What Works briefing on natural environment based health interventions

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Abbreviations
CBR       Cost Benefit Ratio
Defra     Department for Environment, Food and Rural Affairs
HCCLGC    House of Commons Committee for Communities and Local Governments
HIA       Health Impact Assessments
MET       Metabolic Equivalent
NE        Natural England
NICE      National Institute for Health and Care Excellence
NCD       Non-Communicable Disease
NHS       National Health Service
QALY      Quality Adjusted Life Year
ROI       Return on Investment
RSPB      Royal Society for the Protection of Birds
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Suggested citation

Executive summary

Background

The UK faces considerable health challenges including rising rates of non-communicable diseases, chronic disability and persistent socio-economic related inequalities in health outcomes and their contributory risk factors such as low levels of physical activity [1]. A growing body of evidence suggests that the natural environment is associated with better health outcomes and may potentially be of value as a resource in tackling some of our most intractable health issues [2, 3].

A range of policy and service delivery strategies, at all scales and across public, private and third sector, highlight the ambition to better use the natural environment to contribute to health and wellbeing in the UK. A recent Lancet publication, for instance, identified providing ‘green space and subsidised sport and recreation facilities’ as a contributory action in addressing health inequalities [4] and providing equitable access to urban greenspaces is one of the contributory Sustainable Development Goals [5].

As of yet there have been few attempts to draw together and synthesise evidence specifically relating to which natural environment based health interventions work, for whom, in what circumstances, and why. Similarly, there has been little effort to map provision, identify systems through which interventions can be most effectively delivered, or to identify cost-effective approaches.

The what works report scope and aims

This report details the outcomes of brief scoping synthesis which sought to contribute to the process of identifying ‘what works’ in natural environment based health interventions. The report focuses on ‘natural environment based health interventions’; environment based activity which aims to promote good health and prevent poor health (at a population, community or individual level), or in relation to the use of the environment as a therapeutic setting. Specifically, evidence of what works in natural environment based health interventions is discussed in relation to: 1) enhancing the health potential of urban greenspace, interventions focusing on deprived and disadvantaged groups, and in relation to children and young people’s nature based physical activity; and 2) the design, delivery and evaluation of interventions. The report does not focus on some of the more indirect pathways between environments and health such as reduction of heat island effects, air pollution, pollen and allergens, or, through improving water quality or flood resilience.

Characterising natural environment based health interventions

A brief survey of natural environment based health interventions shows that there is a considerable amount of activity. Interventions are supported and funded through a variety of mechanisms and partnerships.

The plurality of natural environment based health interventions makes systematic characterisation difficult, however most interventions can be described using the following typology:

1. Nature of action: Natural environment interventions – where new spaces are created, or existing spaces are linked, modified or improved. ‘Built’ environment interventions – where ‘man made’ elements are created, modified etc. to improve the health potential of a natural environment. Social Interventions – where efforts are made through social activities (e.g. not through physical changes to a space) to improve the health potential of a natural environment. Organisational actions – where organisations (at all levels and types) might shift their practices, policies and strategies to make use of, or take account of the potential of the natural environment to improve health outcomes.

2. Type of exposure to the natural environment: Remote exposure – where natural elements of the environment are present or visible but that the individual is not ‘in’ the natural environment.
Incidental exposure – where activities take place in natural environments but the activity is not specifically focused on the natural environment. Intentional use – where the natural environment is more than just a setting but is fundamental to the activity.

3. **Type of health promotion:** Population level health promotion – where actions are taken which create the conditions in which a population’s health might be improved. A population can be at a national scale or more local (for this definition it is used to refer to a spatial population, and does not refer to demographic populations or populations who share a certain characteristic such as a specific health issue). Targeted prevention – where activities are specifically designed to address a specific health outcome or engage a specific community (e.g. according to a health condition or demographics - older people, children etc.). Therapeutic – where activities are provided to specifically improve health status following, to prevent or manage a health problem such as a heart attack, mental health breakdown or injury. Examples might include therapeutic gardening, or park based exercise for physical strength.

4. **Stage:** ‘indirect’ or ‘direct’ interventions.

### What works in natural environment based health interventions

#### Urban greenspaces

There is some evidence which shows that creating or increasing greenspaces and improving (physical) accessibility, improving the quality or features of urban greenspaces, and promoting, encouraging or facilitating the use of urban greenspaces have some positive impacts on a number of health outcomes. The evidence base is limited, inconsistent and heterogeneous. Positive impacts appear to differ between social groups. Mixed strategy interventions (e.g. those which involve creating and/or improving urban greenspaces with social promotional activities) are the most effective. There is a danger that poorly designed and implemented interventions may exacerbate inequalities.

#### Deprived and disadvantaged groups

Evidence shows that there are effective interventions that can help overcome the barriers many deprived and disadvantaged social groups face in using and benefiting from the natural environment. Many effective approaches build on behaviour change techniques or seek to address the socio-cultural or internalised barriers to use of natural environments. Interventions which increase the availability (greater provision of greenspace near the home), accessibility (including safe routes to spaces, affordable transport), and infrastructure (including toilets, cafes) of good quality natural environments have been shown, in some cases, to be effective in increasing use amongst deprived and disadvantaged groups and potentially improving health outcomes. There is also a growing body of evidence that suggests that the therapeutic, and the highly targeted use of the natural environment as a setting for health interventions, particularly for those with poor mental health and/or facing social isolation, is effective in improving outcomes such as wellbeing and quality of life. Highly targeted programmes of intervention, embedded within wider systems of provision appear to be most effective.

#### Children and young people’s physical activity

There is a growing body of evidence which has examined whether interventions to facilitate and encourage children and young people’s physical activity in natural environments is effective. This evidence has demonstrated that the natural environment is an important facilitator, setting and determinant of their activity and that there are a number of intervention approaches which are effective in increasing use. Key approaches include: environmental modifications to encourage the types of activities children and young people are interested in; social interventions to address barriers to use, normalise usage, and change perceptions; and settings based approaches to embed nature based physical activity into, for example, the school day. Mixed strategies are most effective.
Co-creating interventions with key stakeholders, including children and young people themselves, is crucial.

**What works in nature based health intervention design, implementation and delivery**

Project evaluations and reports provide some indications of effective approaches to intervention design, implementation and delivery. Key evidence based factors include: making use of theory based intervention design; building on best practice in formal public health intervention design and implementation; appropriate targeting of interventions; engaging communities in intervention design and delivery; flexibility in design and delivery; embedding the intervention within wider provision; making use of behaviour change approaches; and settings based interventions.

The outcomes of, and lessons learnt through existing provision, such as the Nature4Health programme, based in the Liverpool region and led by the Mersey Forest [6] and the four case studies examined for this review (Gardening activities; Birmingham Active parks; Forestry Commission Scotland’s Branching Out programme; and Natural Resources Wales’ Come Outside! Programme) provide helpful guidance on best practice in intervention delivery. The Nature4Health team identified the following factors as contributing to the success of their interventions [6]:

- Tailoring activities to fit with the local culture
- Projects cannot simply have a physical health focus, fitting with wider context and provision is crucial
- Effective monitoring and evaluation is important, to inform future delivery and refine projects
- There is a need to be proactive and flexible in delivery

There is currently very little information on the cost-effectiveness of interventions, however the limited available evidence suggests that interventions tend to be cost effective.

**Improving our understanding of what works in natural environment based health interventions**

If the growing interest and demand for good quality, robust natural environment based health interventions is to be met there needs to be further research and evaluative activity.

This review (and others [7-9]) has demonstrated that there is a wealth of natural environment based health intervention activity taking place across the UK despite the structural issues regarding the funding, commissioning and sustainability of natural environment based health interventions, issues which are partly related to, and contribute to, the lack of a good quality evidence base. The disparate, inconsistent, and somewhat poor quality evidence base indicating what works, for whom and in what circumstances, is a result of a number of factors including the relatively high costs (in terms of money, time and expertise) of intervention research and evaluation. However, shifts in approaches to public health research and harnessing of opportunities to gather good quality, transferable evidence could address this deficit.

The following factors may help improve our understanding of what works in natural environment based health interventions: promoting the value of and supporting good quality intervention evaluations; producing evidence of ‘good practice’ and of what works at all stages of intervention design and delivery; clarifying the impacts of ‘simple’ interventions within complex systems; making greater use of theories of change and theory mapping; and exploring how to design and use interventions to respond to specific health sector needs.

**Practitioner, policy and decision makers’ perceptions**

A workshop with a range of policy, practitioner and delivery bodies identified a number of challenges and opportunities to achieve more sustainable and effective nature based health intervention activity.
There was consensus that there is a lack of leadership on nature based health interventions within national and local Government. Real leadership is coming from the grassroots level. Any potential leadership solution will be collaborative and will involve public, 3rd and private sector. Additionally, leadership will need to come in different guises and operate between and within different sectors.

The identification of cross-sectoral and departmental shared interests, drivers and needs is crucial and would help find synergies and facilitate activity. There was a concern that there is a lack of a coordinated voice which can help steer where intervention funding, as well as research and evaluation resources, are directed.

Although the necessary (structural) conditions for effective policies and practice are not clear, it was suggested that actions such as shared health and the environment portfolios within government (national and local) would mean someone has responsibility to identify problems and opportunities and to make links. Putting the achievement and maintenance of a healthy population on the same footing as achieving and sustaining economic growth, and the adoption of Health in All Policies (and the complementary Environment in All Policies) would help direct dedicated resources from a high level.

Although the strength of the evidence was questioned by some, most argued that the trend of the evidence is supportive and that many sectors, including some in the health sector, are actually persuaded of the value of nature based health interventions. The key question for most was, where is the evidence good enough to support activity? Key actors are constrained by a lack of evidence which indicates what to do, where and how.

**Conclusions**

Despite the huge range of ongoing activity and increasing interest and demand, there is still a relatively limited body of evidence as to what works in nature based health interventions. However, the existing evaluations and project reports suggest that there are examples of natural environment based health interventions which are effective in achieving a range of different outcomes for different social groups and in different contexts. There is also evidence of effective approaches to intervention design, delivery and implementation. However, again this evidence is patchy and has yet to be brought together, using systematic methodologies, to inform future intervention design and delivery, and in relation to the transferal of programmes between contexts and populations. Further research would help improve our understanding of what works, for whom and in what circumstances. Many of the key challenges to effective sustainable practice relate to the lack of leadership, constrained financial context, and to the lack of focus on and direction of resources to preventative health.

Useful next steps might include:

- Identifying and focusing on a small number of key issues that are of concern to the health service.
- Increased coordination and commonality between those involved in nature based health interventions (of any kind) and the aims of their strategies, delivery and evaluative activities.
- A focus on mitigating competing priorities, such as the need to achieve higher density of housing for planners and developers.
- Harnessing the opportunities presented by the many existing initiatives and organisations, such as the Sustainable Transformation Plans, NHS Sustainable Development Unit and the Town and Country Planning Association (TCPA), which are working to shift and balance priorities within specific sectors and systems.
- Finding more sustainable ways in which to fund, sustain and deliver interventions.
1. Health and wellbeing in the UK

Premature death rates in the United Kingdom (UK) from causes such as respiratory and circulatory disease have significantly reduced over the past 50 years and between 1990 and 2010 life expectancy increased by 4.2 years [10]. However, such gains mask serious health concerns and our relatively poor performance in relation to comparable countries [10]. For example, the UK performs significantly worse than the 15 members of the European Union, Australia, Canada, Norway, and the USA for age-standardised death rates, age-standardised years of life lost rates, and life expectancy. The specific health challenges the UK faces include rising rates of non-communicable diseases (including heart and other circulatory diseases, diabetes type 2, and mental health disorders [1]), chronic disability and persistent socio-economic related inequalities in health outcomes and contributory risk factors such as low levels of physical activity and poor diet [11].

The rates of non-communicable diseases (NCDs) in the UK (and elsewhere) have been described as at ‘epidemic levels’ [12]: 5.4 million people receive treatment for asthma; the number of people with arthritis is expected to rise from 8.5 million to 17 million by 2030; rates of diabetes rose from 1.4 million in 1996 to 3.1 million in 2010, and by 2025 it is estimated that it will rise to more than 4 million; diabetes costs the National Health Service (NHS) approximately £1.5million an hour and takes up about 10% of the total budget. The prevalence of ‘pre-diabetes’ (a high-risk state for developing diabetes and associated conditions) was shown to have increased from 12% to 35% between 2003 to 2011 [13].

The high rates of NCDs are determined by a variety of factors, of which health behaviours are one. Physical inactivity, for instance, contributes to almost one in ten premature deaths and the costs of low levels of physical activity to the NHS have been estimated to be over £900 million. Poor mental health is an extensive population health issue that current trends, including the increase in factors such as loneliness and poor social contact, will further exacerbate [14]. Poverty, food insecurity, poor nutrition, and environmental degradation also contribute to the burden of poor quality of life and health [15, 16]. Inequalities in health, typically related to socio-economic status, remain an intractable issue [4].

1.1. Health promotion, prevention and intervention

Much effort is devoted to identifying and refining health intervention strategies which promote good health and prevent poor health. The World Health Organisation define health promotion as ‘the process of enabling people to increase control over, and to improve, their health. It moves beyond a focus on individual behaviour towards a wide range of social and environmental interventions’ [17].

Current models of public health, such as Ecological Public Health, recognise the multi-factorial nature of health and the plurality of factors which determine health status and which can be modified to improve health [18]. Such models emphasise the complexity of health promotion, highlighting the need to consider scale, non-linearity and feedback processes in any intervention strategy. Key determinants of health and wellbeing show an interaction between societal structure (community, education and employment) and individual characteristics (gender, ethnicity, and socioeconomic status) mediated by factors such as environments, behaviour, and health and social care [19].

In recognition of the multi-factorial nature of the determinants of health, responsibility for efforts to promote better health at all scales necessarily falls across sectors: ‘...given our understanding of the social, economic, environmental and commercial determinants of health, it is critical that tackling NCDs is not seen solely as the responsibility of the health sector, but engages a coalition of sectors and partners, at national and local levels...this means that an effective strategy for NCDs requires concerted action...on the many underlying influences that drive them (such as housing, employment, transport, income and environment).’
1.2. The natural environment’s contribution to health and wellbeing

The natural environment, and the systems and process it encompasses, is now considered as one of the fundamental determinants of health and wellbeing. Barton and Grant’s [20] adaptation of the Dahlgren and Whitehead [21] model of the determinants of health, to specifically include ecosystems, climate and biodiversity, illustrates the greater prominence the natural environment now has in our understanding of the factors which support good health and wellbeing [18].

The recent Department for Environment, Food and Rural Affairs (Defra) *Evidence Statement on the links between natural environments and human health* [2] highlighted the growing body of evidence which demonstrates the direct and indirect contribution of the natural environment to human health and wellbeing (Table 1). The review found:

- At a global level, evidence has demonstrated that human health and wellbeing depends on air, food, shelter and water, all part of or derived from the natural environment. If global or local thresholds are exceeded, human health and wellbeing may be threatened. At an intermediate level natural environments are crucial for healthy functioning landscapes that support health through a variety of pathways including flood avoidance or mitigation, and reduced air pollution.
- At a more local level, there is relatively strong evidence that direct contact with the natural world is associated with a range of physical and mental health and wellbeing benefits. Particularly strong evidence is seen for mental health and wellbeing and a healthy internal biome and immunological system (Table 1).

### Table 1. Evidence for contribution of natural environments to human health

<table>
<thead>
<tr>
<th>Quality of evidence</th>
<th>Evidence largely from peer-reviewed systematic or non-systematic reviews or meta-analyses</th>
<th>Evidence largely from mixed evidence sources, individual journal articles and reports, or sources that have not been peer reviewed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strong evidence</strong></td>
<td>- Mental health and wellbeing</td>
<td>- Variation between social and demographic groups</td>
</tr>
<tr>
<td>- Development and maintenance of a healthy immune system and reduction of inflammatory-based diseases</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Generally positive links</strong></td>
<td>- Landscape, ecosystem and city scale linkages</td>
<td>- Perceived health status</td>
</tr>
<tr>
<td>- Physical activity (in selected groups)</td>
<td>- Mortality</td>
<td>- Mortality</td>
</tr>
<tr>
<td>- Maternal health, pregnancy outcomes and children’s cognitive development</td>
<td>- Other physiological outcomes</td>
<td>- Maternal health, pregnancy outcomes and children’s cognitive development</td>
</tr>
<tr>
<td>- Social contact and community cohesion</td>
<td>- Other physiological outcomes</td>
<td>- Social contact and community cohesion</td>
</tr>
</tbody>
</table>


1.3. Making use of the natural environment to promote health and wellbeing

Within both primary and public health there is increasing interest as to how the natural environment could be utilised as a health promotion tool, setting or context in which to address the increasing burden of health problems such as NCDs, chronic disease, and health inequity. While the ‘environment’ in a broad sense has long been understood to be a determinant of health and wellbeing, it is only recently that attention has been paid to systematically investigating how the natural environment is supportive of ‘good health and wellbeing’ through its use as a setting or resource in health promotion, prevention of poor health, or therapeutically. Many types of natural environment - from the National Parks, with their protected environments with high levels of biodiversity and culturally important spaces, to urban greenspaces, close to large populations offering spaces for physical activity and stress relief - could have a role in public health promotion or as a therapeutic setting.

A range of policy and service delivery strategies, at all scales and from the public, private and third sector, highlight the ambition to better use the natural environment to contribute to health and wellbeing in the UK. The ‘Healthy Lives, Healthy People’ white paper for health outlined the Government’s commitment to ‘helping people live longer, healthier and more fulfilling lives; and improving the health of the poorest, fastest’ [22]. The aims are, partly, to be achieved by improving people’s living environments and by protecting and promoting access to greenspaces. Similar ambitions have been articulated in relation to environmental, transport, communities and planning policy and service delivery, where the aims have been to consider how places are designed, created, and managed and how this may influence health and wellbeing outcomes. The movement of the responsibility for public health and the commissioning of many services from central to local government and a greater emphasis on innovation (for example, the Vanguard initiative), has also provided the opportunity to restructure health promotion and delivery, potentially taking a more localised, place and asset-based approach.

Now it is quite common to see the natural environment included as a factor in health promotion at all scales. A recent Lancet publication, for instance, identified providing ‘green space and subsidised sport and recreation facilities’ as a contributory action in addressing health inequalities [4] and providing equitable access to urban greenspaces is one of the contributory Sustainable Development Goals [5].

