **2**(1): 19.

- Romagosa, F., P. F. J. Eagles and C. J. Lemieux "From the inside out to the outside in: Exploring the role of parks and protected areas as providers of human health and well-being." Journal of Outdoor Recreation and Tourism.
- Rupprecht, C. D. D. and J. A. Byrne (2014). "Informal urban greenspace: A typology and trilingual systematic review of its role for urban residents and trends in the literature." Urban Forestry & Urban Greening **13**(4): 597-611.
- Sandifer, P. A., A. E. Sutton-Grier and B. P. Ward (2015). "Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation." Ecosystem Services **12**(0): 1-15.
- Thompson Coon, J., K. Boddy, K. Stein, R. Whear, J. Barton and M. Depledge (2011). "Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review." Environ. Sci. Technol. **45**: 1761.
- Toohey, A. and M. Rock (2011). "Unleashing their potential: a critical realist scoping review of the influence of dogs on physical activity for dog-owners and non-owners." International Journal of Behavioral Nutrition and Physical Activity **8**(1): 1-9.
- Tzoulas, K., K. Korpela, S. Venn, V. Yli-Pelkonen, A. Kaz´mierczak, J. Niemela and P. James (2007). "Promoting ecosystem and human health in urban areas using Green Infrastructure: a literature review." Landscape and Urban Planning **81**(3): 167-178.
- van den Berg, M., W. Wendel-Vos, M. van Poppel, H. Kemper, W. van Mechelen and J. Maas (2015). "Health Benefits of Green Spaces in the Living Environment: A Systematic Review of Epidemiological Studies." Urban Forestry & Urban Greening **online first**.
- Völker, S. and T. Kistemann (2011). "The impact of blue space on human health and well-being – Salutogenetic health effects of inland surface waters: A review." International Journal of Hygiene and Environmental Health **214**(6): 449-460.
- Ward Thompson, C. (2011). "Linking landscape and health: The recurring theme." Landscape and Urban Planning **99**(3–4): 187-195.
- Whear, R., J. T. Coon, A. Bethel, R. Abbott, K. Stein and R. Garside (2014). "What is the impact of using outdoor spaces such as gardens on the physical and mental well-being of those with dementia? A systematic review of quantitative and qualitative evidence." J Am Med Dir Assoc **15**(10): 697-705.

### Appendix 3. Typology of ‘natural environments’

Typology from Greenspace Scotland [104]

PAN65 Category	Description
Public parks & gardens	Areas of land normally enclosed, designed, constructed, managed and maintained as a public park or garden.
Private gardens or grounds	Areas of land normally enclosed and associated with a house or institution and reserved for private use.
Amenity greenspace	Landscaped areas providing visual amenity or separating different buildings or land uses for environmental, visual or safety reasons e.g. road verges or greenspaces in business parks, and used for a variety of informal or social activities such as sun bathing, picnics or kick-about.
Play space for children & teenagers	Areas providing safe and accessible opportunities for children’s play, usually linked to housing areas.
Sports areas	Large and generally flat areas of grassland or specially designed surfaces, used primarily for designated sports i.e. playing fields, golf courses, tennis courts, bowling greens; areas which are generally bookable.
Green corridors	Routes including canals, river corridors and old railway lines, linking different areas within a town or city as part of a designated and managed network and used for walking, cycling or horse riding, or linking towns and cities to their surrounding countryside or country parks. These may link greenspaces together.
Natural & semi-natural greenspaces	Areas of undeveloped or previously developed land with residual natural habitats or which have been planted or colonised by vegetation and wildlife, including woodland and wetland areas.
Other functional greenspaces	Allotments, churchyards and cemeteries.
Civic space	Squares, streets and waterfront promenades, predominantly of hard landscaping that provide a focus for pedestrian activity and make connections for people and for wildlife, where trees and planting are included.

#### Appendix 4. Engaging with policy and decision makers, practitioners and academics

Over 280 policy and decision makers, practitioners and academics were consulted or presented to. Representatives of multiple departments and governmental bodies were consulted, these included Defra, Natural England, Environment Agency, DH, Public Health England, NHS, DCLG, Cabinet Office, POST, the Research Councils (ESRC, NERC, AHRC), multiple Local Authorities, and the House of Lords.

Numerous events were attended and contributed to, these include:

- Ecosystems and health workshop in Snowdonia organised by the Collaboration for Health and Biodiversity, Natural Resources Wales and Scottish Natural Heritage
- ESRC NEXUS events
- Natural Capital valuation seminar
- Outdoors for All (working group and research) meetings
- Valuing Nature Network prioritisation event
- 2015 Local Nature Partnership ministerial meeting
- ‘Towards a Daily Dose of Nature’ workshop held in Bristol by the Wildlife Trusts and National Trust
- Heseltine Institute for Public Policy and Practice’s ‘Beyond Greenspace: How can nature create healthier and wealthier places?’ event
- ‘Nature - Our Big Green Ally’ event in Bristol held by RSPB and Wildlife Trusts
- Defra’s evidence specialist meeting
- Natural Capital Committee research needs meeting
- Natural Capital Initiative valuing our support systems report launch
- House of Lord’s Agricultural Economics groups
- BioEcon IUCN conference meeting
- Northamptonshire LNP annual conference
- Launch of 25 Year Environment Plan
- Ministerial workshops to shape the 25 Year Environment Plan

## Appendix 5. Narrative review of the ways in which different social groups understand the health benefits of natural environments

### Review questions

The primary review research question was:

*In what ways do different social groups perceive of the natural environment as a resource for health?*

The following sub-questions were also addressed:

- 1) In what ways do different social groups make use of the natural environment as a health resource and what factors may act as barriers? (also addressed through the broader review of links between natural environments and health)
- 2) Is there evidence which has considered whether values, motivations and practices differ according to social context, environment type or according to different sorts of health benefits (e.g. prevention of ill health or as part of treatment and recovery)?

And in relation to methods:

- 3) What contribution has social science, participatory and deliberative techniques made to this body of evidence?
- 4) What contribution has non-academic evidence (i.e. project evaluations) made and how have relevant interventions been evaluated?
- 5) How does the evidence base ‘fit’ with the priorities of current policy/practice?

### Review methodology

Established narrative review methodologies were used to address the research questions<sup>63</sup>. Narrative reviews are typically used to describe a body of evidence relating to a particular topic and the results of such reviews are generally descriptive and are often used to identify needs for future research. Narrative reviews, whilst not fully systematic, are robust and rigorous; the review is carried out using systematic, documented and replicable methods.

The types of evidence (quantitative or qualitative, published or ‘grey’) of interest to this review related to: personal or social values towards the natural environment, health and wellbeing; cultural norms and narratives regarding use of natural areas; barriers such as lack of interest, perceptions of safety and suitability of available areas; conflicting uses of natural resources; and the role of socio-environmental capital and cohesion.

The review focused on the UK, however relevant evidence relating to western, developed countries which have some consistency in population socio-economic and health status, political systems and cultural practices, was also considered where appropriate.

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<sup>63</sup> [Review methodology](#) from Environmental Evidence

A search strategy suitable to the disparate and dispersed nature of the evidence base was developed and applied. Alison Bethel, an Information Specialist based in UEMS developed the search strategy so that it is inclusive of the types of evidence required but specific enough to ensure that irrelevant literature returns are kept to a minimum (see below for example search strategy). Databases searched include Web of Science and EnviroComplete. In addition to the formal searches, hand searching of journals, backwards and forwards citation searching on key papers, and consultation with experts was undertaken. To ensure that research sub-question 4, relating to non-academic evidence, was addressed extensive searches of ‘grey literature’ were undertaken to identify unpublished project evaluations etc.

The information extracted are shown in Table 4

**Table 4. Data extraction categories**

FirstAuthor, LastName	Sample gender	Env exposure/use description
Title	Gender split	Study category
Year	Sample lifestage	Defra business areas
Full reference	Sample SES	ESS Health value
Publication Type	Sample health status	Sample quotes
Periodical	Sample residential geography	Key quant findings (quants)
Abstract	Sample ethnicity	Study scale
Keywords	Sample relation environment	Sample representative/extensive?
Study link	Study Country(ies)	Study description
Study methodology	Study area details	Free keywords
Methods descriptions	Environment type	Notes on study
Sample N	Geog context	Accessed full text?
Sample age	Environment exposure/use	Completed

The synthesis entailed the creation of a searchable structured database which illustrates the nature, extent and scope of the existing evidence in relation to values, motivations and practices and which will allow each of the review questions to be addressed. Narrative summaries were used to describe the trends in the evidence and in order to address the primary and sub-review questions. The results of the review are linked, where appropriate, to the general summary of the extent of evidence.

### Example search strategy

Devised by Alison Bethel, University of Exeter Medical School

Time frame: 2000-present

Web of Science categories: ecology or environmental sciences or forestry or nursing or environmental studies or social sciences interdisciplinary or psychology experimental or public environmental occupational health or geography or pediatrics or sociology or urban studies or health policy services or behavioral sciences or geosciences multidisciplinary or psychology social or social issues or education educational research or planning development or multidisciplinary sciences or psychology or family studies or psychology applied or hospitality leisure sport tourism or social sciences biomedical or psychology educational or psychology multidisciplinary or psychiatry or health care sciences services or agriculture multidisciplinary or medicine general internal.