However, as Table 1 highlights, there appear to have been few attempts to draw together and synthesise evidence specifically relating to which natural environment based health interventions work, for whom, in what circumstances, and why. Similarly there has been little effort to map provision, identify systems through which interventions can be most effectively delivered, or identify cost-effective approaches (some useful syntheses relate to outcomes such as mental health interventions [23], delivery methods such as social prescribing [9], or in relation to specific natural environment resources such as gardens [24], and green infrastructure [25]). Such evidence is crucial to inform the increasing interest in making better use of the natural environment for health outcomes.
2. The What Works report

2.1. Scope

This report details the outcomes of brief scoping synthesis which sought to contribute to the process of identifying ‘what works’ in natural environment based health interventions. The report focuses on ‘natural environment based health interventions’; environment based activity which aims to promote good health and prevent poor health (at a population, community or individual level), or in relation to the use of the environment as a therapeutic setting. The report does not focus on some of the more indirect pathways such as reduction of heat island effects, air pollution, pollen and allergens, or, improving water quality or flood resilience [25]. However, it is noted that some actions discussed in this report, so called ‘co-beneficial interventions’, may result in such outcomes.

The report considers:

- Evidence of what works in natural environment based health interventions, focusing on:
  - What works in a) enhancing the health potential of urban greenspace, b) for deprived and disadvantaged groups, and c) in relation to children and young people’s nature based physical activity
  - What works in design, delivery and evaluation of natural environment based health interventions
- The extent and nature of delivery, key funding mechanisms, and achieving sustainability
- Examples of good and promising practice in natural environment based health interventions
- What is needed to improve our understanding of what works in nature based health interventions

The aim of the report is to provide an initial indication of ‘what works’ to those involved in designing, funding and commissioning natural environment based health interventions. The report is aimed at decision makers primarily in the environment, transport and planning sectors who may be interested in designing, funding and commissioning natural environment based health interventions. It is hoped, however, that it may be of use more widely.

2.2. Methodology

This report is an initial scoping review of the evidence and was undertaken in December 2016-March 2017. The review was not systematic, in that it is not intended to be exhaustive, the quality and reliability of the evidence used not assessed, and no formal process of meta-analysis was used. Informal, iterative searches of the academic databases and of the grey literature were performed. A request for evidence was disseminated using multiple channels and expert practitioners were consulted.

A range of evidence types were sought and used for this review, these included: previous reviews (systematic or narrative) of factors associated with natural environment based health interventions, primary reports of the outcomes of natural environment based health interventions, and literature relating to health promotion and delivery. This was a short-term project thereby limiting the extent of the evidence gathering, the authors are aware that there is a large body of expertise and knowledge held locally which has not been fully accessed and incorporated into this report. The review was undertaken by a group of academics working within two medical schools, this is likely to have influenced the direction of the work and the interpretation of the evidence.

The workshop was held in London in November 2017. It was attended by representatives of national Government departments and delivery agencies, Local Government, environmental and health non-governmental organisations, private sector, and academics. The agenda can be found in Appendix 1.

The report focuses on evidence and practice relating to the UK context but does incorporate evidence relating to elsewhere in the world where relevant.
2.3. Definitions of key terms and concepts

Health
Health is a complex adaptive system and relating to resilience and capacity to self-manage in the face of social, physical and emotional challenges. Health is usually considered to be a dynamic state, one that is not fixed nor absolute, and one that is constantly responding to environmental, social, biological, emotional and cognitive conditions or states [26, 27].

Wellbeing
Wellbeing is defined following the approach of Dodge et al. [28] ‘stable wellbeing is when individuals have the psychological, social and physical resources they need to meet a particular psychological, social and/or physical challenge’.

Health promotion
The World Health Organisation define health promotion as ‘the process of enabling people to increase control over, and to improve, their health. It moves beyond a focus on individual behaviour towards a wide range of social and environmental interventions’ [17].

Public Health
The World Health Organisation define public health as ‘organised measures (whether public or private) to prevent disease, promote health, and prolong life among the population as a whole’.

Health intervention
Defined by the WHO as ‘an act performed for, with or on behalf of a person or population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions’.

Other health terminology
For other health related terms see the glossary produced by the National Institute for Health and Care Excellence (NICE). A brief glossary of health and research terminology is provided in Natural England’s evidence summary note EIN016.

Natural environment, greenspace, bluespace, open space etc.
There is as of yet no definitive definition of the ‘natural environment’ or typology of different types of natural environments in different settings. For the purposes of this report the natural environment is defined as places with a greater percentage of natural features (i.e. plants), whether urban or rural. The definition does not specify or seek to limit the use of the term in relation to the ownership, management or ecological integrity of any place.

Greenspace Scotland uses an adapted typology (based on one used in the Scottish planning system) to provide a pragmatic set of terms (such as open space, greenspace etc.) of particular relevance to more built up settings such as villages, towns and cities [29]. When not referring to a specific primary source (see below), these usages are followed in this report.

There are a variety of ‘natural environment’ terms used throughout this report, this is deliberate and reflects the use of the original term as used in the source material being discussed.

Green infrastructure
Green infrastructure is a network of multi-functional green space, in both rural and urban contexts, which supports natural and ecological processes and is integral to the health and quality of life of communities.

Natural environment based health intervention
The term ‘natural environment based health intervention’ will be used throughout this report unless a more specific term is used to refer to a particular form of activity. The term refers to the use of the
natural environment as a tool, setting or context for a direct or indirect health promotion activity or action. The term also refers to the design, siting, or management of a natural environment for health outcomes.
3. Natural environment based health interventions

3.1. Characterising natural environment based health interventions

Natural environment based health interventions encompass a range of different types of activity. There are many different ways one could seek to characterise and describe natural environment based health interventions, the approach used in this review is described below and in Table 2.

Key factors characterising natural environment based health interventions include:

Nature of action

Typically, there are four main groups of actions, these are:

1) **Natural environment interventions** – where new spaces are created or, existing spaces are linked, modified or improved. This may or may not be done with the specific aim of improving health outcomes. An example may be the planting or trees on a residential street, creation of a new urban park, or creation of a new greenway.

2) ‘**Built’ environment interventions** – where ‘man made’ elements are created, modified etc. to improve the health potential of a natural environment. This may include adding benches to a park, improving the road system so that communities can more easily or safely access a park.

3) **Social Interventions** – where efforts are made through social activities (e.g. not through physical changes to a space) or service provision to improve the health potential of a natural environment. This is a broad category and may include provision of services such as a bus route, media campaigns to increase awareness, or holding community events in a natural environment.

4) **Organisational actions** – where organisations (at all levels and types) might shift their practices, policies and strategies to make use of, or take account of the potential of the natural environment to improve health outcomes.

It must be noted that the majority of interventions are typically mixed and comprise two or more of the groups of actions above.

Type of exposure to natural environment

There are typically three different ‘levels’ or types of exposure to the natural environment in natural environment based health interventions:

1) **Remote exposure** – where natural elements of the environment are present or visible but the individual is not ‘in’ the natural environment. An example may be greening of hospital grounds visible through a window or exposure through a television or Virtual Reality headset.

2) **Incidental exposure** – where activities take place in natural environments but the activity is not specifically focused on the natural environment. An example may be a community event in a park, or the greening of a commuter route.

3) **Intentional use** – where the natural environment is more than just a setting but is fundamental to the activity. Examples include therapeutic gardening, conservation activities such as a ‘green gym’ for injury recuperation, or fishing activities designed for troubled children.

Type of health outcome

There are different ‘levels’ at which natural environment based health interventions aim to improve outcomes:

1) **Population level health promotion** – where actions are taken which create the conditions in which a population’s health might be improved. A population can be at a national scale or more local (for this definition it is used to refer to a spatial population and tends not refer to demographic populations or populations who share a certain characteristic such as a specific health issue). Examples of population level health promotion include those where activities
could, in theory, be experienced by anybody, such as the creation of new city parks, open access legislation, and the development of the coast path.

2) **Targeted prevention** – where activities are specifically designed to address a specific health outcome or engage a specific community (e.g. according to a health condition or demographics - older people, children, etc.). Examples may be park based physical activities for new mothers or conservation volunteering for people at risk of social isolation.

3) **Therapeutic** – where activities are provided to specifically improve health status following, to prevent, or manage a health problem such as a heart attack, mental health breakdown or injury. Examples might include therapeutic gardening or park based exercise for physical strength.

There is much overlap between these types of health interventions.

**Stage**

1) **Indirect** - Some natural environment based health interventions operate on what are described as indirect factors, an example of this type of activity might include a media campaign (whether generalised or targeted) to promote the use of the natural environment for physical activity. In this case, the outcomes of the activity may relate to perceptions or motivations of the use of the natural environment for physical activity, rather than actual use (though this may also be an outcome) and any health gain.

1) **Direct** – An indirect natural environment based health intervention might aim to directly improve the health of the participants. Examples include therapeutic gardening, or park-based exercise for physical strength where the outcomes are expected to relate directly to improved health status.

Often specific interventions operate at multiple levels.

**3.2. Mapping types of natural environment based health interventions**

In Table 2 common natural environment based health interventions are mapped according to: 1) the type of health outcome (MH (Mental health); PH (Physical health); QoL (Quality of life); HB (Health behaviours); Rcv (Recovery)); 2) type of exposure to the natural environment; and 3) by the nature of action. This is not an exhaustive exercise and the allocation of an activity is not necessarily definitive. Many individual activities have been placed in more than one category as interventions can be used at multiple scales and for multiple outcomes. The table was informed by the model developed by Bragg et al. [9, 23]. Illustrative examples of different natural environment based interventions according to the framework set out below are detailed in Appendix 2, Table 7.
Table 2. Types of natural environment based health interventions

<table>
<thead>
<tr>
<th>Types of NEs</th>
<th>Population level health promotion</th>
<th>Targeted prevention</th>
<th>Therapeutic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Remote exposure (through window, TV)</strong></td>
<td>• Urban greening around homes, workplaces (MH, QoL) • Increase biodiversity of NEs (esp. birds) (MH, QoL)</td>
<td>• Urban greening around homes, workplaces (MH, QoL)</td>
<td>• Greening care homes/hospitals etc. (MH, QoL, Rcv) • Increase biodiversity of NEs (esp. birds) (MH, QoL, Rcv)</td>
</tr>
<tr>
<td><strong>Built environment intervention</strong></td>
<td>• Urban design to improve remote exposure to NE (MH, QoL)</td>
<td></td>
<td>• Designing care homes/hospitals so that NE can be viewed/experienced from indoors (MH, QoL, Rcv)</td>
</tr>
<tr>
<td><strong>Social intervention</strong></td>
<td></td>
<td>• Urban greening promotional campaigns and policies (MH, QoL)</td>
<td></td>
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<tr>
<td><strong>Organisational intervention</strong></td>
<td>• Increase understanding of benefits of presence of NEs around home/workplace to health in key professions (e.g. planning) (MH, QoL, PH, HB) • Modify space/building standards (MH, QoL)</td>
<td></td>
<td>• Increase understanding of benefits of NEs to HWB and recovery in key professions (e.g. care home/hospital managers, grounds staff) (MH, QoL, PH, HB)</td>
</tr>
<tr>
<td><strong>Incidental exposure/use</strong></td>
<td>• Increasing street trees &amp; greenery (MH, PH, QOL) • Greening commuter routes (MH, PH, QOL, HB) • Greening home, work, education environments (MH, PH, QoL, HB) • Improve connectivity and configure greenspaces to facilitate active transport (MH, PH, HB, QoL)</td>
<td>• Greening home, work, education environments (MH, PH, QoL, HB) • Greening commuter routes (MH, PH, QOL, HB)</td>
<td>• Greening care home/hospital grounds (MH, Rcv) • Greening access routes (MH, PH, QOL, HB)</td>
</tr>
<tr>
<td>Built environment intervention</td>
<td>Social intervention</td>
<td>Organisational intervention</td>
<td>Intentional use</td>
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</tr>
<tr>
<td>• Increase biodiversity of NEs (MH, QoL)</td>
<td>• Improving physical access to NE (MH, PH, QOL, HB)</td>
<td>• Increase understanding of benefits of NEs to health in key professions (e.g. planning) (MH, QoL, PH, HB)</td>
<td>• Increasing urban park size and proximity (MH, PH, QOL, HB)</td>
</tr>
<tr>
<td>• Improving physical access to NE (MH, PH, QOL, HB)</td>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
<td>• Support staff to build incidental exposure to NE into working practices (MH, QoL, PH, HB)</td>
<td>• Modification of park features (e.g. tree cover, flower beds) to meet</td>
</tr>
<tr>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
<td>• Improving visual/physical access to NE (MH, PH, QOL, HB)</td>
<td>• Modifying work/educational practices to facilitate incidental exposure to NE (MH, PH, HB, QoL)</td>
<td>• Modification of park features (e.g. tree cover, flower beds) to meet</td>
</tr>
<tr>
<td>• Improving visual/physical access to NE (MH, PH, QOL, HB)</td>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
<td>• Increase understanding of benefits of NEs to HWB and recovery in key professions (e.g. care home/hospital managers, grounds staff) (MH, QoL, PH, HB)</td>
<td>• Improve connectivity and configure greenspaces to facilitate physical activity (for specific population groups) (MH, PH, HB, QoL)</td>
</tr>
<tr>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
<td>• Improving visual/physical access to NE (MH, PH, QOL, HB)</td>
<td>• Modify space/building standards (MH, QoL)</td>
<td>• Walking routes around care home/hospital site (MH, PH, QoL, HB, Rcv)</td>
</tr>
<tr>
<td>• Improving visual/physical access to NE (MH, PH, QOL, HB)</td>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
<td>• Increase understanding of benefits of NEs to HWB and recovery in key professions (e.g. care home/hospital managers, grounds staff) (MH, QoL, PH, HB)</td>
<td>• Improve connectivity and configure greenspaces to facilitate physical activity (for specific population groups) (MH, PH, HB, QoL)</td>
</tr>
<tr>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
<td>• Improving visual/physical access to NE (MH, PH, QOL, HB)</td>
<td>• Modify space/building standards (MH, QoL)</td>
<td>• Walking routes around care home/hospital site (MH, PH, QoL, HB, Rcv)</td>
</tr>
<tr>
<td>Needs of multiple user groups (MH, PH, QoL, HB)</td>
<td>Developing specific green commuter routes (MH, PH, QOL, HB)</td>
<td>Improving connectivity and configuration of greenspaces to facilitate physical activity (MH, PH, HB, QoL)</td>
<td>Improving physical access to NE (MH, PH, QOL, HB)</td>
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</tr>
<tr>
<td>• Increasing biodiversity of NEs (MH, QoL)</td>
<td>• Greening home, work, education environments (MH, PH, QoL, HB)</td>
<td>• Conservation activities (MH, PH, QoL, QB)</td>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
</tr>
<tr>
<td>• Sensory trails (MH, QoL)</td>
<td>Built environment intervention</td>
<td>• Care farming (MH, PH, QoL)</td>
<td>• Park/outdoor gyms (MH, PH, HB, QoL)</td>
</tr>
<tr>
<td>• Community gardening (MH, PH, QoL, HB)</td>
<td>• Greening home, work, education environments (MH, PH, QoL, HB)</td>
<td>• Therapeutic horticulture (MH, PH, QoL, HB)</td>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
</tr>
<tr>
<td>• Other NE based PA (MH, PH, QoL, Rcv)</td>
<td>• Sensory trails (MH, QoL)</td>
<td>• Conservation activities (MH, PH, QoL, HB, Rcv)</td>
<td>• Improving physical access to NE (MH, PH, QOL, HB)</td>
</tr>
<tr>
<td>• Care farming (MH, PH, QoL)</td>
<td>• Sensory trails (MH, QoL)</td>
<td>• Care farming (MH, PH, QoL)</td>
<td>• Improving facilities (benches, toilets, lighting etc.) of NE (MH, PH, QOL, HB)</td>
</tr>
<tr>
<td>Social intervention</td>
<td>Organisational intervention</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
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<tr>
<td>Increasing ‘access’ to an environment through legislation or policy change (e.g. Open Access legislation) (MH, PH, QoL)</td>
<td>Increase understanding of benefits of NEs to health in key professions (e.g. planning) (MH, QoL, PH, HB)</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
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</tr>
<tr>
<td>Providing transportation links to NEs (MH, PH, QoL, HB)</td>
<td>Increase understanding (e.g. Provide training) of potential ways to use NEs to prevent poor health (MH, QoL, PH, HB)</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
</tr>
<tr>
<td>Generalised promotional campaigns (e.g. media) (MH, PH, QoL, HB)</td>
<td>Support staff to build intentional use of NE into working, educational practices (MH, QoL, PH, HB)</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
</tr>
<tr>
<td>Modifying work/educational practices to facilitate and integrate use of NE (e.g. Forest School) (MH, PH, HB, QoL)</td>
<td></td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
</tr>
<tr>
<td>Environmental community events in NEs (e.g. Bioblitzes) (MH, PH, QoL, HB)</td>
<td></td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
</tr>
<tr>
<td>Targeted promotion of NE for at risk (HWB) groups (MH, PH, QoL, HB)</td>
<td>Targeted promotion of use of NE for specific outcomes (e.g. physical activity) (MH, PH, QoL, HB)</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
</tr>
<tr>
<td>Targeted specific environmental community events in NEs (e.g. outdoor NE play activities, Bioblitzes) (MH, PH, QoL, HB)</td>
<td>Targeted specific environmental community events in NEs (e.g. outdoor NE play activities, Bioblitzes) (MH, PH, QoL, HB)</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
</tr>
<tr>
<td>Modifying work/educational practices to facilitate and integrate use of NE (e.g. Forest School) (MH, PH, HB, QoL)</td>
<td>Providing transportation links to NEs (MH, PH, QoL, HB)</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
</tr>
<tr>
<td>Providing transportation links to NEs (MH, PH, QoL, HB)</td>
<td>Other NE based PA (e.g. Medal Routes, walking groups, Park Run) (MH, PH, QoL)</td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Nature based social prescription activities (MH, PH, QoL, HB, Rec) (activities typically those mentioned elsewhere such as Forest therapy, conservation volunteering, walking groups, natural environment based art therapy etc.)</td>
<td></td>
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</tbody>
</table>

Key: NE (Natural Environment); MH (Mental health); PH (Physical health); QoL (Quality of life); HB (Health behaviours); Rcv (Recovery)
3.3. Delivery, funding of and support for natural environment based health interventions

Natural environment based health interventions are delivered, funded and supported through a variety of mechanisms.