TS=(people\* or person\* or group\* or communit\* or child\* or teenag\*) NEAR/4 (value\* or engage\* or motiv\* or percept\* or perceive\* or connect\* or use\* or access\* or experience\* or prefer\* or view\*))

AND

TI=(Allotment\* or Beach\* or bog or bluespace or Coast\* or Countryside\* or Forest\* or Garden\* or Grassland\* or greenfield\* or "green field\*" or "Green space\*" or greenspace\* or Heath or "Natural environment\*" or Nature or "Open space\*" or Outdoor\* or park\* or "Playing field\*" or "Recreation\* ground\*" or seaside\* or wilderness or wood\*)

### **Additional evidence**

Through the search process we also identified a body of research which relates to 1) the barriers and facilitators of access to/use of the environment (some of which is specifically related to health), 2) how the natural environment is valued more generally and 3) how values are used/integrated etc.

## Appendix 6. Documentary analysis policies, strategies, positions and guidance statements

The purpose of the documentary analysis was to better understand the types of evidence which have been used to support policies, strategies, positions and guidance.

The documentary analysis contributed to the evaluation of the types of evidence that are needed by Defra and the Network (as well as other stakeholders and partners) in relation to fully appreciating and incorporating health-environment values. As stated in the Evidence Strategy, there is a need to “*maintain and improve access to the evidence required to meet our policy and operational needs*” (pp 9).

### Documentary analysis methods

A set of key research questions were address using the documentary analysis:

- What types of evidence are most commonly used to justify or illustrate statements?
- What types of evidence have been used in relation to health and environmental policy and specifically what contribution has non-academic evidence made?
- Drawing on the results of the narrative review and evidence summary, have parts of the existing evidence base been used to a greater or lesser degree than others (e.g. according to methodology, topic, origin (i.e. non-/academic)?

Relevant policy, position and strategy documents, including supporting materials such as consultation responses, were examined for the use of evidence. Documents from across government were sought, focusing primarily on Defra and Department of Health (DoH) but including where relevant Department for Communities and Local Government (DCLG), Department for Culture Media and Sport (DCMS) and others. Relevant documents from key NGOs such as Mind, Royal Society for Protection of Birds (RSPB) and The Conservation Volunteers (TCV) and from professional bodies such as the Landscape Institute were also included. Further suggestions of key documents from the steering group, scientific advisory group and external experts were requested. The list of document can be found below (Table 5).

**Table 5. Guidance, policy and position papers**

Natural Environment White Paper ‘The Natural Choice’	<b>Defra</b>
Natural capital: supporting evidence and analysis to the Natural Environment White Paper	Defra
Natural Environment White Paper discussion document	Defra
‘Nature Nearby’. Accessible Natural Greenspace Guidance	Natural England
Our Natural Health Service. The role of the natural environment in maintaining healthy lives	Natural England, PHE
The case for trees in development and the urban environment	Forestry Commission
Developing the contribution of the natural heritage to a healthier Scotland	SNH
Urban Green Infrastructure Benefits Factsheets	SNH

Healthy Lives, Healthy People: Our strategy for public health in England	Department of Health
Local action on health inequalities: Improving access to green spaces	Public Health England
Health and Wellbeing Boards - Local Implementation Toolkit Draft version	NHS, PHE
Promoting and creating natural environments that encourage or support physical activity	NHS, NICE
Environment and health: Is there a role for environmental and countryside agencies in promoting benefits to health?	NHS, HDA
Great Outdoors: How Our Natural Health Service Uses Green Space To Improve Wellbeing Briefing Statement	Faculty of Public Health
Green space, reduction of health inequities, and cost effectiveness of interventions	Public Health Wales
Woodlands for Health and Wellbeing: Why and How	National Public Health Service Wales
Good Places, Better Health. A new approach to environment and health in Scotland	Scottish Government
Urban GI	POST
Commentary on NICE Promoting and creating built or natural environments that encourage and support physical activity	NHS Health Scotland
Mutual Benefits: The environment and Health, Social Care and Well-being Strategies	WLGA, CCW, EA and WAG
Natural environment and green space	Bedford Borough Council
The health impacts of spatial planning decisions	Kings fund, NHS London HUDU
Sustainable social care: the natural environment	Social Care Institute for Excellence
A nature and wellbeing act	RSPB, Wildlife Trusts
Wellbeing through wildlife	RSPB
Health and wellbeing	Planning guidance portal
The Value of Public Space: How high quality parks and public spaces create economic, social and environmental value	CABE
Green space strategies a good practice guide	CABE
Health, place and nature How outdoor environments influence health and well-being: a knowledge base	Sustainable Development Unit
Improving Young People's Lives. The role of the environment in building resilience, responsibility and employment chances	Sustainable Development Unit
Public Health and Landscape Creating healthy places	Landscape Institute
Planning for a healthy environment –good practice guidance for green infrastructure and biodiversity	Town and Country Planning Association, Wildlife Trusts
Health Impact Assessment of greenspace. A Guide	Greenspace Scotland
Greenspace and Health Outcomes Framework	Greenspace Scotland, NHS Scotland
Greenspace design for health and well-being	NHS Forest, Forestry Commission

The built environment and health

Glasgow Centre for  
Population Health (NHS  
Greater Glasgow and Clyde,  
Glasgow City Council, and  
the University of Glasgow,  
funded by the Scottish  
Government)

## **Appendix 7. Case studies of activity in relation to the value of natural environments to health**

The aims of the case studies were to better understand current activity around the value of natural environments to health and to examine the role of evidence in relevant decision making.