Individual projects, many of which are run through or by the third sector are often funded through charitable trusts or charitable arms of businesses. For instance, the Tees Valley Wildlife Trust project and evaluation was funded by the Dame Mary Smieton Strategic Development Fund and Northern Rock Foundation [30].

One of the largest funders of activity has been the Big Lottery, which has supported many programmes including MIND’s Ecominds programme of mental health interventions. Heritage Lottery Fund has also been an important funder of a number of initiatives, particularly in relation to urban parks.

There are many examples of projects supported by Natural England, Local Authorities and other statutory bodies. The Green Open Spaces for Health project based on the South Downs National Park was funded by the Park Authority and supported by a partnership of local organisations and local councils [31]. Urban greenspaces have been created through the use of Section 106 (a mechanism which aims to make development proposals more acceptable – see Error! Reference source not found.) and Landfill Tax Funding. The Devon and Somerset based Moor to Enjoy projects were part funded by Local Authority Public Health departments.

European mechanisms such as the European Regional Development Fund have also supported larger scale projects. For example, Scottish Natural Heritage leads the £15million European Regional Development Fund Green Infrastructure programme which aims to ‘improve Scotland’s urban environment, increasing and enhancing green space in our towns and cities, especially close to areas of deprivation’.

Typically, individual projects are supported and delivered in partnership by a range of organisations. The Get Hooked on Fishing charity, which delivers fishing interventions for children at risk of anti-social behaviour, works with a range of partners including the Environment Agency, the Angling Trust, the Angling Development Board, Positive Futures, other charitable trusts, central and local government. An example Get Hooked on Fishing project in Shropshire received funding from Sport England’s Sport Unlimited Programme, Shropshire Council’s Youth Services Positive Activities Fund and the Environment Agency and was used to reach over 2000 young people engaged in fishing through school or community services. A habitat restoration programme on the River Crane (a tributary of the Thames) was supported by a range of mechanisms and organisations including the Big Green Fund, Transport for London, Thames Water Fund, Parks Improvement Project, Environment Agency, Forestry Commission, and the local Health and Wellbeing board [32].

Some interventions are provided through versions of social prescribing mechanisms. Social prescribing is where health or social care professionals ‘prescribe’ or refer individuals to local, non-clinical sources of support, resource or perhaps to led activities. However, the funding typically does not come directly from health or social services (e.g. not commissioned through Clinical Commissioning Groups (CCGs), or directly by primary health practices). In most cases the interventions people are referred to are funded through charitable trusts, philanthropy, and occasionally Local Government [9, 33]. There are a small number of examples of the use of social impact bonds for funding social prescribing interventions. The Ways to Wellness group, for example, is funded through health impact bonds. The group secured funding from social investors and is commissioned by the NHS to deliver mental health and wellbeing programmes.

There are a number of examples of interventions funded directly by health and social care commissioning or through direct Department of Health and Social Care, Public Health (generally
local) or NHS funds. For instance, NHS Wyre Forest CCG funded a horticulture project in Wyre Forest for people with moderate learning and physical disabilities⁹ and Public Health Dorset is supporting activity in Dorset.
4. What works in natural environment based health interventions

The plurality and diversity of nature based health interventions (see Table 2 and Table 7 (Appendix 2)) meant that a comprehensive review of ‘what works’ across all nature based health interventions was not feasible within the timeframe of this project, therefore three priority topics were selected:

1. Urban greenspaces
2. Deprived and disadvantaged groups
3. Children and young people’s physical activity

These topics were selected as they represent some of the key intersections of current policy and service delivery priorities, both at the national scale (e.g. Defra and other national governmental departments) but also at the local scale (e.g. Local Authorities). Although the three topics are discussed separately, in reality many interventions relate to two or even three of these topics.

The background and policy relevance is detailed for each section, followed by a review of evidence of effect, and of effective interventions. Each section concludes with a discussion of delivery considerations.

4.1. Urban greenspaces

Urban ‘greenspaces’ includes parks, gardens, green infrastructure, and other forms of visually or physically accessible natural spaces.

Background

The publication of the House of Commons Committee for Communities and Local Government’s (HCCLGC) report on the state and future of public parks has again raised questions about how we design, manage and promote urban greenspaces, including parks, to benefit the health of urban dwelling people [34]. The report focused heavily on the health potential of urban parks, noting that ‘almost everybody’ (they had 400 formal written responses and 1300 survey responses) noted the contribution of parks to health and wellbeing outcomes.

Parks are one of the most visited forms of natural environment; the Heritage Lottery Fund report that over 37 million people regularly use parks in the UK [35]. The Monitor of Engagement with the Natural Environment survey shows between December 2015 and February 2016 164.8 million visits were made to urban parks and a further 66 million to other urban open spaces [36]. This was recognised by the current Government which committed to launching ‘an ambitious programme of pocket parks – small areas of inviting public space where people can enjoy relief from the hustle and bustle of city streets’, a total of 80 pocket parks have since been given the funding.

Although urban greenspace is usually within the remit of local government there is a strong argument to be made that there needs to be consideration at the national level. The HCCLGC parks report stated: ‘We believe that the importance of parks to national strategic objectives such as climate change mitigation and public health mean that there needs to be leadership and vision at the level of national government.’ [35]. Further, the Committee specifically recommended Defra should integrate urban greenspace into its future policy: ‘The Minister should work with his colleagues in Defra to ensure that parks, and green infrastructure more widely, are properly recognised in the Government’s forthcoming 25-year Environment Plan’.

Indeed, the relevance of urban greenspaces to health outcomes is also being considered at the international level. The World Health Organisation has undertaken work to identify suitable urban greenspace indicators and interventions options [36]. The UN’s Sustainable Development Goal (SDGs) 11.7 requires that States will: ‘by 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities’.
Parks are not the only form of urban greenspace with the potential to promote better health. Other forms of natural features, such as street trees, private and domestic gardens, greenways, and (some forms of) Sustainable Urban Drainage systems are experienced by many millions of people on an everyday basis and can also confer health benefits. The potential of such forms of urban greenspace to contribute to the health of the urban living (or visiting) population is significant [3]. Policy and delivery from a range of different departments at multiple scales (e.g. transport, communities and culture) has relevance to the health potential of such resources. For instance, the Government’s strategy for increasing rates of walking and cycling by 2040 includes ambitions of relevance to this review including creating ‘better streets’ which include ‘places designed for people of all abilities and ages so they can choose to walk or cycle with ease and a wider green network of paths, routes and open spaces’ [37]. The draft National Planning Policy Framework advises that ‘Planning policies and decisions should aim to achieve healthy, inclusive and safe places which... enable and support healthy lifestyles, especially where this would address identified local health and wellbeing needs – for example through the provision of safe and accessible green infrastructure...’

Evidence

General linkages between urban greenspaces and health

There is now a sizable body of evidence which has demonstrated linkages between greener urban environments (parks, street trees, incidental greenspace etc.) and multiple mental health, physiological health, and quality of life outcomes in a range of different populations [38-45]. Linkages have been demonstrated between better (sub-) population health status, potential preventative health factors, and opportunities for health promotion using urban greenspace as a resource or setting. More deprived and disadvantaged groups appear to benefit disproportionately from the presence of (good quality) urban greenspace around the home residence (see next topic) [46-51]. However, there is consistent evidence which shows that deprived and disadvantaged groups a) have lower quality natural elements in their living environments, b) have less access to usable greenspaces such as parks, and c) visit and use urban greenspaces to a lesser degree than other social groups (see next topic).

There is currently little certainty as to the (causal) pathways linking urban greenspaces to health outcomes, however physical activity, provision of restorative spaces, contexts for social contact, and exposure to the natural world have been proposed and investigated [3, 52]. Ongoing research using, for example, longitudinal datasets and genetic analysis is beginning to unpick relationships [53-60].

Interventions to enhance the health promoting potential of urban greenspaces

Although much of the previous research effort has focused on describing and better understanding population level health associations with urban greenspaces (see above), there is now a small body of evidence which has considered the theory and efficacy of the many different types of urban greenspace interventions. This evidence indicates promising approaches to increasing urban residents’ and visitors’ use of and potential benefits from urban greenspaces [56, 61]. There are a number of large scale intervention studies ongoing which may provide further guidance on what works in the near future [62].

Health outcomes of urban greenspace interventions

There are multiple forms of urban greenspace intervention (see Table 2), for simplicity we have created a basic typology of actions:

A. Creating or increasing greenspaces and improving (physical) accessibility
B. Improving the quality or features of urban greenspaces
C. Promotion, encouraging or facilitating the use of urban greenspaces
What Works briefing on natural environment based health interventions

The different types of interventions target different types of health improvement/promotion or preventative health strategies, with some working at the population level (e.g. creating new greenspaces) and others aiming to address health issues at a more local and specific level (e.g. promotion amongst a particular population sub-group).

A. Creating or increasing greenspaces and improving (physical) accessibility

There is evidence which indicates that creating and increasing greenspaces in urban areas may be effective in promoting good health outcomes [63].

The creation of new Pocket Parks (US) has been shown to have resulted in increased population level physical activity and compared favourably in promoting moderate-to-vigorous physical activity with that of existing nearby parks. The research found they were cost-effective at $0.73 (approx. £0.59)/MET hour (metabolic equivalent hour) gained [64]. Danish research found that Pocket Parks are especially effective in promoting socialisation and ‘rest and restitution’ with the researchers concluding that such parks should be designed with these types of quality of life outcomes in mind [65]. The researchers found, however, that additional strategies and programs were needed to encourage non-using residents to use these parks [64]. There is ongoing research in the UK considering the health benefits of Pocket Parks13. The creation of a new park in Rugby, UK, resulted in an increase in local residents using parks; an evaluation found that 14% of users of the new park reported having not visited any park in Rugby in the preceding 12 months [66].

As noted previously, studies have consistently demonstrated a spatial inequality in urban greenspace provision [67] with communities with lower socio-economic status (SES) having fewer accessible greenspaces, or good quality green infrastructure elements within their living environments. Increasing the amount (accessibility and quality) of greenspace in areas of deprivation has been linked to improved perceptions and use of such spaces, and to improved health outcomes (e.g. reduced depressive symptoms [56]) and increased social cohesion [68] in communities with lower SES [69, 70]. Programmes where new greenspaces are created are most effective when integrated with additional outreach activities.

Informal urban greenspace appears to be relatively important and should not be forgotten [42]. The greening of vacant sites and street trees are important aspects of quality of life, walkability and can provide networks of attractive urban spaces [36]. Untended ‘vacant lots’ have been shown to be associated with higher levels of stress than vacant lots which have been ‘greened” [71]. The greening of vacant lots has also been associated with reductions in certain types of crime and with higher levels of community wellbeing [72]. Street trees have also been shown to be associated with a number of positive health outcomes [73-75]. A study in London found reduced rates of depressive symptoms in areas with a greater number of street trees [74]. However, the impact increasing the number or type of street trees has on health outcomes is not clear. Provision of greenspaces near to workplaces in Glasgow was described by local employees to be important to their wellbeing and greenspaces were used during their break times [76]. Wilder spaces were most valued. However, some interventions appear to result in little health gain. For instance a Dutch study found that increasing the number of street trees in deprived neighbourhoods was only associated with more leisure time cycling among adolescents [56]. In another study, the creation of a new greenway resulted only in non-significant increases in rates of moderate physical activity in those who lived closest to the resource [77].

The need to appropriately site urban greenspaces for maximum and equitable health benefit has received some attention [67, 78, 79]. Strategies such as increasing accessible and good quality greenspaces around residences of low SES groups, such as housing association estates, have been shown to be of particular value [80, 81]. Accessibility (usually in terms of distance from residence) of greenspace is of particular interest and UK governments have developed and promoted urban greenspace standards designed to increase and protect accessibility. In England, Natural England
developed the Accessible Natural Greenspace Standard\textsuperscript{14}, which recommends that everyone, wherever they live, should have an accessible natural greenspace:

1. of at least 2 hectares in size, no more than 300 metres (5 minutes walk) from home
2. at least one accessible 20 hectare site within two kilometres of home;
3. one accessible 100 hectare site within five kilometres of home; and
4. one accessible 500 hectare site within ten kilometres of home; plus
5. a minimum of one hectare of statutory Local Nature Reserves per thousand population

The Countryside Council for Wales\textsuperscript{15} (now Natural Resource Wales) recommended that there should be at least 2 hectares of natural space per 1000 population, and that:

1. no person should live more than 300 metres from the nearest area of natural space;
2. there should be at least one accessible 20 hectare site within 2km of home;
3. there should be one accessible 100 hectare site within five kilometres of home; and
4. there should be one accessible 500 hectare site within ten kilometres of home

The urban greenspace indicator proposed by the World Health Organisation builds on these standards and recommends a 300 metre maximum linear distance to the boundary of urban green spaces of a minimum size of one hectare [82]. However, despite these planning level interventions it is not clear whether any research has been conducted on the outcomes of meeting the standard.

Effective modification of built infrastructure can have impacts on the health potential of local (new or existing) greenspaces. A report from the Landscape Institute highlights the contribution of the renovation of a previously threatening underpass in Lewisham, London, to the successful promotion of a new greenspace [83]. The park is now used by diverse groups including young people, families and ethnic minority groups. The project also had the involvement of the local Secondary School’s citizenship programme embedding the design and implementation within the local community.

\textbf{B. Improving the quality or features of urban greenspaces}

The WHO, and others, have advised that simply providing \textit{more} greenspaces is not enough either to increase use or improve health outcomes – attention also needs to be paid to their design and quality (25).

A systematic review of behaviour change interventions in urban greenspaces found that interventions which modified the environment, either by restructuring the space or by improving the physical facilities of the environment typically resulted in increases in use [7]. Interventions which delivered a prompt or cue to use the spaces alongside those physical changes were also found to be effective.

Park and greenspace renovations have been shown to have some positive outcomes on usage. One study (USA) found that compared to parks that had not yet been renovated, improved parks saw more than a doubling of the number of visitors and a substantial increase in energy expended in the parks [84]. Increased park use was greatest in working age adults and younger children (though no increases were found for teens and older people) and the park renovations were associated with a significantly increased perception of park safety. Similarly, an Australian study found that improvements to an urban park resulted in significant increases in usage for physical activity compared to a control park, where activity declined [85]. Improving the ‘quality’ in terms of the maintenance of spaces has been shown to be particularly important for certain population sub-groups [71, 84, 86].

Improvements to the quality of urban greenspaces (unfortunately little detail of what types of improvements were delivered is provided) in the Netherlands were associated with increases in physical activity in adolescents (leisure time cycling) and older adults (leisure time walking), but not younger adults [56]. A study showed that renovating an urban greenway resulted in increased levels
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of physical activity at the neighbourhood level between pre- and post-intervention [87]. The creation of walking loops in urban parks has been associated with increases in physical activity [88]. The installation of outdoor gyms in urban greenspaces has been demonstrated to result in increased rates of positive health behaviours. One study found a small but significant increase in the numbers of people engaging in moderate to vigorous physical activity at follow-up following renovations to a park [89].

There is evidence that the addition of certain features to urban greenspaces improves perceptions, increases use, and can improve health outcomes, however the relevance of different features appears to be dependent on the needs and desires of the target population [7, 90]. The DWELL project [91], which focused on age friendly spaces, found that the most successful examples of urban greenspaces were attractive, safe, and could accommodate the needs of multiple user groups but which brought multiple generations and groups together rather than segregating them into different areas.

Safety is an important consideration for many users of urban greenspaces. Perceived lack of safety has been shown to be a significant barrier to use [69, 92]. Improving features related to safety, such as increasing staffing in urban parks to reduce anti-social behaviour, and improving lighting and increasing visibility, has been linked with increases in the use of the urban greenspaces [69, 84, 93, 94]. A multi-agency project in Stoke on Trent (including the Police, Youth Services, Natural England and local residents) to promote local greenspace, reduce anti-social behaviour and improve safety, resulted in more positive attitudes toward the parks and increased social cohesion [92].

C. Promotion, encouraging or facilitating the use of urban greenspaces

There is some evidence to suggest that interventions which seek to promote, encourage or facilitate the use of urban greenspaces are effective in improving health and wellbeing outcomes and increasing physical activity. Promotional strategies need to be appropriately targeted.

Studies have demonstrated multiple barriers to the use of urban natural environments and that those barriers differ according to context and population [95-97]. Overcoming barriers is a key intervention strategy to enhancing the health potential of urban greenspaces.

Many studies have demonstrated that outreach and promotional activities are effective in increasing use of urban greenspaces (predominantly parks) [36, 98]. There should be no assumption that local residents are even aware of existing provision [99]. Approaches which are targeted to specific population sub-groups or in relation to the outcome of interest (e.g. increasing physical activity behaviours) have been shown to be the most effective [93, 100]. There is evidence that outreach programmes and interventions which adopt behaviour change methodologies can modify behaviours. The review by Roberts et al. [7] found that, although the evidence was weak, the inclusion of 'demonstration of behaviour' within greenspace intervention strategies was associated with increases in use in 95% of the interventions they reviewed.

Holding a range of events or siting alternative attractions in urban parks has been shown to improve awareness and attitudes. Previous programmes have used mass participation sporting events, art galleries, cafes, children’s play areas and specific cultural attractions aimed at non-users [101, 102]. Introducing non-users to parks through such activities increases awareness of the space and likelihood of future use [102].

A small amount of research has shown that behavioural change within park management teams can have positive effects on public usage. One study showed that providing feedback on park use and community perspectives, and offering park directors training on outreach and marketing with modest discretionary funding was associated with increased rates of physical activity in parks [103].

Some studies have highlighted the potential that urban greenspace interventions (relating to both amenity spaces such as parks, and more general greening of urban spaces) can increase social,
environmental and health inequalities [67, 104]. For instance, the designer of New York’s Highline recently suggested that although the project has brought inward investment and increases in visitor numbers, it has had little meaningful impact on the lives of the residents of local housing projects16. Several intervention evaluations have shown that those in greatest need do not necessarily benefit from interventions [79]. There is a lack of good quality evidence as to the differential impacts of interventions, or how to avoid harm.

**Barriers and facilitators of effective practice**

**Elements of effective practice**

There is a wealth of evidence from a variety of sources, from formal academic papers through to project reports, which indicates effective approaches to urban greenspace intervention design and delivery.

Effective programmes tend to be context specific and responsive to local needs and desire. Many of the studies included in this report highlight that there is no ‘one size fits all’ option. Community involvement at all stages of urban greenspace development, management and maintenance appears to be a crucial factor [70, 80, 93]. One study found that 109 of the 120 spaces that received community co-designed interventions experienced an increase in use; where the community was not involved, almost half of the intervention spaces (7 of the 16 spaces) saw a decrease in use post-intervention [7]. Of similar importance are sustainable long term funding and maintenance plans.

Generally, intervention sites need to be local to the target population. It is much harder to engage people with sites that are some distance from where they live or work, and with which they do not feel any connection or ownership. In addition, there is likely to be great variation between levels of engagement between sites; programmes need to be adaptable and flexible when delivering between sites.

Multi-component programmes (changes to both the resource and social promotional programmes, led by teams from across relevant sectors) appear to be most effective [36, 98], particularly those which are long(er) term and embedded within wider systems of provision [105]. Multi-sectoral and departmental approaches to urban greenspaces may also be effective. This was recognised in the HCCLGC report which strongly emphasised that the Department of Health and Social Care at the national level and Health and Wellbeing boards at the local level should engage with and take some responsibility for urban greenspaces and parks: ‘We recommend that the Minister issues very clear guidance to local authorities that they should work collaboratively with Health and Wellbeing Boards, and other relevant bodies where appropriate, to prepare and publish joint parks and green space strategies.’ [34]. The report also advocated that efforts should be made to identify and access health funding (e.g. funds related to the obesity strategy), to monitor greenspace provision and distribution, and improve access for deprived communities.

**Barriers to good practice and positive outcomes**

There are a number of barriers to effective practice and the potential to realise the health promoting opportunities of urban greenspaces.

Poorly designed interventions with inadequate theoretical bases for how a programme or intervention may bring about health gain are less likely to be effective [105]. Inadequate levels of community engagement at all stages of the intervention can result in inappropriate design and implementation reducing the chances of success [106].

There is a lack of intervention evaluations carried out using suitable methodologies. A recent review found that the quality of existing evidence hampers interpretation of exactly what combination of elements of urban greenspace interventions are important in delivering health improvement [7]. Further it has been argued that there is currently too little evidence to draw firm conclusions on the impact of urban green space interventions on a range of equity indicators [36].
Structural issues relating to short term funding opportunities and cuts to and restructuring of Local Authority budgets (which often fall heavily on environment departments\(^{17}\)) and difficulties in demonstrating relevance to health departments also act as barriers to effective and sustainable intervention development and implementation \(^{34}\).

### 4.2. Deprived and disadvantaged groups

Key deprived and disadvantaged groups relate to: ethnicity; long term, life limiting disabilities and poor health; lower Socio-Economic Status (SES); and older age groups.

**Background**

The burden of poor health falls disproportionately on deprived and disadvantaged groups. Life expectancy can differ by as much as 10 years between the richest areas of the UK and the poorest \(^{107}\) and according to factors such as ethnicity \(^{108}\). Inequalities in health are related to many factors including disparities in resource availability and life chances \(^{109}\). There is evidence of a causal relationship between income inequality and poor health \(^{110}\). Efforts to address inequalities are a key strand of all forms of health policy \(^{22, 111-115}\). The Marmot report on health inequality \(^{116}\) included the physical environment as a key determinant of health, noting that the places we are born, live, grow, work and age have profound impacts on our physical and mental health and wellbeing. Natural environments, whether in rural or urban locations, and whether wild, semi-managed or wholly managed, are an important element of the broader environmental determinants of health and are linked to reduced SES related inequalities in health.

However, there are inequalities in the spatial distribution and accessibility of good quality natural environments across the UK (including both rural and urban settings). The benefits of spending time in the natural environment are not open to everyone, contributing to poor health and other inequalities \(^{117}\). Those living in deprived areas, minority ethnic communities, elderly people and those with long term poor health and disabilities typically have less (physical) access to green spaces, tend to use them less, and are more likely to have negative perceptions as to their usage of such spaces.

As a result of the growing body of evidence, the Marmot report identified ‘improving the availability of good quality open and green spaces across the social gradient’ as a policy recommendation specifically to improve population health and reduce SES related inequalities \(^{116}\). This recommendation is reflected in Indicator 1.16 of the Public Health Outcomes Framework which assesses use of green space for health reasons to track progress in addressing disparities in mortality between communities \(^{111}\), and in the practice and delivery of bodies such as Natural England, which supports the ‘Outdoors for All’ networks. Similarly, the UN’s SDG relating to urban greenspaces specifically notes that access should be available for disadvantaged groups including ‘women and children, older persons and persons with disabilities’\(^{118}\). To achieve these ambitions there is a need to consider which nature based health interventions are effective for the key deprived and disadvantaged groups.

**Evidence**

**Disparity in availability, access and perceptions towards natural environments for deprived and disadvantaged groups**

Evidence shows that there is a significant disparity in tavailability and physical or perceptual accessibility for different deprived and disadvantaged social groups. In England patterns vary by area but people living in the most deprived areas of cities such as Bristol report poorer perceived accessibility, poorer safety, and less frequent use of available natural environments \(^{118}\). In Scotland, the Government’s greenspace indicator shows that people living in the most deprived areas are less likely to live within a 5-minute walk of their nearest greenspace than people in less...
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deprived areas\textsuperscript{19}. Further evidence from Scotland found that the most income-deprived groups were also the most deprived with regard to access to public parks [119]. There was, however, little evidence of unequal access between ethnic groups in this Scottish study.

There is also evidence that deprived and disadvantaged groups have poorer access to \textit{good quality} natural environments, particularly those with high levels of biodiversity. Multiple descriptive studies have shown strong correlations between neighbourhoods characterised by lower SES (or other factors such as high immigrant populations) and proximity to environments with lower levels of biodiversity [120-125]. One study, for instance, found that wealthier neighbourhoods, which were typically situated close to forests, parks, rivers and other high quality greenspaces, had a greater richness of species than poorer neighbourhoods (57). Differences can be stark, a further study found averages of 28 avian species in high-income area parks, compared with only 18 avian species in low-income area parks [125].

Deprived and disadvantaged groups are underrepresented in nature based activities associated with wellbeing. One study showed that people from socio-economically deprived areas rarely participate in citizen science and nature recording schemes at both the national and local levels [126].

Where accessible greenspaces are (importantly) of a good quality disadvantaged groups appear to benefit disproportionately (especially in urban areas) and SES related inequalities in health are lower [46-51]. For example, one recent UK study focusing on the links between natural environments, walking and mortality found that whilst the relationship between greenspace access and walking was observed for all areas regardless of SES status, the relationship between greenspace access and reduced mortality was only apparent in the most deprived areas [127]. In the Netherlands the strongest associations between proximity to natural environments and health are found in people with the lowest SES [48] and for ‘housewives’, the elderly and ‘lower educated’ people [49].

Research using UK data found lower rates of income deprivation related health inequalities in all-cause mortality and circulatory disease amongst those living in the greenest places [50]. Nearby natural environments have also been found to help women in low-income groups better cope with stress [51]. Finally, a study undertaken in the post-industrial north east of England found that place attachment, the natural environment and social capital contributed to mediating the detrimental health effects of long term deprivation [128].

**Interventions targeting deprived and disadvantaged groups**

Four broad intervention types, targeting deprived and disadvantaged groups, were identified:

A. Increasing the \textit{availability} of good quality natural environments for deprived and disadvantaged groups

B. Increasing the \textit{accessibility} of natural environments for deprived and disadvantaged groups

C. Increasing \textit{awareness and use} of natural environments amongst deprived and disadvantaged groups

D. \textit{Therapeutic and highly targeted} use of natural environments as settings for health interventions

As with the other typologies included in this review, this approach may be a little unhelpful as many interventions necessarily draw on multiple approaches, however it is used here to bring some level of order to the range of intervention activities reviewed.

A. \textit{Increasing the availability of good quality natural environments for deprived and disadvantaged groups}

Evidence suggests that increasing the provision of natural environments which are accessible (visually or physically – see next section) and appropriate can benefit the health, wellbeing and quality of life of certain deprived and disadvantaged groups. There is also evidence that modifying and increasing the quality of urban greenspaces can be effective in improving the health and wellbeing of deprived communities. Some evidence suggests that spaces may need to be
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strategically modified or even created to meet the needs of specific deprived and disadvantaged groups [129].

A review of place based approaches to health improvement in deprived communities (which included increasing the amount of greenspaces and access to greenspaces), found some positive impacts to specific health outcomes, predominantly mental health, and some health behaviours e.g. physical activity [105]. Interventions which sought to increase the amount of greenspaces within urban deprived neighbourhoods have had mixed results. A quasi-experimental study of the Dutch URBAN40 programme of greenspace creation in deprived neighbourhoods did not result in increases in physical activity or general health among adults [130]. A further Dutch study found that improvements to the amount of incidental green elements (extra street trees) in deprived neighbourhoods was only associated with more leisure time cycling among adolescents and an increase in accessible, usable greenspaces (e.g. parks) was associated with a decrease in depressive symptoms among adults [56].

The location of any new greenspace is important in achieving health gain in deprived and disadvantaged groups. Several studies have shown that there is a need to provide good quality local natural environments close to or around home residences as often deprived groups, and especially those with life limiting or long term illnesses or disabilities, won’t or can’t travel far [131, 132].

There is some evidence that improving the quality of natural environments has an impact on deprived and disadvantaged groups’ perceptions and motivations to use the natural environment and, potentially, their health and wellbeing. In the previous topic (urban greenspace) evidence was discussed which suggested that ‘greening’ derelict urban lots (typically found in more deprived areas) was associated with various positive outcomes (e.g. reduced crime) which directly and indirectly benefit health and wellbeing [71, 72]. A qualitative study of the use of London’s Peabody Hill Wood found that the key factors that would increase local residents’ (many of whom were social tenants) desire to use the space related to quality [81]. Cleaning the space and removing rubbish was mentioned the most frequently, followed by improving lighting, cutting back over grown trees and regular management and maintenance.

Efforts to increase provision should, however, be carefully considered so as to avoid exacerbating inequalities in access and, potentially, health outcomes [79]. Proximity is not the only factor determining use and, therefore, benefit and increasing provision may not necessarily result in increased use amongst deprived and disadvantaged groups [79]. The ethnographic element of the evaluation of the THERAPI (Tackling Health through Environmental Regeneration and Public Involvement) programme, centred on the Thames Chase Community Forest, showed how important internal (to the individual or community) and external perceptions of ‘appropriate’ use of an environment are in determining engagement [79].

As of yet there appear to have been few attempts to evaluate at what scale efforts to increase the availability of natural environments to deprived and disadvantaged groups are most effective. Much of the evidence described in this section relates to more local initiatives. The review of urban greenspace interventions found that, where clear, the scale of programmes did appear to be important, with large scale, both in terms of reach and in relation to influence over systems and environments, achieving the greatest impact on the health and wellbeing of the deprived communities [105]. The integration of equity considerations into national level planning and place standards guidance, such as the Scottish Government’s Place Standard, may improve the availability of natural environments in deprived communities [133].

B. Increasing the accessibility of natural environments for deprived and disadvantaged groups

‘Accessibility’ is considered to be an important factor in deprived and disadvantaged groups’ use of the natural environment and, as noted above, relates to more than just proximity but includes the physical ability to get to natural environments. This section considers physical accessibility (and
where it intersects with perceived accessibility), the following section more specifically focuses on perceived accessibility.

The Woods In and Around Towns (WIAT) programme focused on woodlands within one kilometre of settlements of 2000 or more people and took a multi-strategy approach, including improving physical access through new pathways and boardwalks. The programme was delivered in conjunction with a range of promotional activities (see next section). The robust, controlled evaluation of the WIAT programme found increased positive perceptions towards the woodlands, frequency of visits, and perceptions of safety at the intervention sites, with no change in the control sites [69]. Improving access routes to natural environments, e.g. providing underpasses to busy roads has also been shown in another UK based study to be associated with increased park usage [83].

Targeted efforts to increase physical accessibility to wild landscapes for deprived populations elsewhere have, however, been found to be ineffective. The development and designation of Los Angeles' Santa Monica Mountains National Recreation Area in the US was intended 'to bring nature and recreational opportunities to socio-economically disadvantaged communities' however surveys of use showed that visitors were predominantly white and affluent suggesting the project failed to increase access by the target communities [133]. Again, this result suggests that inappropriate interventions have the potential to negatively affect social, environment and health inequalities. Similarly, quantitative analysis of the development of the Thames Chase Community Forest (which included reducing the average distance to useable greenspace to 162 metres) found that overall access to greenspace improved but that this improvement was inequitably distributed socially [79]. Although people from deprived communities and those with poorer health did have better access, the greatest improvement was found in areas of 'below average deprivation'.

Many deprived and disadvantaged groups have specific needs which affect their use of natural environments. Facilities such as car parks near sites, toilets, and cafes are significant derivers of use (or not). Introducing or improving the state and accessibility of such features is likely to be effective in promoting greater use [7, 134].

C. Increasing awareness and use of natural environments amongst deprived and disadvantaged groups

There is a growing body of evidence which suggests that natural environment based interventions to increase awareness and promote positive attitudes towards the (potential) use of natural environments amongst deprived and disadvantaged groups can be effective. Many effective interventions build on stepped behaviour change strategies.

‘Access’ is about more than just physical presence or access routes and can be related to feelings of integration and inclusivity [96, 97, 135, 136]. For example, a local needs assessment in Penzance found that in some particularly deprived areas only one in three children had ever been to the beach despite living less than a mile from it [137]. Tackling the multifactorial barriers to use of the natural environment is complex as they relate to inter-generational perceptions, engrained behaviours, and to social, economic, cultural and structural constraints. There are a number of useful studies summarising the evidence on the nature of barriers to the natural environment for specific groups and how they may be overcome (see for example [96, 135, 138, 139]).

The Welsh Come Outside! programme, which incorporated a range of different activities for deprived and disadvantaged groups achieved changes in perceptions of individual barriers such as lack of confidence, experience and concerns about safety, but less so in relation to the structural barriers such as transport and organisational support [95]. The MOSAIC programme, one of the ‘Access to Nature’ funded projects (Big Lottery) aimed to a) enable people from Black and Minority Ethnic (BME) communities to access the natural environment and b) work with key agencies to help them improve how they engage with BME communities [140, 141]. The programme had some
success in introducing people from BME groups to the natural environment and achieved positive shifts in perceptions, however the impact on health outcomes is not clear [141]. The Active England woodlands project evaluation revealed mixed outcomes [96]. Overall the projects achieved increased engagement with woodlands amongst, for example, BME communities, with those interventions involving a led element found to be most effective. However, the project also increased usage amongst non-target groupings.

Other interventions have addressed perceptions and attitudes to natural environments. Studies have shown that there are differences between what is provided and what is ‘perceived’ as being available. Deprived and disadvantaged groups do not necessarily see greenspaces as being provided for ‘them’ [118]. Ethnographic research focusing on the development and outcomes of the Thames Chase Community Forest (TCCF) highlighted the importance of different interpretations of the concept of ‘access’. The authors found that use of TCCF was ‘determined by a variety of factors including whether a person could ‘imagine themselves’ using such a space, different perceptions of what is actually being accessed (e.g. a place to exercise or a place to socialise), and ideas about using the countryside ‘properly’” [79]. As one research participant said “There’s no one Asian [in the pictures] – I’d be a bit passive, on the fringe, because it’s all White”.

Facilitated use of the natural environment is a common intervention strategy. Multiple studies including several meta-analyses have shown that walking groups, particularly those targeting a range of user groups such as those with long term poor health or suffering other forms of marginalisation, to be effective at increasing physical activity [142-146]. However, these studies of led walking groups show some variation in impact. Analysis of Natural England’s Walking for Health programme found mixed results with a decrease in the number of people taking part in no activity each week, but also a decrease in the number of people being active on three or more days in the week [146]. A further systematic review showed that uptake of walking interventions was most common for white, older women of higher SES [147] suggesting that the programmes may need to be designed specifically to target deprived and disadvantaged groups. A study of the development of walking groups in natural environments for people with long term poor health highlighted the need to identify appropriate intervention strategies. The authors found that group walking in nature was not viewed as ‘effective exercise’ with health benefits, this affected perceptions of acceptability and adherence [143]. Furthermore, for some participants the group format and social expectations were a barrier. However, where appropriately targeted, walking groups can positively impact on motivations to continue with walking with the group, and to try walking independently: “These (walking) boots I bought, 3 or 4 year ago and they’ve sat on a shelf 2 years. I haven’t had a chance to go walking on my own... now I have confidence to walk on my own.” (Mark, aged 60–64)[143].

There is some evidence that facilitated gardening is beneficial for certain disadvantaged groups including people with poor mental health, older people in care homes and refugees [282]. For more on gardening interventions see Case Studies.

A review of conservation activities found beneficial impacts for multiple disadvantaged groups including those with poor health, experiencing social isolation, and worklessness [148, 149]. The authors produced a graphic illustrating the multiple pathways through which the activities were thought to be beneficial (Figure 1).
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*Figure 1. Environmental conservation activities and health, wellbeing and quality of life outcomes.*

(Reproduced from Lovell et al. [148])
As with the interventions to increase urban greenspace (which clearly overlap with this topic) improving perceptions of safety is a key intervention strategy for improving use amongst certain deprived and disadvantaged groups. Perceptions of the safety of greenspaces are significantly correlated with the outcomes of interventions and rate of use of natural environments in deprived and disadvantaged groups [69, 72, 81, 150, 151]. The biggest single barrier to accessing urban greenspaces reported in several studies of deprived groups’ use of natural environments using focus groups and other methodologies was concerns for safety [81, 132].

**D. Therapeutic and highly targeted use of natural environment as setting for health interventions**

There are a number of highly structured interventions which target the health and wellbeing of deprived and disadvantaged groups (occasionally delivered through social prescribing type mechanisms – see [8, 9]). A good example, with a robust evaluation, is the ‘Branching Out’ programme led by Forestry Commission Scotland [152, 153] and delivered at multiple sites (see Case Studies). The programme targets people with poor mental health, and consists of highly structured, led activities in woodlands. A key aspect of such interventions is that they take place in settings away from typical institutional settings, where the environment and role of the clinicians is fundamentally different. The Branching Out programme resulted in some positive gains in health status, an increased interest in the natural environment amongst participants, and was demonstrated to be cost-effective [152, 153]. Other programmes such as the Offenders in Nature scheme [154] and the Tees Valley Wildlife Trust’s Inclusive Volunteering scheme [30] for people with severe mental health issues, MIND’s ‘Ecominds’ programme [155], and Mersey Forest’s Nature4Health projects [6], have also resulted in positive change to multiple indicators of health, wellbeing and quality of life. Most of these interventions are group based and have certain elements in common such as regular frequent engagement with the intervention, facilitated social contact, skills development, and local community-based action.