### **The four case study topics**

- Local projects on Dartmoor and Exmoor
- Coordinated activity in the Liverpool region
- Academic and Local Government knowledge sharing in Cornwall
- Natural Capital, a valuation strategy

The case studies represent some of the key delivery mechanisms and valuation activities, where the natural environment sector (whether that is Defra/Network, NGOs or others) is (or could be) working with the health (or in some cases, social) sector to deliver programmes, projects or activities which link health with natural environments. The cases have also been chosen so as to allow for some consideration of spatial scale, a variety of delivery mechanisms, and to be of particular relevance to Defra or network interests (for instance the involvement of LNPs).

### **Case study methods**

The methods used to complete the four case studies included documentary analysis, semi-structured interviews with key stakeholders, group discussions, and site visits (where necessary) [262].

The case studies were analysed separately using analytical methods most suitable to the type of evidence produced (e.g. thematic analysis for interview data, content analysis for documentary evidence). The separate case studies were brought together, where appropriate, to examine what lessons could be learnt from the evidence.

## Appendix 8. Prioritisation meetings and workshops

A series of six specific workshops and meetings were held, or contributed to, in order to identify opportunities and options to better act upon the value of natural environments to health:

1. A meeting with academics focusing on ecosystem services and valuation
2. A meeting with Cornwall Council
3. A meeting with health sector representatives
4. A prioritisation workshop with a range of health and environmental professionals and academics
5. A meeting with EKN, Pennine Prospects, and 2 North-Western LNPs on Childhood obesity
6. A meeting with academics and policy/practice on health values for Natural Capital

Additional activities included those detailed in Appendix 5 and the workshops associated with the development of Defra's 25 Year Plan for the Environment.

In general, each of the meetings and workshops addressed the following topics:

- a. Taking stock of existing knowledge regarding environment-health values
- b. Considering what evidence has had impact and why
- c. Identify potential emerging issues and opportunities
- d. Considering longer-term strategic approaches, aligned with policy needs
- e. Identify key strategies (considering how, when, where and who)

Specific details and results from each of the meetings are provided below, structured, where relevant, according to the five topics above.

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### *Meeting 1. South-west ecosystem service group. July 2015. Plymouth Marine Lab.*

#### **Attendees (included):**

Patrick Devine Wright	University of Exeter
Mat White	University of Exeter Medical School
Helen Adams	University of Exeter
Luisa Evans	PML
Nicholas Kirsopp-Taylor	University of Exeter, Centre for Rural Policy
Lora Fleming	University of Exeter
Sian Rees	University of Plymouth
Catherine Butler	University of Exeter

...

**Aim of the meeting:** as part of a wider meeting which related to ecosystem service approaches and health, the following questions were addressed by the group:

- a. In your experience how is ESS evidence used in decision making?
- b. What types of evidence are influential?
- c. In what format is it used?

- d. Does it get used ‘out of sector’?
  - e. Who are the key gatekeepers?
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**Meeting 2. Cornwall Council. October 19th 2015. Pydar House, Truro.**

**Attendees:**

Rachael Bice	CC Strategic Environment Manager
Veryan Jones	CC Senior Environment Officer
Cindy Marsh	CC Public Health Consultant
Andy Berelsford	Volunteer Cornwall
Rebecca Lovell	University of Exeter
Mike Thomas	Director Cornwall Sports Partnership
Peter Butts	Co-ordinator for the Cornwall Learning in the Natural Environment (LINE) Project
Terry Grove-White	CC Planning Strategy Manager

**Aim of meeting:** To develop a framework for mapping what’s already been done on in Cornwall on environment and health and setting out what is needed take this agenda forwards. To discuss and agree on prioritised message for Defra.