The Green Open Spaces for Health project of led activities based on the South Downs National Park, funded by the Park Authority and supported by a partnership of local organisations and local councils [31], was targeted at communities identified as at risk of health inequality (primarily communities with higher rates of poor health but also where health intersected with factors such as ethnicity and age) within the National Park or adjacent to it. The project resulted in improved perceptions towards the natural environment and the National Park, and to reported gains to wellbeing and quality of life.

**Barriers and facilitators of effective practice**

*Elements of effective practice*

Again, mixed intervention strategies are likely to be most effective. For instance, the quality and usability of existing greenspace in deprived neighbourhoods is often low, with only less attractive, unsafe places to use which may then reduce the effectiveness of any promotional activities [118].

The mixed approach (increased accessibility, improvements to quality, promotional interventions) taken by the WIAT initiative was suggested by the authors to relate to an enhanced sense of place belonging and a reduced sense of social isolation, as well as in offering opportunities to manage or mitigate stress and maintain year-round healthy activity [69, 156]. The authors note that for deprived groups, having access to nearby good quality greenspace might buffer against some of the effects of stressors such as unemployment. Similar processes were considered important in a study of health resilience in an economically deprived area of the North East [128]. Successful approaches to building on the capacity of natural environments to buffer against stress will rely on identifying the specific elements which confer protection against the health effects of deprivation within diverse communities [128]. Interventions should support communities to use such resources to enhance health and wellbeing.
Highly targeted interventions, which recognise the cultural specificity of barriers and facilitators, are likely to be most effective [132]. Each deprived and disadvantaged group (however defined) will face specific barriers and challenges to using the natural environment. In-depth qualitative research with older people, for example, revealed that poor health, lack of social connection, fragility and vulnerability, negative attitudes, time commitments, concerns about safety and poor weather all affected their use of the natural environment [157]. Intervention strategies which recognise and seek to mitigate such factors are more likely to be effective.

Longer term, well embedded programmes are more likely to result in health change [105]. Large scale, coordinated programmes of activity which focus on specific health outcomes or population groups appear to be effective. One example is MIND’s ‘Ecominds’ programme which supported many small scale interventions using the natural environment to promote better mental health [155]. Interventions which aim to affect population health outcomes need to be of a sufficient scale [105].

There are a number of large scale ‘interventions’ (often operating at the regional scale) such as the Mersey Forest or the Central Scotland Forest which have effectively integrated multiple approaches such as increased provision of natural environments and modifications to existing environments, with both targeted and generalised outreach and promotional programmes. Similar pluralistic approaches are being taken by Scottish Natural Heritage to deliver its £15million Green Infrastructure programme which aims to ‘improve Scotland’s urban environment, increasing and enhancing green space in our towns and cities, especially close to areas of deprivation’. The intention of the programme is to deliver the programme through a number of ‘high impact improvements to the quantity, quality and accessibility of green space and other green infrastructure in urban Scotland’ [20].

**Barriers to successful practice**

Droomers et al. [105] argued that area based health interventions typically demonstrate little effect because they are often ‘unfocused, unsubstantial, and short-term’. Often this relates to difficulty in identifying pathways through which health might plausibly be improved and with poor targeting of key populations. Ineffective programmes often fail to develop evidentially sound theories of change and to use these to design and deliver interventions. However, the need to provide appropriate intervention options for specific groups can fragment provision and risk missing sub-groups in need [143].

Identifying a lack of provision of good quality accessible natural environments for deprived and disadvantaged groups is complicated by availability of suitable data. One study which compared different indicators (at different spatial scales) of environmental resources found that the indicator that only detected larger spaces highlighted less greenspace in areas of socioeconomic deprivation in comparison to more detailed indicators [63]. The new Greenspace Mapping project may help with spatial targeting.

There are many individual level barriers to uptake of interventions. A study of barriers to involvement in citizen science recording schemes, for example, found issues related to: lack of awareness of opportunities; a lack of motivation; a lack of accessibility of the schemes both in terms of equipment or facilities and knowledge; and the financial costs of participation [126]. Finally, many of the more generic challenges to responding to health interventions faced by deprived and disadvantaged groups also apply to nature-based health interventions, these include [21]:

1. Low health literacy levels
2. Cultural and social norms surrounding health behaviours
3. Higher poverty rates, which can make it difficult for participants to access services or programs
4. Difficulties in accessing the activity, including limited affordable, reliable, or public transportation options
5. Inflexible and unpredictable work hours or unemployment
6. Economies of scale affecting coverage

4.3. **Children and young people’s physical activity in natural environments**

This section focuses on children and young people aged approximately 5-16 years old.

**Background**

There is reliable and robust evidence to suggest that physical activity is beneficial throughout the life course [158]. Systematic reviews of the evidence have established links between adequate levels of physical activity and: reduced overweight and obesity; reduced rates of depression and anxiety; reduced incidences of certain cancers; decreases in cardio-vascular and all-cause mortality; and good bone mass, muscle strength, balance and endurance. Insufficient physical activity is responsible for 1 in 6 deaths (similar to smoking) and up to 40% of many long-term conditions such as Type 2 diabetes [159, 160].

There is a body of evidence which indicates that interventions using physical activity are effective at preventing conditions including childhood asthma and cerebrovascular disease, in treating conditions such as depression, or in the promotion of recuperation from diseases such as cancer [159]. The health benefits of achieving adequate levels of physical activity are greatest for those who were initially doing the least [52]. More recently evidence has emerged to suggest that there may be linkages between physical activity in childhood and educational achievement, with an association between physical activity and higher attainment [161].

The pre-school years are considered critical for establishing healthy lifestyle behaviours such as physical activity. Despite rates of activity reducing as children reach adolescence [162] physical activity behaviours have been shown to track through from childhood into adulthood. Establishing habitual physical activity early in life is, therefore, vital [163, 164].

The strength of evidence regarding the health benefits of physical activity has supported the development of recommendations, endorsed by the Chief Medical Officer for England, for minimum levels of physical activity for adults and children [166]. It is recommended that adults achieve a minimum of 30 minutes of at least moderate intensity activity 5 times or more a week and that children should achieve a minimum of 60 minutes of at least moderate intensity activity every day.

For children and young people (five to 18 years) [165]:

1. All children and young people should engage in moderate to vigorous intensity physical activity for at least 60 minutes and up to several hours every day.
2. Vigorous intensity activities, including those that strengthen muscle and bone, should be incorporated at least three days a week.
3. All children and young people should minimise the amount of time spent being sedentary (e.g. sitting) for extended periods.

In England just 21% of boys and 16% of girls aged 5-15 years met the Chief Medical Officer’s recommendations regarding minimum levels of physical activity [166]. Rates of activity peak in middle childhood (5-7) where 24% of boys and 23% of girls meet the recommendations but fall away as they reach adolescence, to 14% of boys and 8% of girls aged 13-15 years. Certain population sub-groups, including Indian, Pakistani, Bangladeshi and Chinese ethnic groups, are less likely to meet the recommended levels of physical activity [167]. Recent statistics suggest that physical inactivity contributes to almost one in ten premature deaths and that the costs of low levels of physical activity to the NHS have been estimated to be over £900 million in 2009/10 [166].

Promoting higher levels of physical activity is an important element of government health promotion. ‘Start Active, Stay Active’ details the UK Government’s position on the need to promote
and facilitate adequate levels of physical activity among the population. The strategies recognise the importance of developing activity behaviours in childhood and reflect the change in Sport England’s remit from investing in sport for those aged 14 and over to supporting people from five years old to post retirement. ‘Everybody active, every day’ is an evidence-based approach which aims to embed physical activity ‘into the fabric of daily life and make it an easy, cost-effective and ‘normal’ choice in every community in England’. The strategy is part of the cross-government ‘Moving More, Living More’ campaign for a more active nation which formed part of the ambitions for the 2012 Olympic and Paralympic Games legacy. The strategy aims for local areas to support ‘every child to enjoy, value and have the skills to be active every day’ and to ‘create safe and attractive environments where everyone can walk or cycle, regardless of age or disability’.

Attainment of the Government’s recommendations and aims is tracked by three of the Public Health Outcomes Framework indicators:

- 1.16 – Utilisation of outdoor space for exercise/health reasons (derived from Natural England’s Monitor of Engagement with the Natural Environment dataset)
- 2.13i – Percentage of physically active and inactive adults
- 2.13ii – Percentage of active and inactive adults

**Evidence**

*Linkages between natural environments and physical activity in children and young people*

Potential pathways between natural environments, physical activity and health include:

- Provision of a useable and accessible context for a range of physical activities
- Provision of opportunity for incidental physical activity (e.g. active commuting)
- Promotion and support for motivations for physical activity
- Affordances for specific (e.g. climbing) or more vigorous types of physical activity

Although it is a key theoretical pathway, there is currently relatively little evidence that clarifies whether or not physical activity is an important mechanism which explains the apparent health benefits of living in or using natural environments. A review of reviews found just one study in which physical activity was a mediating factor in a positive relationship between greenspace and health outcomes. However, undertaking physical activity is an independently desirable outcome. Although there is still uncertainty as to the nature of the relationship between the quantity, proximity and accessibility of natural environments (typically assessed in relation to the home) and rates of physical activity, robust analyses of large datasets (relating to the UK and elsewhere) do show positive associations between living in areas with a greater amount of natural spaces and higher rates of physical activity. Relationships appear to be strongest for urban populations, for example a study of people living in Bristol found that those who lived closest to a park were most likely to achieve the national physical activity recommendations, or in relation to certain types of natural environments, such as coasts.

Studies which have examined actual use of natural environments (as opposed to assumed/potential use as in the evidence described before) tend to show that they promote and facilitate higher levels of physical activity. A study of children’s activity in Bristol showed that, for boys especially, when in greenspace their physical activity is of a higher intensity. Research using GPS to track children’s physical activity locations highlighted the importance of the natural environment as a setting, but also showed the differences between urban children (for whom parks and gardens were particularly important) and rural children (for whom farmland and grassland were important).
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Research from the UK has shown that use of greenspace and other forms of natural environments is particularly important in supporting a variety of different forms of physical activity, as diverse as walking, children’s play and gardening [57, 179]. This is especially the case for certain population sub-groups such as urban boys, as mentioned above [179]. Regardless of the setting, children are 3 to 5 times more active outdoors than indoors [181]. A UK study which used objective measures of the location and rates of children’s activity showed that about half of their weekend moderate-vigorous activity took place in greenspace [182]. A systematic review of international studies found evidence of positive relationships between outdoor time and physical activity in children [183]. NICE (in 2009) concluded that there is moderate-to-strong positive association between time spent outside and physical activity in young people\textsuperscript{16}. Play in natural environments has been linked to good motor function development (especially in young children) [184, 185].

Several studies have identified a link between (self-recall of) positive activity experiences in natural environments during childhood and the likelihood of nature based physical activity in adulthood [186-188]. This suggests that, similarly to general physical activity behaviours, attitudes towards the use of the natural environment as a setting may track through from childhood to adulthood.

The Monitor of Engagement with the Natural Environment pilot indicator of visits to the natural environment by children shows that, in general, most children are regularly visiting the natural environment [189]. The survey shows that 70% of children visit at least once a week, however there is significant variation according to ethnicity and SES; 56% of children in Black, Asian and Minority Ethnic (BME) households and 64% of children from lower income households (socio-economic groups D and E) visit at least once a week. Children report that natural environments are important spaces for their physical activity and many, given the choice, would chose to use such space over other places [190]. Studies show that children perceived natural environments as providing space, privacy, and interesting and challenging opportunities [191, 192]. There are a number of key drivers of children’s nature based physical activity. One of the drivers is dog walking which has been linked with higher levels of walking and with children’s play [193-196].

The outdoors, and in particular the natural environment is clearly an important setting and motivator of physical activity in children, with the potential to contribute towards achieving better population health. The strength of the evidence is such that in 2015 a coalition of European and Canadian researchers and other stakeholders agreed upon a position statement in support of encouraging children’s outdoor play (defined as ‘unstructured physical activity that takes place outdoors in the child’s free time’) for their health and development [197]: ‘Access to active play in nature and outdoors—with its risks— is essential for healthy child development. We recommend increasing children’s opportunities for self-directed play outdoors in all settings—at home, at school, in child care, the community and nature’. The statement was informed by the findings of two robust systematic reviews [190, 198]. This statement supported an earlier statement relating to children’s activity and the built environment which also suggested that ‘…Neighbourhoods and communities can provide opportunities for recreational physical activity with parks and open spaces, and policies must support this capacity…’ [199].

The key issue is, therefore, determining which approaches to encouraging or facilitating children and young people’s greater use of the natural environment for physical activity, of all types, are most effective and equitable.

Health and behavioural outcomes of interventions focusing on children and young people’s physical activity in natural environments

For this topic, three broad intervention strategies have been identified:

A. Environmental modifications to encourage nature based physical activity
B. Social and promotional interventions to encourage nature based physical activity
C. Settings based approaches to encourage nature based physical activity
1. **Environmental modifications to encourage nature based physical activity**

There is a growing body of evidence which shows some positive outcomes of physical changes and modifications to natural environments on the physical activity (and related health outcomes) of children and young people. Lack of availability or physical access to natural environments is a key constraint on children’s physical activity. Protecting the accessibility of, and facilitating increases in the quantity of large areas of good quality safe urban greenspaces, and encouraging provision for private green spaces such as gardens in new developments are important approaches to encouraging population level physical activity in children and young people [98, 134, 172, 200-203].

The evidence as to the effectiveness of renovating and improving the quality of parks and other urban greenspaces on children and young people’s physical activity is mixed. A controlled US study found significant increases in young children’s (but not teenagers’) physical activity following park renovations [84]. The renovations included new play equipment and play spaces, and the landscaping and resurfacing of areas in the parks. However a systematic review of intervention studies concluded that, overall, park renovations and changes to infrastructure had little impact on children’s or young people’s levels of physical activity, with inconsistent effects on overall usage [41]. A number of the studies included in the review even found reductions in rates of activity following renovations [41, 204]. The authors of the review noted that the evidence base is poor, with most studies at serious risk of one or more forms of bias, thus limiting our understanding of the actual impacts of park based interventions.

In the US, where park creation and renovations were combined with a programme of other interventions including traffic calming measures, installation of pedestrian crossing signs and the painting of crossing points, and the installation of bike racks, a controlled evaluation found increases in physical activity (and positive change to a number of other health outcomes such as reductions in BMIz (weight status) scores) amongst the children exposed to the intervention in comparison to the control groups [205, 206].

A quasi-experimental Dutch study of urban greening interventions (e.g. additional street trees as well as amenity space) in deprived neighbourhoods (the interventions were implemented as part of a wider social programme) found lower levels of reductions in adolescents’ leisure time cycling in greened areas in comparison with areas not receiving the intervention, which experienced the expected reductions in rates of activity as the adolescents aged [56]. The authors suggest that the greening interventions may mitigate the process of decreased physical activity through adolescence. A second Dutch study found that the physical activity levels of 11 to 13-year-old children was associated with the amount of space in their home neighbourhood devoted to trees and woods suggesting that increasing the diversity of landcover may be an important element of greening interventions [207]. While these interventions resulted in some positive outcomes, the potential of urban greening to exacerbate inequalities in physical activity behaviours, and therefore, health outcomes was highlighted. Gubbels et al. report that increased urban greenery was only associated with increases in walking for transportation in the highest SES groups [56].

Modifying the features of natural environments has shown some effect on physical activity behaviours. It has been suggested that types of greenspaces which enable physical activity in children need to have facilities such as trails, playgrounds for younger children and open spaces for older children, and that children are less motivated by aesthetics [208]. A systematic review found that physical changes to environments, and the addition of facilities such as play equipment, had positive impacts on young children’s physical activity [208]. Improving and increasing play parks resulted in significantly increased usage and rates of activity amongst children [209].

Identifying and providing culturally appropriate spaces and resources is likely to be effective. Ethnographic studies of children’s identities and desires for natural environments have demonstrated the specificity of attitudes and, therefore, needs between dynamic and shifting demographic and cultural groups. One study of young mountain bikers’ experiences and perception
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towards the natural environment revealed the iterative and reciprocal process of developing suitable spaces:

‘Mountain biking through cycling and materially altering the landscape involves performative embodied experiences through which spaces are ‘shaped’. Countryside space afforded young people possibilities to materially and emotionally imprint their own ideas on landscapes and offered the opportunity to develop symbolic ownership over space... which heightened the fusion between participant and place. The countryside spaces provided the raw materials for cycling and relationships with the countryside were based upon an appreciation of the landscape and nature through its function and contribution to the performance of mountain biking. The countryside provided specific landscapes or infrastructure which supported mountain biking, yet crucially the mountain bikers were involved in shaping spaces that were malleable and largely free from control that included especially woodland but also quarries and former farmland.’ [210]

Improving safety features of urban environments (including parks) has emerged as a key strategy to increase physical activity in children [41]. Spaces which are perceived as safe reassure parents and other adults that they are appropriate places for children to play and be active (also see next section on social interventions). For older children and teenagers, the dynamic shifts and evidence suggest that they need private spaces where they can congregate without being seen as a threat to others [101].

Urban form is known to have an impact on children’s natural environment based physical activity, with inability to safely and easily access parks and other urban greenspaces acting as a barrier to use [211-213]. Increasing children’s options to use safe routes to parks and increasing greenspace round the home have been argued to be likely to be effective intervention strategies [191, 213]. The availability of domestic gardens is also an important element of urban children’s physical activity [180].

2. Social and promotional interventions to encourage nature based physical activity

There is a moderate amount of evidence which suggests that social interventions, which focus on promoting, encouraging and facilitating children’s nature based physical activity can be beneficial. Interventions which address the constraints on children’s physical activity in natural environments are likely to be effective [191, 213]. Constraints (other than the physical availability of spaces – see previous section) are multi-factorial and often highly dependent on the age and context of the child. However common constraints include children’s fears regarding the presence of older children and teenagers, the weather, time pressures, parental fears regarding safety, and the social management of available spaces.

The social context is an important correlate of children’s outdoor (including in the natural environment) physical activity [213-215]. Intervention programmes which have focused on the social context of nature based activity promotion in children and young people have had some positive effects on attitudes and behaviours. Evidence has demonstrated that time spent outdoors with friends has also been shown to be associated with greater amounts of physical activity in young people [181, 215].

Using the natural environment to promote alternative forms of physical activity to competitive sport has had some success in a number of outcomes. For instance, the Get Hooked on Fishing27 charity developed out of a programme which aimed to divert young people away from anti-social behaviour and to tackle poor wellbeing. It now partly targets children who are not ‘switched on’ by traditional sports but still works to reduce anti-social behaviour, and to increase understanding and care of the natural environment.

Some interventions have focused on the family unit as a means to promote and then embed nature based physical activity behaviours into everyday life [216]. It is known that children’s nature based
physical activity is often constrained by familial time, availability and commitment. Increasing motivation within families, though goal setting and reinforcement has been shown to be an effective behaviour change strategy in relation to children’s physical activity [217]. Such behavioural approaches can be quite simple, for example encouraging families to explicitly plan what activity, when they will do it and where [217, 218].

Interventions which ‘gamify’ behaviours such as active commuting to school or visits to the park have been shown to have moderate positive effects on children’s physical activity outcomes [219]. However, the longer-term impacts of such approaches are not well understood. Evaluation of the use of incentives to encourage children’s outdoor exercise have shown some positive outcomes on increased step counts and toward improved health outcomes [220].

No evidence was found to suggest that merely providing information and raising awareness is an effective approach to increasing children’s nature based physical activity. More general physical activity interventions have also found such approaches to be ineffective [216].

3. Settings based approaches to encourage nature based physical activity

There is a small, but growing body of evidence which suggests that a ‘settings based’ approach to facilitating children’s natural environment based physical activity is likely to one of the most effective approaches [197, 221]. ‘Settings’ are defined by the WHO as ‘The place or social context in which people engage in daily activities in which environmental, organizational, and personal factors interact to affect health and wellbeing’ [222].

In the UK NICE concluded that there is good evidence to support the principle of ensuring that children have the opportunity for regular outdoor play and highlight the need for a systemic approach to improving opportunity. Guidance, built from numerous reviews of intervention evidence, notes that outdoor play should be promoted within the school setting for instance, and ideally it should provide opportunities for movement and challenge, and to play safely with natural elements [28].

The school is a crucial setting for encouraging and facilitating children and young people’s natural environment based physical activity and the setting for which the most robust evidence exists. Multiple studies have shown that natural elements in school playgrounds are associated with higher rates of use and of physical activity [223-226]. Use of the natural environment as a delivery setting has also been linked with higher levels of physical activity than more typical delivery settings [227].

Led afterschool activities making use of the natural environment, such as gardening clubs, have also been shown to be associated in with higher rates of physical activity [228]. However, some interventions which sought to use the natural environment as an alternative activity space during playtime were found to be less effective at increasing moderate to vigorous rates of physical activity than more traditional forms of sport [229]. Public Health England also advocate increasing access to, and integration in the school/college day of, open space, forests, parks and playgrounds [161].

**Barriers and facilitators of effective practice**

*Elements of effective practice*

Children’s cultures and self-identities are important [210] and inform their choices of physical activities, settings and contexts. Misunderstanding the ways and places in which children and young people want to be active can affect the success of any intervention. Therefore, children should be involved in the design of any programme to improve their physical activity. Similarly, targeted programmes which focus on specific socio-cultural barriers and enablers of outdoor physical activity are likely to be effective [230]. Patterns in children’s park use and activity have been shown to be associated with the socio-demographic characteristics of surrounding neighbourhoods [231].
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Up-stream interventions and asset-based approaches are likely to be cost-effective in the long term but must be appropriately designed and implemented. Generational approaches, where attitudes and behaviours are encouraged in one generation in order to influence both that individual’s behaviours later in life as well as those of future generations, may be beneficial [186-188]. Interventions should be rigorously designed so as to reduce risk of enhancing physical activity related health and social inequality [58]. There is a danger that ill-informed interventions may further entrench multiple forms of inequality.

Providing (or allowing) children the opportunity to explore local surroundings (for example, local parks with their friends and/or alone) may be a strategy to facilitating self-directed physical activity29. Interventions which address safety are fundamentally important. This may relate to the design of physical environments (e.g. traffic, access, and visibility) but also to socio-cultural perceptions of where is safe and what is safe for children and young people.

There appears to be real value in taking a whole systems approach and harnessing opportunities to integrate outdoor physical activity into everyday settings. The reviews and stakeholder engagement process conducted for the development of the position statement on children’s outdoor play mentioned earlier [197] identified the value of taking a ‘whole systems’ (an element of settings based approaches) approach. Such a strategy would include intervention elements which together would help encourage and facilitate greater participation, these include:

- Parents should encourage their children to go outside and engage with outdoor environments
- Educators and caregivers should regularly embrace the outdoors and recognise that risky outdoor play is an important aspect of childhood development
- Health professionals should widely promote the importance of children’s ability to go outside for play and physical activity
- Injury prevention professionals should find a balanced approach to highlighting and minimising risks
- Schools and childcare professionals should review policies and practices which prevent outdoor play, choose natural elements over man made play spaces, and encourage and enable children to use them
- The media should provide balanced reporting, particularly in relation to risks of children being outdoors
- National and local government should work together to mitigate legal liability, increase investment in natural play spaces in all neighbourhoods, and identify and reduce barriers to children’s access to outdoor play
- Society as a whole should recognise children’s rights and abilities to take decisions regarding their free time and play spaces

For children and young people schooling could be one settings based delivery option. Alternative approaches to education delivery such as Nature and Forest Schools offer opportunities to integrate activity with learning.

Barriers to successful practice

Many children face significant socio-cultural barriers to making use of the natural environment for physical activity. The MENE survey tells us that children from BME households are less likely to frequently visit the natural environment (56%) compared to children from non-BME households (74%). Similarly, children from higher income households (socio-economic groups A and B) were more likely to visit frequently (77%) than children from lower income households (socio-economic groups D and E) (65%)30. Such groups are harder to reach with non-specific interventions.

Structural and organisational culture barriers (such as in the school setting) appear to prevent the integration of activity through settings based approaches [232]. NICE noted that certain barriers
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would need to be addressed to ensure success: ‘Practitioners (e.g. teachers) may limit the amount of outdoor play offered to children due to a number of assumptions: that the outside is dangerous; that higher adult/child ratios are needed outside; that educators are merely supervisors outdoors, and that no learning happens outside; that the weather is a barrier; and that being outside is somehow less healthy. All of these assumptions can be tackled to increase active play outdoors.’

Short term, limited programmes are unlikely to have long term outcomes and to shift attitudes towards use of the natural environment for physical activity.
5. What works in natural environment based health interventions design, implementation and delivery

The following section reviews what is known about what works in relation to the design, implementation and delivery of natural environment based health interventions, with sections relating to:

- Building on best practice in formal public health intervention design and implementation
- Theory based interventions
- Appropriate targeting of interventions
- Settings based interventions
- Interventions embedded within wider provision
- Behaviour change approaches
- Engaging communities in intervention design and delivery
- Flexibility in delivery
- Lessons in effective delivery from nature based health interventions
- Avoiding harm
- Sustainability of natural environment based health interventions sustainability
- Guidance on natural environment based health interventions

Specific evidence in relation to the three topics considered in this review (urban greenspaces, deprived and disadvantaged groups, and children and young people’s physical activity) can be found at the end of each of the respective sections of this report (Sections 5.1, 5.2, and 5.3).

5.1. Building on best practice in formal public health intervention design and implementation

Developing effective public health interventions is an iterative process, new interventions should ideally build on lessons learned from previous efforts. Whilst health promotion can be highly context dependant there is currently much work underway to identify ‘active components’ of interventions that are transferable between programmes of activity or between settings. A systematic review of public health intervention strategies undertaken by Ng and de Colombani was used to inform a framework of best practice intended to guide future design and delivery [233]. Table 3 (reproduced from Ng and de Colombani [233]) provides detail on best practices in public health intervention design.

Table 3. Framework for selection of best practices in public health

(reproduced from Ng and de Colombani [233])

<table>
<thead>
<tr>
<th>Category</th>
<th>Criterion</th>
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<tbody>
<tr>
<td>Context</td>
<td>Relevant</td>
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</table>
|          | • Relevant to the needs of the community (conduct problem analysis and needs assessment of the community prior to programme development; consider perspectives of the target group and stakeholders)  
           | • Relevant to the setting of the community (describe characteristics of the community and context) |
| Process  | Engages the community (community participation) |
|          | • Describe who and how members of the community are involved  
           | • Empower the community  
           | • Achieve synergy through community participation in programme development and implementation |
|          | Involves the right stakeholders (stakeholder collaboration) |
Further evidence based good practice in intervention design can be found in the Medical Research Council’s complex intervention design and evaluation guidance [234].

5.2. Theory based interventions

There is a growing body of applied evidence which demonstrates that successful health interventions are based on a sound theoretical framework which articulates (amongst other information) the components of the intervention, which health outcomes are likely to be affected by the intervention, who is likely to benefit and how, and to what extent [105, 235].

Public health interventions are complex, and can often operate in many different ways, subject to feedback loops and unintended consequences [234]. Often intervention providers are not systematic in defining what they are trying to achieve and how. Clarity can be achieved by articulating the intentions of the intervention through a ‘Theory of Change’ (ToC) model. The ToC provides the framework for intervention development and, subsequently, evaluation. Breuer et al. describe the process of development of a ToC, which is typically done in consultation with stakeholders:

‘The ToC is often developed using a backward mapping approach which starts with the long-term outcome and then maps the required process of change and the short- and medium-term outcomes required to achieve this. During this process, the assumptions about what needs to be in place for the ToC to occur are made explicit as well as the contextual factors which influence the ToC. Additional
elements of a ToC can include beneficiaries, research evidence supporting the ToC, actors in the context, sphere of influence, strategic choices and interventions, timelines and indicators. These elements are usually presented in a diagram and/or narrative summary’. [235]

A ToC checklist designed by Breuer et al. [235] provides guidance on what a ToC should articulate. A five-step process promoted by the Scottish Government also advocates for a similar process of theory articulation within intervention design[32]: 1) identify problem; 2) review evidence; 3) draw logic model; 4) identify indicators and monitor model; and 5) evaluate logic model.

The Grounds for Learning play project[33] aimed to increase children’s outdoor active play by transforming spaces and adapting learning practices. A simple logic model (in effect a form of ToC) was devised to illustrate key processes (Figure 2):

**Figure 2. Logic Model for Grounds for Learning project**

A further example of the use of a theory of change model was used to inform the Welsh Come Outside! Programme (see Case Studies) [95].

### 5.3. Appropriate targeting of interventions

Effective interventions are often highly targeted [93, 236]. The approach to targeting an intervention is highly dependent on the population group of interest, the context or setting, the nature of the activity proposed, and the type of health improvement/promotion aimed for [234]. Poorly targeted interventions often miss their target. The need to effectively target is important for all types of interventions, no matter how ‘complex’. For instance, work undertaken by Elliott et al. [237] on the ability of walking leaflets to encourage walking in the natural environment found that the types of messages included were unlikely to be of relevance to, or motivate inactive people. Droomers et al. [105] warn that there is, however, a need to find the balance between targeted intensity of a programme, with achieving adequate reach.

There are many ways in which intervention providers have gone about clarifying the targets of their programmes. Bodies such as Sports England have used segmentation approaches to define key populations of interest and to better understand their needs, desires, motivations and constraints [192]. Evidence suggests that use of Health Impact Assessments (HIAs) in intervention planning can be an effective methodology through which the range of potential health, wellbeing and quality of life impacts of an intervention or development can be anticipated [83]. This knowledge can then be used to effectively target and refine interventions [238]. The approach has been applied to multi-agency nature based health interventions, such as the Stepping Stones to Nature programme in Plymouth [239]. The Stepping Stones to Nature programme (£1.065 million – Access to Nature fund) aimed to promote local greenspaces for health outcomes and took a staged approach by engaging people with first, their local greenspace, second, with spaces a little further away (e.g. NNRs), and
then thirdly, introducing people to more distant environments such as Dartmoor. The HIA was used to identify areas of need and where an intervention may be effective. Greenspace Scotland produced guidance on the use of HIA to assess the outcomes of greenspace interventions [240] with a number of illustrative case studies.

5.4. Settings based interventions

Settings based interventions have been argued to be of particular (evidence based) value throughout this document. In particular, there is strong evidence for taking a settings based approach to physical activity promotion, with bodies such as Public Health England specifically noting the contribution of natural environments such as urban greenspace to achieving adequate population levels of activity [221]. However, the ways in which settings are understood and considered as a suitable context for health promotion can vary significantly between stakeholders [241]. Effective settings based approaches seek to clearly articulate assumptions, and consider validity and likelihood of success of any intervention. The capacity of the community, delivery body and setting to achieve change should also be considered [157].

5.5. Interventions embedded within wider provision

Health promotion is complex and individual interventions usually take place within wider systems and networks of provision. Ensuring that any intervention is complementary to and embedded within those wider systems is important to achieving engagement and positive outcomes. As the DWELL project highlighted ‘age friendly’ greenspaces are only one component of an age friendly community [91]. Whilst the provision of an age friendly park contributes to an inclusive community, it must be complemented by provision of suitable transport and housing options and so on. Likewise, highly targeted therapeutic nature based health interventions will most likely be offered in conjunction with a range of other services. Recognising the demands of engaging with multiple services and providers (for all partners, including the participant) is of particular importance for projects working with highly vulnerable groups [153].

Weldon et al. argued that linking separate natural environment based health provision can be an effective and pragmatic method of maximising available resources to extend capacity and to address multiple needs [129].

5.6. Behaviour change approaches

Many natural environment based health interventions are, in effect, behaviour change interventions. Behaviour change science is now well developed and there is a large body of evidence which identifies ‘what works’. A review of behaviour change techniques, including those used in nature based health promotion, undertaken by Forest Research [242] concluded that the most effective approaches are:

- Interventions which target the social environment, not just the individual
- Interventions which involve direct contact between those delivering the intervention and the participant
- Interventions which take a multi-factorial approach
- Interventions which make use of specific behaviour change techniques including goal setting, self-monitoring, feedback, and motivational interviewing
- Interventions which relied on passive provision of information were found to be ineffective.

There is a range of guidance on effective accessible behaviour change techniques [243]. The Behaviour Change Wheel, developed by Michie et al., represents a synthesis of 19 behaviour change frameworks [244-246]. The wheel is based on a ‘behaviour system’ which considers ‘context’ to be crucial. The model describes the three key conditions for change: capability, opportunity, and
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motivation. The wheel also illustrates nine intervention ‘functions’ and seven key policy and delivery strategies that provide a context for interventions.

5.7. Engaging communities in intervention design and delivery

Working with communities (whether of interest, characteristic or spatially) to design and implement suitable natural environment based health interventions appears to be crucial [70, 80, 93, 129, 242]. A review found that community co-designed interventions were most effective in achieving the intended outcomes [7]. Building local capacity is also a key strategy to longer term sustainability of programmes [129].

The National Lottery funded Access to Nature programme evaluations provide useful indications of how to engage individuals and communities with interventions [247], key factors include:

1. Local relationships based on trust are critical to engaging people in inner-city greenspace improvements
2. In inner-cities, where people have little experience of the benefits of greenspace, tap into the enthusiasm of a few and build from there
3. People need inspiration and support to get involved in improving inner-city greenspace

For further guidance, NICE have produced a systematic evidence-based guide to community engagement [248].

The ‘community’ also includes professional stakeholders. As Lorenc et al. [249] argued ‘Intersectoral public health research could benefit from taking into account non-health decision makers’ needs and preferences, particularly around relevance and political feasibility.’ The evaluation of the NHS Glasgow and Clyde ‘Health Centres Using Greenspace’ project found that close working with and gaining the commitment of the six health centres involved and effective professional community engagement were crucial to success [250].

Meaningful engagement with professional communities can also enhance engagement with target recipients of any intervention [66]. The Access to Nature programme evaluations showed that partnerships with communities of practice were critical to the successful engagement of a wide range of people in the natural environment [251]. Across the Access to Nature programmes the partnerships included social landlords, local authorities, environment charities, schools, voluntary organisations and community groups. Each partner made different types of contribution. Capacity building activities provide a vehicle to embed inner-city green space improvements both strategically and operationally [247].

5.8. Flexibility in delivery

The need for flexibility in delivery has been identified as a key factor in successful delivery by a number of projects [6]. For example, research conducted on walking groups highlighted the multiple drivers of involvement, from the social aspects through to health outcomes [143]. Similarly, the Come Outside! programme experienced considerable variation in uptake necessitating a flexible approach to provision [95]. Recognising variability in what people want from an intervention can improve the type of offer and inform delivery processes.

5.9. Lessons in effective delivery from nature based health interventions

The outcomes of, and lessons learnt through existing provision, such as the Nature4Health programme, based in the Liverpool region and led by the Mersey Forest [6] and the four case studies examined for this review (Gardening activities; Birmingham Active parks; Forestry Commission Scotland’s Branching Out programme; and Natural Resources Wales’ Come Outside! Programme) provide helpful guidance on best practice in intervention delivery.
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A review of the ‘Dose of Nature’ project, nature-based interventions for mental health and wellbeing in the southwest of England, identified a number of key factors likely to contribute to successful delivery [252]:

- Effective engagement between all stakeholders including patients, doctors, those delivering the interventions and those who owned the natural environments
- Flexibility in design, ‘ownership’ and delivery of the interventions (especially in relation to timing), and identification of co-benefits
- A managed process of transferral from the primary health care setting to the nature based health intervention
- Skilled practitioners
- Relevance of the intervention to local health provision needs

Forestry Commission Scotland’s Woods in and Around Town initiative (WIAT; shown to be effective in directly and in-directly improving some health and wellbeing outcomes [69]) takes a pluralistic approach to delivery, integrating systemic change and policy levers with effective local delivery [253]. These include:

- Advocacy and working in partnership to deliver both WIAT and other strategic objectives
- Supporting good practice, in relation to both public engagement and management/delivery plans
- Producing and building on a robust evidence base
- Demonstrating effective delivery
- Promoting quality standards
- Using Forestry Grant Funding to support the delivery of WIAT objectives
- Linking the WIAT programme to Scottish Government policies and strategies such as the Land Use strategy, National Planning Framework and the Good Places, Better Health programmes.