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**Meeting 3. Health and the natural environment with health professionals. October 23rd 2015. Defra, London**

**Attendees:**

David Buck	Kings Fund
Iain Lang	University of Exeter Medical School
Jenny Shepherd	NIHR CLAHRC West Midlands and Health and Wellbeing Department, Worcestershire County Council
Craig Lister	TCV, previously Public Health England
John Newton	Public Health England
Michael Depledge	University of Exeter Medical School
Rachel Stancliffe	The Centre for Sustainable Healthcare
Rebecca Lovell	University of Exeter Medical School
Ruth Garside	University of Exeter Medical School
Simon Maxwell	Defra
Stephen Marks	Public Health and Wellbeing Directorate, Northamptonshire County Council
Tina Henry	Public Health, Devon County Council

**Aim:** the meeting addressed the following topics:

- How can we frame the potential value of the natural environment in addressing public health challenges within the context of overarching health priorities?
- How can we effectively position the natural environment in the context of key policy and delivery agendas?

- How should/could the environment sector engage with different health service and policy areas within the current economic and funding contexts? What are the key opportunities, both locally and nationally?
- We have evidence of the value of the natural environment for public health but what is ‘in it’ for the health services? How can we promote the natural environment as a determinant of health?
- How useful is the evidence base; is it reliable, rigorous and robust enough to support decision making?

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**Meeting 4. Prioritisation meeting. October 26th 2015. Defra, London**

**Attendees:**

Rebecca Lovell	University of Exeter Medical School
Ruth Garside	University of Exeter Medical School
Ben Wheeler	University of Exeter Medical School
Bruce Howard	Ecosystem Knowledge Network
Chris Blythe	The Conservation Volunteers
Clare Austin	Liverpool John Moores University, Mersey Forest
Conor Kretsch	Co-operation on Health and Biodiversity (COHAB Initiative), University of Nottingham
Cristina Romanelli	UN CBD Secretariat, and University College London
Dan Bloomfield	NERC, University of Exeter
Jessica Simpson	Lake District National Park Authority
Kaye Richards	Liverpool John Moores University
Kris Murray	Grantham Institute
Lynne Osgathorpe	RSPB
Malcolm Ward	Public Health Wales
Nick Holliday	Cotswolds AONB, Gloucestershire CPRE, National Association of AONBs, Exmoor National Park
Nigel Doar	Wildlife Trusts
Pam Warhurst	Pennine Prospects, Incredible Edible
Paul Hamblin	National Parks England
Roger Mortlock	Gloucestershire Wildlife Trust
Sarah Preston	Natural England
Sue Williams	Natural Resources Wales
Tom Oliver	University of Reading
Tony Leach	London Parks & Green Spaces Forum
Tristan Pett	University of Kent

**Aims:** The aim of the workshop was to collaboratively identify, discuss and prioritise effective strategies and opportunities to embed health values of natural environments in future decision making with particular reference to health inequalities and non-monetary values. A range of opportunities to support future decision making and activity were considered, these included:

- How systems and networks are, or could be organised.
- How we could build on and extend existing evidence and whether there are needs for new approaches to the collection, dissemination and use of data.
- How effective policies and programmes could be supported and translated.

**Methods:** A prioritisation approach called ‘nominal groups technique’ (NGT) was used. NGT<sup>64</sup> is one of a family of approaches (which includes Delphi) which are used to gain consensus from groups of experts to identify key strategies, activities or research needs.

The procedure of the NGT was as follows:

1. Participants are grouped into themes (~5 per group).
2. Ideas are generated by participants and then discussed and grouped
3. Ideas are refined to produce final list which is then voted upon
4. Prioritised list of ideas within each thematic group are generated
5. The small groups come together to review and further refine all prioritised ideas
6. Final round of private voting to generate the top rated ideas ACROSS all the groups
7. The prioritised ideas are discussed and key opportunities identified

The three themes were 1) Evidence and research; 2) Policies and programmes; and 3) Networks and systems

### **Summarised outcomes:**

#### **Theme 1: Evidence and research**

##### Round 1. Identification of key ideas:

- Role of natural environment in mitigating health inequalities. Resilience in health and environment
- Where and how can natural environments exacerbate health inequalities
- Health protection and promotion – within total ecosystem service value
- What’s the inter-relationships between place and practice that maximises health benefit?
- Whats the USP of the natural environment for health and wellbeing and for specific outcomes?
- Longitudinal data for causal outcomes? Longitudinal MENE?
- Standardised metrics – research and evaluation; environment, health and process
- Scales of processes; data collection, polies and plans
- Short term priorities; low hanging fruit – health and environment gain
- Improve the evidence base on to improve practice to maximise health benefits of the natural environment as a setting for health improvement and protection
- Intervention road map – what works, in what setting for whom and how?
- Evidence of what’s most effective in shaping behaviour – is it adjusting the environment, direct engagement, opt in vs opt out?
- Diversity of experiences – maintaining heterogeneity

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<sup>64</sup> <http://www.cdc.gov/healthyyouth/evaluation/pdf/brief7.pdf>

### Round 1. Prioritised ideas:

1. Standardised metrics – research and evaluation; environment, health and process. Standardised metrics to measure health and environment links across space, time and place. Finding common ways of conceptualising ‘values’. Working across evaluations and monitoring. Defining what are the metrics that matter.
2. What’s the inter-relationships between place and practice that maximises health benefit? In practices, experiences, preferences and activities. Taking into account different localities and environments. Process evaluation and qualitative evidence needed.
2. Need much better understanding of the role of natural environment in mitigating health inequalities. Equigensis. How to avoid worsening health?
2. Longitudinal data for causal outcomes – getting buy in from other sectors (In term funding is a barrier). Needs strong advocate at senior level. Needing to link this to govt policy indicators. Crucial for cross-sectoral policy delivery. Longitudinal MENE?