The Nature4Health programme, based in the Liverpool region and led by the Mersey Forest identified a number of key factors in successful delivery of natural environment based health interventions [6]:

- Tailoring activities to fit with the local culture
- Projects cannot simply have a physical health focus – social interaction is critical
- Effective monitoring and evaluation is crucial, to inform future delivery and refine projects
- Need to be proactive and flexible in delivery

The South Downs National Park’s Green Open Spaces for Health project evaluation highlighted the multiple issues the project team encountered with engaging disadvantaged communities with nature based outdoor programmes [31] ‘For example, people in a caring role might like the idea of accessing the local countryside, but they have limited availability and very great demands on their time and energy, people experiencing anxiety can be unable to enjoy group activities or use public transport to get to them, people with chaotic lives caused by difficult housing situations cannot always manage to be in the right place at the right time, people on certain medications have difficulty sleeping and feel unwell in the mornings, so again have limited opportunity to attend events’. Disadvantaged groups also reported feeling that offered activities are not for ‘people like me’. However, the project evaluators identified a number of key ‘enabling factors’ which included:

- An organising facilitator
- A local recruiter/potential leader if the group is to become self-sustaining
- A local community infrastructure
- A variety of activities (especially creative activities)
What Works briefing on natural environment based health interventions

- A set of activities honed to the interests of the group
- A highly responsive and flexible approach to planning activities

The DWELL project [91] concluded that achieving positive change in the provision of new and improved greenspaces within communities, is likely to be dependent on a number of factors including:

- A mutual understanding of what you’re trying to achieve (goals and objectives)
- A joint/long-term vision of where you want to get to
- Support for collaborative working between partners
- Get stakeholders and residents involved from the outset in order to be part of a joint vision
- Make it meaningful (people will only get involved if they feel they are making a meaningful contribution)
- Transparency is vital to ensure that the involvement is not carried out in a tokenistic way
- Not all members of the wider community will be directly involved (or will want to be)
- Awareness-raising through media channels is needed to let them know what’s happening
- Mixed-use developments were proposed to accommodate multiple interests. For example, a mixed-use development might be able to be designed to be higher or denser, as long as there was a local benefit to residents
- Win-win scenarios were more likely to emerge where collaboration was built-into the process from the outset
- Proposals where partners shared risk and reward were more likely to produce innovation

5.10. Avoiding harm

As noted throughout this document there is the potential of natural environment based health interventions (as with many other public health interventions [254]) to result in exacerbating health inequality. The process is most clearly understood through urban greening strategies which may result in gentrification and the marginalisation of those most in need of help [78, 255]. There is a need when designing interventions, particularly those which will seek to increase the amount and quality of natural environments, to identify how much green is ‘enough’, there is a tangible danger that greening interventions result in gentrification (through, for example, raised house prices) and the displacement of the very people whose health the programme was trying to improve [67, 78, 256, 257].

5.11. Sustainability of natural environment based health interventions

Intervention sustainability is dependent on a number of factors, not least the systems of support underpinning delivery (funding, resource availability, and so on). Often sustainability is constrained by limited funding opportunities.

The Access to Nature programme (funded by Big Lottery and managed by Natural England) produced a useful document detailing the ways in which partners have tried to ensure the sustainability of the interventions [258]. Key factors in determining the sustainability of the programme were identified:

- physical legacy resources and infrastructure within neighbourhoods;
- the dissemination of learning; the embedding of practice;
- strengthening of relationships; and
- the development of new structures and new funding streams.

Also important was the focus on sustainability in the design of programmes (itself a funding evaluation criteria) and adequate time to embed the intervention. Building local capacity has been
demonstrated to be a key strategy to longer term sustainability of programmes in other studies [129].

5.12. **Guidance on natural environment based health interventions**

There is a considerable amount of evidence based guidance on various aspects of different types of natural environment based health interventions. A number of these have been gathered here in Table 4. *Topic n* refers to relevance to the three intervention topics focused on throughout this review:

1) urban greenspaces,
2) deprived and disadvantaged groups and
3) children and young people’s nature based physical activity):

**Table 4. Guidance and best practice tools**

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Topic n</th>
<th>Title</th>
<th>Type of guidance</th>
<th>Audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Environment Network</td>
<td>1, 2, 3</td>
<td>Ethnic Communities and Green Spaces: Guidance for green space managers</td>
<td>Guidance on increasing ethnic communities’ engagement in greenspace.</td>
<td>Greenspace managers</td>
</tr>
<tr>
<td>Cornwall Sports Partnership</td>
<td>3</td>
<td>Promoting physical activity through outdoor play in early years settings</td>
<td>Guidance on how to promote and embed outdoor play opportunities for younger children.</td>
<td>Schools, care facilities, families</td>
</tr>
<tr>
<td>Design Commission</td>
<td>1</td>
<td>People and Place: Design of the built environment and behaviour</td>
<td>Multi-level guidance on how to achieve a healthier, happier and more prosperous and sustainable country through the changes to the built environment.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Design Council</td>
<td>1, 2, 3</td>
<td>Spaceshaper: A users guide</td>
<td>The Spaceshaper is a practical toolkit for use by anyone – whether a local community activist or a professional – to measure the quality of a public space before investing time and money in improving it.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Design Council</td>
<td>1</td>
<td>Start with the Park</td>
<td>Guidance on creating sustainable urban green spaces in areas of housing growth and renewal.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Design Council</td>
<td>1, 2</td>
<td>Managing Greenspace</td>
<td>Guidance on successful management of greenspaces. It also outlines the resources that greenspace managers can draw on to describe the critical services that greenspace provides to local communities.</td>
<td>Greenspace managers and owners</td>
</tr>
<tr>
<td>DWELL (Sheffield University)</td>
<td>1, 2</td>
<td>Age friendly environments</td>
<td>Guidance for designing age friendly living environments.</td>
<td>Mixed</td>
</tr>
<tr>
<td>East Hampshire</td>
<td>1, 2, 3</td>
<td>Planning for Dog Ownership in new development. Reducing conflict – adding value</td>
<td>Access and greenspace design guidance for planners and developers.</td>
<td>Planners, developers</td>
</tr>
<tr>
<td>Fields in Trust</td>
<td>1, 3</td>
<td>Outdoor Sport and Play</td>
<td>Tool for developers, planners, urban designers and landscape</td>
<td>Developers, planners, urban</td>
</tr>
<tr>
<td>Organization</td>
<td>Reference(s)</td>
<td>Title</td>
<td>Description</td>
<td>Audience</td>
</tr>
<tr>
<td>--------------</td>
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<td>----------</td>
</tr>
<tr>
<td>Glasgow Centre for Population Health</td>
<td>1, 2, 3</td>
<td>It’s More Than Just the Park</td>
<td>Guidance on the barriers different social groups experience in accessing urban greenspaces. Audit tools.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Gloucestershire NHS</td>
<td>1,3</td>
<td>Active Planning Toolkit</td>
<td>Guidance on promoting and creating built or natural environments that encourage and support physical activity.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Green Infrastructure North West</td>
<td>1</td>
<td>Building natural value for sustainable economic development: Green Infrastructure Valuation Toolkit</td>
<td>Updated toolkit and calculator to estimate values of green infrastructure including to health.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Greenspace Scotland and GCV Green Network</td>
<td>1,2, 3</td>
<td>Greenspace Quality Guide</td>
<td>The ‘Greenspace Quality Guide’ contains three sections: guidance on creating a strategic framework, auditing and monitoring and evaluation frameworks.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Greenspace Scotland outcomes frameworks</td>
<td>1,2, 3</td>
<td>Greenspace SROI guidance</td>
<td>Application of Social Return on Investment analyses.</td>
<td>Mixed</td>
</tr>
<tr>
<td>HM Government</td>
<td>1</td>
<td>National Planning Policy Framework</td>
<td>The National Planning Policy Framework sets out the Government’s planning policies for England and how these are expected to be applied, inc. guidance on green and open spaces for health and wellbeing.</td>
<td>Mixed, primarily planners and developers</td>
</tr>
<tr>
<td>Landscape Institute</td>
<td>1, 2, 3</td>
<td>Public Health and Landscape: Creating Healthy Places</td>
<td>Report and guidance on healthy place making.</td>
<td>Mixed</td>
</tr>
<tr>
<td>National Housing Federation</td>
<td>1</td>
<td>Greener Neighbourhoods</td>
<td>This guide makes the case for good quality green spaces within social housing and provides a practical resource for those aiming to achieve it.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Natural England</td>
<td>1, 2, 3</td>
<td>Good Practice in social prescribing for mental health, the role of nature-based interventions,</td>
<td>The report explores the options for improving the commissioning of, and referral to, these services as well as scaling-up the provision of nature-based interventions.</td>
<td>Health care providers</td>
</tr>
<tr>
<td>NESTA</td>
<td>1</td>
<td>NESTA rethinking parks</td>
<td>Guidance on alternative forms of park funding and management, has focus on maximising health potential of parks.</td>
<td>Mixed</td>
</tr>
<tr>
<td>NHS Forest</td>
<td>1, 2</td>
<td>Greenspace design for health and well-being</td>
<td>The booklet provides a guide to the design of accessible outdoor healing environments (includes case studies).</td>
<td>Health institutions</td>
</tr>
<tr>
<td>NHS Scotland greenspace</td>
<td>1, 2, 3</td>
<td>Greenspace guidance</td>
<td>Monitoring and Evaluation framework for NHS greenspace projects.</td>
<td>NHS</td>
</tr>
<tr>
<td>outcomes framework</td>
<td>1,2,3</td>
<td>Resource</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-------</td>
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<td>-------------</td>
<td></td>
</tr>
<tr>
<td>NHS Scotland Place standard tool</td>
<td></td>
<td>The Place Standard tool</td>
<td>The Place Standard tool lets communities, public agencies, voluntary groups and others find those aspects of a place that need to be targeted to improve people’s health, wellbeing and quality of life.</td>
<td></td>
</tr>
<tr>
<td>NICE</td>
<td>1,3</td>
<td>Physical activity pathways</td>
<td>Guidance on what is effective in promoting physical activity, topics on environments, schools and in relation to other settings and processes.</td>
<td></td>
</tr>
<tr>
<td>NICE</td>
<td>1,3</td>
<td>Physical activity and the environment</td>
<td>The guidelines cover how to improve the physical environment to encourage and support physical activity, includes greenspaces.</td>
<td></td>
</tr>
<tr>
<td>Northamptonshire Pocket Parks</td>
<td>1</td>
<td>Pocket Parks</td>
<td>Toolkit for setting up Pocket Parks.</td>
<td></td>
</tr>
<tr>
<td>Participation Works</td>
<td>1,2,3</td>
<td>How to involve children and young people in designing and developing play spaces</td>
<td>A how to guide aimed at all those involved in designing and developing play spaces for children and young people. Also see the 11 Million report.</td>
<td></td>
</tr>
<tr>
<td>Play England</td>
<td>1,2,3</td>
<td>Children’s play areas</td>
<td>Support for good practice in the development and improvement of public play space.</td>
<td></td>
</tr>
<tr>
<td>Play England</td>
<td>1,2,3</td>
<td>The role of ‘friends of’ groups in improving play opportunities in green spaces</td>
<td>The briefing aims to provide ideas and practical advice on how communities can encourage play in green spaces by becoming involved in friends of the park and similar groups.</td>
<td></td>
</tr>
<tr>
<td>Play England (for DCMS)</td>
<td>1,2,3</td>
<td>Design for Play: A guide to creating successful play spaces</td>
<td>Guidance on the principles for creating imaginative, innovative, and stimulating play spaces that will enrich the lives of children and young people.</td>
<td></td>
</tr>
<tr>
<td>RSPB</td>
<td>1,2,3</td>
<td>Planning Naturally: Spatial Planning with Nature in Mind</td>
<td>Guidance on integrating natural environments which benefit health and wellbeing into developments.</td>
<td></td>
</tr>
<tr>
<td>Sensory Trust</td>
<td>2</td>
<td>Designing NEs for sensory impairment</td>
<td>Guidance on how to design and implement access to NEs for people with sensory impairment.</td>
<td></td>
</tr>
<tr>
<td>Sensory Trust</td>
<td>2</td>
<td>Sensory rich trails</td>
<td>Guidance on developing sensory rich natural environments.</td>
<td></td>
</tr>
<tr>
<td>Sport England</td>
<td>1,3</td>
<td>Planning tools</td>
<td>Variety of tools for developing sport activities including those in natural environments.</td>
<td></td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Provider</th>
<th>References</th>
<th>Description</th>
<th>Authorship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sport England</td>
<td>1, 3</td>
<td>Active Design: Planning for health and wellbeing through sport and physical activity. Guidance on the opportunities to encourage and promote sport and physical activity through the design and layout of our built environment.</td>
<td>Mixed</td>
</tr>
<tr>
<td>TCPA and Wildlife Trusts</td>
<td>1, 2, 3</td>
<td>Planning for a healthy and natural environment: good practice guidance for green infrastructure and biodiversity. Practical guidance for planners to provide local authorities with all they need to ensure local plans deliver a network of wildlife-rich places in their area. Makes explicit links to health and inclusivity.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Town &amp; Country Planning Association and The Wildlife Trusts</td>
<td>1</td>
<td>Planning for a healthy environment: Good practice guidance for green infrastructure and biodiversity. Provides a number of model policies and guidance (esp. Stratford upon Avon example: Embedding health at the green infrastructure level).</td>
<td>Mixed</td>
</tr>
<tr>
<td>Town and Country Planning Association</td>
<td>1, 2, 3</td>
<td>Research database. Includes guidance on many aspects of green infrastructure and health.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Town and Country Planning Association</td>
<td>1, 2, 3</td>
<td>Reuniting Health with Planning. Several resources on making effective links between planning and health outcomes.</td>
<td>Mixed</td>
</tr>
<tr>
<td>Town and Country Planning Association</td>
<td>1, 2, 3</td>
<td>Public Health in Planning: Good Practice Guide. The guide is a practical resource produced to help public health and planning within LAs identify where public health can contribute towards the planning process. Planning Healthier Places report provides details of PH and planning ‘hooks’.</td>
<td>LAs, mixed</td>
</tr>
<tr>
<td>World Health Organisation</td>
<td>1, 2, 3</td>
<td>Promoting physical activity and active living in urban environments. Guidance on how Local Authorities can design, adapt and manage urban environments, including greenspaces, to promote physical activity.</td>
<td>Mixed, Local Authorities</td>
</tr>
</tbody>
</table>

### 5.13. Cost effectiveness of natural environment based health interventions

**Cost effectiveness of public health interventions**

There is growing evidence that public health interventions are cost-effective and that they can reduce health service costs. While not specifically focused on environmental interventions, a recent systematic review found that in general public health interventions were cost saving and that they resulted in ‘substantial’ returns on investment (ROI)[259]. Specific cost savings of different intervention types and scales were found to be:

- **Health promotion interventions:** Median ROI was 2.2 (range 0.7 to 6.2). Median cost-benefit ratio (CBR) was 14.4 (range 2 to 29.4).
- **Legislative interventions:** Median ROI was 46.5 (range 38 to 55). Median CBR was 5.8 (range 31 to 8.6).
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- Healthcare public health interventions: Median ROI was 5.1 (1.15 to 19.35). No evidence for CBR.
- Wider determinants interventions: Median ROI was 5.6 (range 1.1 to 10.8). Median CBR was 7.1 (range 0.66 to 23.6).

The review found that national level programmes offered the greatest returns on investment.

Cost-effectiveness of nature based interventions

There is a lack of good quality, reliable and usable evidence regarding the cost-effectiveness of natural environment based health interventions [61, 260]. The lack of evidence is further compounded by the plurality of different valuation methodologies used. This means that it is difficult to compare across studies when valuation methodologies and units are used.

There are emerging values regarding urban greenspaces and their value to health and social systems. Recent analysis has begun to put monetary values on the health potential of urban greenspaces [260, 261]. In the US researchers estimated an annual monetary value of urban greenspaces of between US$2.7 and 6.8 billion (2012 US$; approx. 2019 £2.2-5.5 billion) [262]. The values take into account urban greenspace’s health benefits to new-borns, attention deficit hyperactivity disorder, high school performance, crime reduction, cardiovascular disease, and Alzheimer’s disease [262]. Similar values have been ascribed to nature based physical activity [263]. The annual value of active visits to the natural environment was estimated to be approximately £2.18 billion in welfare gain (overall population estimate of 109,164 Quality Adjusted Life Years (QALYs) per year and assuming the social value of a QALY to be £20,000) [264]. The value of walking on the Welsh coast path was estimated to represent potential savings to the health service of £81,167,864 [265]. The monetised health benefits of physical activity along canals were estimated to be approximately £6million (derived using the WHO HEAT tool) [266].

A small number of economic evaluations of interventions have been identified:

- The creation of new Pocket Parks (US) resulted in increased population levels of physical activity and compared favourably in promoting moderate-to-vigorous physical activity with those of existing nearby parks. The research found they were cost-effective at $0.73/MET hour (metabolic equivalent hour) gained [64].
- The estimated values of a proposed expanded Walking 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) 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.
- The estimated the economic value of increased physical activity resulting from the Forestry Commission’s Woods In and Around Towns intervention was approximately £0.36m per year [267].
- MINDs Ecominds programme evaluation estimated a number of values, including for five ‘typical’ Ecominds participants, savings of £35,413 in one year (an average of £7,082 each) achieved through reduced NHS costs, benefits reductions and increased tax contributions, the programme also resulted in an estimated saving of £1.46m for the 246 people who found full-time work [155].
- Forestry Commission Scotland’s ‘Branching Out’ programme evaluation estimated the cost per QALY to be £8600 [116].
- Greenspace Scotland applied Social Return on Investment analysis to the outcomes of a number of health-related interventions. For instance, the value of the involvement of conservation volunteers in delivering the Greenlink project was estimated to have resulted in a social return of £7.63 for every £1 invested [29].
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- The Mersey Forest Objective 1 funded programme resulted in an estimated total monetised benefit of £5.5million per year [268].
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6. Case studies and examples of natural environment based health interventions

In the following section four case studies of different types of natural environment based health interventions are described:

1) Group based gardening activities
2) Birmingham Active Parks
3) Forestry Commission Scotland’s Branching Out programme
4) Natural Resources Wales’ Come Outside! Programme

Each intervention type is characterised using the typology outlined in section four.

The recent (2017) WHO report on urban greenspace interventions provides further case studies [61].