## **Theme 2. Policies and programmes**

### Round 1. Identification of key ideas:

- Formal education; from primary/early years to tertiary. Integrating greater understanding of the environments influence on our health throughout systems. Nature Free Schools
- Continuing professional development and professional training (education, medical, planning, civil service). Embedding environment and health across all streams. Increasing understanding that place can be salutogenic, obesogenic etc.
- Finding common cause to facilitate communication. NGOs role in bridging and bringing together different govt (or LG) departments. Identify existing priorities to work towards (e.g. childhood obesity, men in their 50’s, suicide prevention)
- Sectoral join up on specific campaigns – structure and justifying reasons, increase likelihood and impact
- Ensuring national scale policy translates to local delivery
- Replication mechanisms, benchmarking activity – looking for achievable challenges
- Engage with the sport strategy – broaden it to more than sport, provide leadership (link Defra and DCMS and 3<sup>rd</sup> sector), identify local resources that can be made available up by national priorities. Understanding the blocks on use/access (using segmentation, helping people navigate activities and spaces). Better understandings will help with Defra’s and other’s business model
- Re-thinking place. Provoking entitlement to the environment, local communities, public, marketing, motivating, identities, motivating people to protect ‘their’ environments
- Raising public awareness that their environments are embedded in national and global environments. Reducing localisms
- Ongoing policy re-appraisal and review. Adaptive management. Intersectoral review. Policy appraisal guidance (green/magenta book)
- Green belt and local plans. Re-designating multifunctional greenspaces – protection mechanism. Designation for health and social value.

- Green infrastructure as a common cause. Requiring health's involvement in planning processes. Many NCDs partially environmentally determined
- LNPs as a joined up delivery mechanism. Good practice in some areas, e.g. Cornwall and Gloucestershire. Need to define their remit and give them a job to do.
- Communities of policy and practice (good examples in other countries – Belgium and Finland) working on common causes. Operating at national and local level (work needed on how to disseminate up-down). Work as a group around budgetary negotiations that would have cross-departmental implications. Needs treasury/CO buy in.
- Social Return on Investment – role in policy re-appraisal in communicating breadth of gains and cumulative benefits. Cost effectiveness data more representative. Could be aprt of the communities of practice/common cause.

#### Round 1. Prioritised ideas:

1. Greater use of social return on investment models as a means to communicate gains
2. Bringing communities of interest in policy and practice together (?role of the public)
3. Fining common cause - issues that cut across sectors and departments. Campaigns to achieve impact

### **Theme 3. Networks and systems**

#### Round 1. Identification of key ideas:

- **Overarching aim/narrative:** Trying to deliver a more sustainable future – (needs to tackle health, injustice, etc. as well as environment) Defra need to deliver towards this goal.
- Breaking out of silos, creating synergies, improving efficiency, and joined up working.
  - Get onto the NHS 5year plan – nature and wellbeing.
  - Mirror Wales' Wellbeing and Future Generations strategy (see the 7 Principles key govt messages)
  - SDG – hooks?
  - Vanguard initiatives / CCG– HWB get observers onto these boards/meetings to see how they might influence this new thinking.
  - Involve health sector in discussions about land use.
  - Healthy places initiative with housing developers – housing associations/ private builders communicating the health impact of different plans (as well as environment sector)
- Leadership Nationally
  - DEFRA should suggest that there is always an observer from the environ sector on key health boards like CCGs, HWB, Vanguard committees.
  - Non-governmental credible organisations to take on this role?
  - Find supportive reps from Professional bodies – eg Inst PH, RCGPs etc.
  - Figure head?
  - Future Foresight report / committee?

- Oliver Letwin (Cabinet Office) health and environment commission.
- Planning system and health and environment responsibilities – DEFRA should take a stand / statement on this.
- Leadership Locally:
  - GPs nature on prescription – make it easy, promote local examples of good practice
  - LNPs/ National Parks other groups as a way to piloting social prescribing? Creating a product for these activities
  - Geography of the environmental sector needs to be simplified – who does “health” go and talk to?
  - LNPs need to look beyond green/nature – also broaden to other NGOs (for eg around social prescribing) Roll out best practice in social prescribing.
  - Investigate the potential for using Health Impact Assessments about environment and health

#### Round 1. Prioritised ideas:

1. Creating synergies and breaking out of silos
2. National leadership – equality of interest from Defra, Health and DCLG. Defra should do some territory grabbing. Need neutral input e.g. CO. need theme leads at high level e.g. physical activity – provide a bridge across departments and sectors. Defra needs to be more involved in planning
3. Local leadership. E.g. LNPs, NGOs working together on social prescribing. Use tools such as Health Impact Assessments (integrated with Environmental impact assessments?)

#### **Final round prioritised ideas from across themes:**

1. Creating synergies, breaking out of silos, finding common cause to facilitate cross-sectoral working
2. National leadership to bring communities of practice together, trying to ensure some equity in leadership (e.g. environment not dominated by health) with, crucially, the involvement of a cross cutting department such as (in England at least) Treasury or Cabinet Office
3. Developing and agreeing on standardised metrics/approaches to further understanding of environment-health linkages, supporting those undertaking the huge range of evaluative activity to bring cumulative impact through coordinated approaches.

*Meeting 5. Natural environment based approaches to tackling childhood obesity. 25<sup>th</sup> November 2015. Bradford*

#### **Attendees:**

Pam Warhurst	Pennine Prospects, Incredible Edible
Bruce Howard	EKN
Rachel Stanniccliffe	CSH
Harry Rutter	PHE, LSHTM

30+ representatives of health and environment organisations from the Bradford area

...

**Aims and summary:** The meeting aimed to identify how the natural environment could contribute to tackling one of the most intractable health concerns of the modern day. The participants discussed the fact that there is little money in public health and that the systems that would have once addressed the issues around obesity are no longer in place. There is, therefore, a need to rethink how we tackle the issues and make best use of the resources available to us.

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**Meeting 6. Health values and Natural Capital. December 1st 2015. Defra, London**

**Attendees:**

Sarah Jane Chimbwandira	Surrey Wildlife Trust
Helen Dunn	Defra
Rob Fish	University of Kent
Julian Harlow	Defra
Rebecca Lovell	University of Exeter Medical School
Simon Maxwell	Defra
Kathryn Monk	Natural Resources Wales
Ruth Waters	Natural England

**Aims:** There is now a substantial body of evidence which strongly suggests that natural environments are of value in the promotion and maintenance of good human health. However, as of yet, there has been relatively little activity that has used the approaches or language of ‘Natural Capital’ to consider linkages with health. The purpose of this meeting was to discuss the relevance of health to the Natural Capital agenda and to identify ways in which this could be better understood, communicated and acted upon. The following questions were addressed:

- Should we link health values/outcomes to Natural Capital? If so, how do we understand/articulate the linkages?
- How can we effectively position health in the context of key Natural Capital policy and delivery agendas?
- What are the key opportunities to link health and Natural Capital, both locally and nationally?
- How useful is the evidence base; is it reliable, rigorous and robust enough to support Natural Capital decision making? What type(s) of evidence has traction and why?
- Does non-monetised/economic values and non-quantified evidence have value to Natural Capital?

*Additional Meeting. Defra 25 Year Plan for the Environment Workshop. November 3-4<sup>th</sup> 2015. Defra, London*

The three key points from each of the two ‘Environment as a broader policy delivery tool: Health, wellbeing & integrated outcomes’ workshop session are detailed below.

**Day one:**

1. The natural environment is key to health and wellbeing
  - a. There are lots of direct benefits at individual and community level in terms of physical health but perhaps more importantly for mental health and wellbeing. The 25 year plan should identify and target key health challenges across these areas, e.g., obesity, neurological diseases, and mental health
  - b. But there are also many links at ecosystem level, across catchments, and between urban areas and surrounding rural areas. Some of these links may not be so obvious, but we need to understand them, take them into account in policy and decision-making, and work to maximise benefits/minimise negative health impacts
2. The 25 year plan should aim to understand and take account of multiple benefits from different land management options. Health benefits are one form of benefit but only one
  - a. One example the group discussed was putting carbon back into soils. Much of our food is significantly less nutritious than it used to be, and putting carbon back into the soil would increase nutrition and therefore health. Returning carbon would also help reduce water pollution and ameliorate climate change [note: this is as discussed by the group - would be worth checking if used in formal workshop report]
  - b. Key point: The health benefits alone may not be enough to justify action - or at least it would be harder on the basis of these benefits alone. But if health benefits are added together with other benefits the case may be much clearer
3. The 25 year environment plan needs to find the right balance of approaches for getting things done and use the most appropriate approach for particular challenges
  - a. For some challenges, there may be a need for legislation. The group did not identify challenges where legislation is definitely required but discussed illustrative examples, e.g., statutory underpinning may be required for access to greenspace standards
  - b. There are other issues where there is a lot going on at the moment, many examples of success on which to build, and few practical barriers to action
  - c. The 25 year plan needs to identify the right approach for different issues, be prepared to legislate on key issues if necessary, and enable or take other approaches in other cases

**Day two:**

1. Use the EU level structural funding and subsidy mechanisms to help promote and act upon the links between environments and social/health outcomes

- d. Defra signalling and leadership around the value of the environment to social/health outcomes
  - e. Mechanism to link LEPs, LNPs and HWbBs
  - f. Pathways between national leadership on this issue and the local decision making and practice.
- 2. Develop, strengthen and use integrated ways to understand the value/benefits/costs of the (existence, use, resources, services provided by the) natural environment to society.
  - g. Examples suggested included integrating ROI and SROI, or using a what works/NICE type approach
  - h. Need to demonstrate breadth of intervention outcomes, means to argue for more integrated working (co-ownership) as it is likely there are significant cost-savings (real or potential) we are failing to understand/missing.
  - i. This needs a coherent and accessible evidence base
- 3. Vision: strive for an environment which is consistently good quality (across all measure of quality – ecological, social, health. access etc.) to support and facilitate good health and strong social systems, via food systems, access, community resources etc.
  - a. This would require attention to context specific issues such as differentials in equality of access to environments between urban and rural areas.
  - b. Defra could provide leadership on this by providing a stronger (and potentially in partnership with the Department of Health) voice in the planning process.

## Appendix 9. Opportunities within health sector policy and strategy

**The strategies of Local Authorities and Health and Wellbeing Boards:** Local Authorities are expected to consider health in relation to all policies and to “*encourage health promoting environments, for example, access to green spaces*” [pp3 263]

**The Social Value Act** “*requires people who commission public services to think about how they can also secure wider social, economic and environmental benefits*”<sup>65</sup>

All bodies within the Department of Health have to consider health inequalities. The role of the natural environment in tackling health inequalities was highlighted in the Marmot Review [264], this is reflected in the inclusion of environmental use data in the Public Health Outcomes Framework<sup>66</sup>.

**The NHS 5 Year Forward View**<sup>67</sup> strongly recommends an enhanced focus on preventative health stating that “*the future health of millions of children, the sustainability of the NHS, and the economic prosperity of Britain all now depend on a radical upgrade in prevention and public health...The NHS will therefore now back hard-hitting national action on obesity, smoking, alcohol and other major health risks. We will help develop and support new workplace incentives to promote employee health and cut sickness-related unemployment. And we will advocate for stronger public health-related powers for local government and elected mayors*”

**Integrated Care approaches**<sup>68</sup> [265] provide further innovative opportunities to consider interventions taking place in the context of, or in relation to the natural environment. The Five Year forward View stated that “*the NHS will take decisive steps to break down the barriers in how care is provided between family doctors and hospitals, between physical and mental health, between health and social care. The future will see far more care delivered locally but with some services in specialist centres, organised to support people with multiple health conditions, not just single diseases*”. Some of the environmental interventions which have been evaluated are suggestive of multiple benefit pathways encompassing social, physical and mental health outcomes [266].

**Community centred approaches** [267]. Recent guidance notes that use of the existing assets available to communities provide opportunities to promote equity and increasing people’s control over their lives and health. There is clear potential to harness the value of the natural environment to promote communities’ health, this is being reflected in current activity such as that led by the Devon LNP focusing on the communities surrounding Dartmoor and Exmoor National Parks.

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<sup>65</sup> [Social Value Act](#)

<sup>66</sup> [Public Health Outcomes](#)

<sup>67</sup> [NHS Five Year Forward](#)

<sup>68</sup> [Enabling Integrated Care in the NHS](#)

The NHS has begun a process of developing new care models which are to be developed at a series of Vanguard sites<sup>69</sup>. The Vanguard projects are tasked with delivering the aims of the Five Year Forward View and supporting improvement and integration of services. There are five categories of vanguard, of which ‘*Multispecialty community providers – moving specialist care out of hospitals into the community*’ is the most relevant to this work.

There is growing interest in the use of Social and Health Impact Bonds (or payment by results) to ‘drive more effective policies’. This partly driven by Cabinet Office and relates to wider policy areas than just health<sup>70</sup>, however there are examples relating to the health system (predominantly relating to social prescribing). In Newcastle, for example, ‘Ways to Wellness’<sup>71</sup> has raised money from social investors, who then share some of the risk of developing and delivering the social prescribing solutions, before the savings and benefits work their way through the NHS commissioning framework.

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<sup>69</sup> [New Care Models NHS](#)

<sup>70</sup> [Social Impact Bonds](#)

<sup>71</sup> [Ways to Wellness](#)