6.1. Case study: Group based gardening activities

Characterising Group based gardening activities
(for more detail on the intervention characteristics see Section 4)

Type of actions:

• Natural environment interventions
• ‘Built’ environment interventions
• Social Interventions

Type of exposure to natural environment:

• Intentional use
• Incidental exposure

Type of health outcome:

• Targeted prevention
• Therapeutic

Stage:

• Indirect
• Direct

Community, school and therapeutic gardening is a vehicle through which multiple health, wellbeing and social outcomes can be achieved [24, 269, 270].

Community gardening is a popular activity through which people create, enhance and use greenspaces to benefit the quality of life, health and wellbeing of those who take part and of the wider community in which it is situated [271-273]. Examples are found across urban and rural UK; Brighton alone has over 70 communal growing spaces, some used as settings for health interventions [271]. A community garden is a piece of land gardened by a group of people who, working cooperatively, share both the labour and fruits of their efforts, whether that is a pleasant environment, edible produce, or flowers. There are a range of ways in which community gardens and their activities are developed, supported and delivered including: a) as community resources which are cooperatively owned, funded and managed by community members; b) the garden, or the land on which it sits, is owned by a third party but the garden is managed by, and for, community use; or c) it is owned and managed by a charitable or public sector organisation and is used as a
community resource for a variety of health, social or educational interventions. In the latter model there are a variety of bodies involved, from large scale environmental organisations such as the Royal Horticultural Society [272], small scale charitable organisations who focus on helping particular groups or using particular health promotion approaches, to local Councils and health bodies. A range of different services and organisations may make use of a single community garden. For example, the Dig4Jaywick Community Garden is situated on land leased from Tendring District Council and is used by (amongst others): The Princes Trust; Essex Youth Offending Team; Essex Probation Service; British Red Cross; Essex Fire Services; and Essex County Council [274]. Funding structures vary, ranging from self-supported (voluntary activity and through sales of produce), to grant aided.

Therapeutic gardening is often more targeted and delivered by an organisation, such as the charity Thrive, as a specific health improvement or recuperative intervention. Activities are funded through core charity funds or through externally funded programmes. Both community gardening and therapeutic gardening can be delivered through social prescribing mechanisms [275]. Occasionally both community and therapeutic gardening will take place in the same space.

School gardening is a relatively popular activity within both primary and secondary schools. Initiatives are supported by a range of organisations including the Royal Horticultural Society and the Soil Association. School gardens are often a component of wider health and environmental promotional activities such as the WHO Health Promoting Schools Framework [276].

There are many ways in which people get involved in school, community or therapeutic gardening; people may join because they enjoy gardening, or doctors and health professionals may offer gardening as a way to treat or prevent poor health. There are many instances of community gardening delivered to people with, or at risk of poor health, through social prescribing [275, 277].

### Box 1. Royal Edinburgh Community Gardens: Morningside, Edinburgh

The Royal Edinburgh Community Gardens are on a 3 acre community garden on hospital grounds. The garden is run in partnership between Edinburgh Cyrenians and NHS Lothian. The project costs are around £26,000 per annum, initially it was funded by the Central Scotland Green Network Development Fund, and it is now supported by NHS Lothian and Scottish Natural Heritage. Over 20 community and health groups have contributed to the community garden. The project incorporates elements of community, therapeutic and school gardening on the one site.

The project focuses on improving health and embedding sustainability into practices. A range of different people with different health needs and concerns participate in the gardening, but those at risk of social isolation, users of mental health services and people who face difficulties accessing other community services are targeted for involvement. Workshops help participants develop new, transferable skills which can contribute to gaining other volunteering opportunities and even employment, one participant stated “I feel more positive about myself and being part of Edinburgh”.

Successful elements of the project include:

- The communal development of the programme and resource helped break down barriers and promoted community engagement.
- Finding effective ways to overcome conflicting needs of the space
- An enthusiastic community garden leader and the involvement of interested organisations such as Shandon Local Food, Transition Edinburgh South, Steiner School and Napier Conservation Volunteers
- Sustainability of participations, patients of the hospital who were initial participants have graduated to become volunteers, helping current patients
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*Health benefits of community gardening*

Community, school and therapeutic gardening is a complex multi-factorial activity, which has been shown to have multiple impacts (direct and indirect) on the QoL, health and wellbeing of those taking part and the wider community [270, 273, 278-282]. Gardening can benefit health by providing opportunities for physical activity, social contact, and skills acquisition, and may promote community wellbeing through improved social cohesion and local environments [270, 273, 283, 284]. Community and school gardening also improve local environments which may also benefit the health and wellbeing of people not directly involved in the gardening activities themselves. Often found in deprived areas, communal and therapeutic gardens have the potential to promote health in disadvantaged groups however there is as of yet little direct evidence of the magnitude of effect. However other bodies of evidence suggest that where local and well maintained, other types of natural environment appear to confer health benefits for deprived groups, increasing resilience against unfavourable health determinants, to a greater degree than for other, more affluent, social groups (36, 37).

Factors such as the type of gardening, organisational structure, socio-cultural context, and routes to participation may influence outcomes and their potential to address health inequality [273]. There is need to better understand how community gardening could be best used to promote QoL, health and wellbeing for such groups. Gardening within specific institutional settings, such as care homes, have also been shown to have positive health impacts, particularly for residents with neurodegenerative diseases such as dementia [282]. School gardening was found to result in some improvement in nutritional outcomes, and to be of particular value to children who struggle in traditional classroom settings [285].

The specific ways in which community, school and therapeutic gardening may impact on QoL, health and wellbeing are numerous and operate on a variety of scales and through several mechanisms [273]. Ohly et al. [285] produced a conceptual model illustrating the outcomes and factors influencing success and sustainability within school gardening (Figure 3), it is likely this model is transferable to other communal gardening activities.
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**Figure 3. Health and wellbeing impacts of school gardening**
(Reproduced from Ohly et al. [285])

6.2. Case study: Active Parks, Birmingham

**Characterising Active Parks, Birmingham**
(for more detail on the intervention characteristics see Section 4)

*Type of actions:*
- Social Interventions

*Type of exposure to natural environment:*
- Intentional use

*Type of health outcome:*
- Targeted prevention
- Therapeutic

*Stage:*
- Indirect
- Direct
Active Parks is an example of using natural environment assets (in this urban parks) to contribute to the delivery of health promotion programmes. It is a component of Birmingham City Council’s Wellbeing Service’s ‘Be Active’ programme (see box below) and provides free to access park based physical activities.

### Box 2. Birmingham Be Active

Birmingham Be Active is a scheme that provides free of charge physical activity sessions to all Birmingham City Council residents (approximately 1.1 million people). The scheme was developed from an earlier initiative, Gyms for Free, through a partnership between the Council and NHS Heart of Birmingham Primary Care Trust (PCT). It is now supported by Birmingham Health and Wellbeing Partnership (Birmingham City Council and the three Birmingham NHS primary care trusts – Heart of Birmingham PCT, NHS South Birmingham and NHS Birmingham East and North). The approach is based on that of the national ‘Change 4 Life’ programme. The aims of the programme are to tackle the high levels of health inequality and to improve deprivation related poor health through removing some of the barriers to physical activity. Specific aims were to:

- Increase the number of people who regularly take part in active recreation and sport – Move from 17% to 20% of the adult population (an additional 23,000 people) being active at least five times a week
- Improve the mental and physical health of those who take part in physical activity
- Promote healthy eating and enable more people to maintain a normal body weight
- Reduce early death and disability from chronic diseases by promoting physical activity and improving cardiovascular fitness among those who experience the most inequality in health
- Provide opportunities for employment, volunteering and youth inclusion
- Demonstrate effective partnership working to achieve better outcomes

In 2011 the scheme had about 140,000 active users per year [286] and by 2013 approximately 400,000 users [287]. In 2013 72% of the users were from the target populations, for example 50% from the most deprived quintiles and 61% from Black and Minority Ethnic groups [287]. An evaluation found that 20% of participants had previously been ‘totally inactive’ and that 89% increased their activity levels to ‘moderately to very active’ over a three-month period [287, 288].

A cost-benefit analysis of the Be Active programme found that it was cost-effective generating around £21.3 in benefit for every £1 spent (health care related benefits, reduced medication costs, and improved quality of life) [286]. The cost per QALY was estimated to be £1,164, below NICE’s cost-effectiveness threshold of £20K per QALY. A further economic analysis also found the programme to be cost-effective with a cost per QALY of between £16-400 [289].

The Be Active programme has now been replicated elsewhere [36].

The use of parks to contribute to the Be Active programme was piloted in the summer of 2013 and was initially conceived of as ‘leisure centres without walls’ [287, 290]. The Active Parks programme is underpinned by a theory-based approach to reducing the barriers to engagement with physical activity. These barriers typically include cost, availability, knowledge of availability, feeling uncomfortable in formal exercise settings (e.g. indoor gyms), and perceived (in)ability to take part. It is suggested that providing free, fun, non-traditional led activities in parks has the potential to overcome many of those barriers [290]. The evaluation of the piloting activities showed that:

- Active Parks helped families exercise together.
- It appealed to all ages.
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- People who do not traditionally access leisure facilities were more likely to stay active in parks and open spaces.
- The project changed people’s perceptions of where they can be active.
- People attending for exercise went on to volunteer, becoming active members of the community.  

Active Parks is now run in partnership with Friends of Parks, Birmingham Open Spaces Forum, Birmingham City Council Parks, ParkLives (a partnership between Coca Cola Great Britain and six Local Authorities), Sport England, and StreetGames, and has received funding from Public Health and Sport England. The Active Parks programme is run across the city of Birmingham’s 600 greenspaces in collaboration with Birmingham parks rangers, the police, and ‘friends of’ groups to ensure sustainable delivery and the safety of those participating.

Members of the scheme can choose from many different outdoor activities including walks and rambles, running, cycling, Zumba, Tai Chi, sports like rounders, basketball, boules, tennis, rowing and canoeing, gardening, conservation and bush craft. There is a searchable website of activities.

The programme has been shown to shift attitudes towards physical activity participation: “Working in the hospitality industry left me very little time to get to the gym or attend fitness classes that I liked. Heard about Park Lives and it has literally changed my life! Did a 2 hour tennis session at Cannon Hill park today and I’m doing a rowing session at Edgbaston reservoir tomorrow.....the activities are endless, and all for free!!” Park Lives participant, Birmingham.

The pilot programme engaged 4,000 members in the scheme, by the third year this had grown to 90,000. A report from Sports England highlighted the programme’s success in engaging with typically ‘hard to reach’ groups (e.g. by the physical activity, health and environment sectors), in the years 2015 to 2016:

- **attendance from black and minority ethnic communities was 52% and the proportion of women attending the activities was 46%.**
- **81% of participants accessing the programme come from the top two most deprived areas of Birmingham**
- **participation has also increased in under-fives and the 70+ age range**
- **attendance by women has seen a significant increase due to the women’s-only sessions.**
6.3. Case study: Branching Out, Forestry Commission Scotland

**Characterising Branching Out, Forestry Commission Scotland**  
(for more detail on the intervention characteristics see Section 4)

*Type of actions:*  
- Natural environment interventions  
- Social Interventions

*Type of exposure to natural environment:*  
- Intentional use

*Type of health outcome:*  
- Therapeutic

*Stage:*  
- Direct

Branching Out is an award winning highly targeted natural environment based health intervention for adults with mental health difficulties. The intervention aims to achieve ‘positive mental health through nature’ [292].

**Box 3. Experiences of the Branching Out programme**

“I wasn’t an outdoor person. I’d decided I’d go give it a week or so and the first week I absolutely loved it. And then the rest of it, I absolutely adored the course”

“I feel in myself I’ve achieved something, like see when I gae home after leaving here I’m puffed oot nd I feel as if I’ve achieved some-thing. I’m knackered and I’m quite proud of myself cause I’ve done it”

Two participants of the Branching Out intervention [292, 293].

“They’ve noticed that they’re capable of things and they have now moved on to volunteering and they’re doing that reasonably independently. That’s a big, big step...”

Healthcare worker [292].

Branching Out forms part of Forestry Commission Scotland’s commitment to help address Scotland’s most significant health issues. The collaborative approach that they have taken to health promotion is detailed in the ‘Woods for Health’ strategy [294]. The Branching Out intervention was designed to respond to Scottish Government strategies on health and health inequalities [40] and the development of the intervention was informed by studies carried out between Forestry Commission Scotland and NHS Greater Glasgow & Clyde, Glasgow Centre for Population Health, and Glasgow and Clyde Valley Green Network [152, 295]. The approach draws on the ‘Five Ways to Wellbeing’ framework [296][41], Ecotherapy practices [152, 297], and Mindfulness approaches to mental health promotion [292].

Initially the interventions were piloted over a six-month period, and were delivered by a Community and Environment Ranger and an assistant psychologist. This process allowed for a period of development and iterative adjustment to the intervention. As a result of this process the types of activities changed, from conservation activities to more bush craft and art based activities, so as to
meet the needs and capacities of the user group but also to appeal to a wider range of people (especially women) [293]. Now people who are referred to the intervention are offered a twelve-week course of weekly three hour visits to a local woodland [292]. The activities are led by a qualified Branching Out instructor who is supported by an assistant leader, all groups have a qualified mental health worker in attendance and taking part. The intervention is group based, with up to twelve people participating at any one time. The activities undertaken at each session are flexible, so as to respond to the setting and needs of the user group, however they typically include: bush craft, physical activities such as Tai Chi, conservation activities (such as removal of invasive plants), arts activities, and some personal development and skills acquisition [292]. At the end of the twelve weeks, participants graduate from the intervention and are presented an award at a ceremony. They are supported to continue similar activities though other mechanisms such as the John Muir awards.

The interventions are managed by Forestry Commission Scotland and delivered through partnerships with 22 other organisations (including NHS Borders, Forth Valley, Greater Glasgow and Clyde, Lanarkshire, Lothian, Fife, Tayside, and Highland; The Scottish Association for Mental Health; Angus Council Ranger Service; The Borders Forest Trust; Cassiltoun Housing Association; Central Scotland Forest Trust; South Lanarkshire Council; Clyde Muirshiel Regional Park; and Edinburgh & Lothian Greenspace Trust) [292]. Branching Out activities are delivered in ten of Scotland’s fourteen NHS health board areas. The programme was initially funded by Glasgow and Clyde Valley Green Network Partnership, NHS Greater Glasgow and Clyde, Glasgow Centre for Population Health, and Glasgow City Council [297]. A 2017 summary of the programme reported that over 2000 people have passed through and completed the programme, around 300 per year. Access to the interventions is thorough referral by health or social services. Typical users are adults with mental health difficulties but it has also been offered to adults with learning disabilities and to an over 65s group.
Table 5 shows the referral service route for participants (reproduced from the 2009 evaluation [297]).
Table 5. Branching Out referral services

<table>
<thead>
<tr>
<th>Title of Service</th>
<th>Service Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Esten South Service</td>
<td>For clients between 16-25 years who are presenting for the first time with an untreated episode of psychosis. Clients must reside within south Glasgow.</td>
</tr>
<tr>
<td>Directorate of Forensic Mental Health &amp; Learning Disabilities: Levantdale Low Secure Unit Group A</td>
<td>Patients recovering with long and enduring mental health problems in low secure rehabilitative care</td>
</tr>
<tr>
<td>Directorate of Forensic Mental Health &amp; Learning Disabilities: Levantdale Low Secure Unit Group B</td>
<td>Patients recovering with long and enduring mental health problems in low secure rehabilitative care</td>
</tr>
<tr>
<td>Recreational Therapy Levantdale Hospital</td>
<td>18 years – 65 years of age with a moderate to severe mental health issue.</td>
</tr>
<tr>
<td>2. Glasgow North ESP Training</td>
<td>Clients of working age who have experienced – or are recovering from mental health problems</td>
</tr>
<tr>
<td>2. Glasgow South Integrated Training</td>
<td>Clients of working age who have experienced – or are recovering from mental health problems</td>
</tr>
<tr>
<td>Directorate of Forensic Mental Health &amp; Learning Disabilities: Levantdale Low Secure Unit Group C</td>
<td>Patients recovering with long and enduring mental health problems in low secure rehabilitative care</td>
</tr>
<tr>
<td>The Anvil Centre Community Mental Health Team</td>
<td>18 years – 65 years of age with a moderate to severe mental health issue. (Group were largely clients with chronic psychotic disorders)</td>
</tr>
<tr>
<td>Glasgow East Community Health and Care Partnership</td>
<td>18 years – 65 years of age with a moderate to severe mental health issue. (Group were largely clients with chronic depression)</td>
</tr>
<tr>
<td>Stobhill Hospital: Local Forensic Psychiatric Unit Medium Secure Unit</td>
<td>Patients recovering from long and enduring mental health problems in medium secure rehabilitative care</td>
</tr>
<tr>
<td>The Auchinlea Centre Community Mental Health Team</td>
<td>CMHA: 18-65 with a moderate to severe mental health issue</td>
</tr>
<tr>
<td>Glasgow East Community Health and Care Partnership</td>
<td>DART: inpatients from Parkhead/Staffhill Hospital who are homeless or potentially homeless. Patients who have been recently rehomed and continue to be supported by DART. Patients will have an RMO and have a mental health diagnosis</td>
</tr>
<tr>
<td>Discharge and Resettlement team, Parkhead hospital, Community Mental Health Team</td>
<td>18-65 with a moderate to severe mental health issue</td>
</tr>
</tbody>
</table>

Participation is dependent on meeting a range of criteria relating to service use, health status and behaviours [297].

The Branching Out intervention has been robustly evaluated on two occasions [297-299]. The 2009 evaluation demonstrated, using mixed methods, that participation in the intervention was associated with improved health and wellbeing outcomes [153, 297]. A pre-post use of standardised instruments showed increases in rates of physical activity, and in measures of physical functioning, body pain, general health, vitality and mental health [153, 297]. The qualitative component highlighted the breadth of benefit felt by the participants and the mental health workers:

“I’ve learnt more about things I didn’t know about and done things I’ve never done before ... The first couple of weeks opened my eyes to the outside sort of thing; eh I just enjoyed it from there ... I’ve thoroughly enjoyed them, the different kinds of trees and other parts of the forest. The woods that we’re going to. Not everybody knows about eh there’s a lot more activity can be done outside than what I thought about.” Branching Out participant [297].

“The people I work with are chronically psychotic...and none of them really mentioned anything in twelve weeks about their mental state affecting anything at all. They felt normal, they felt the same as everyone else and I think the tasks were chosen so they didn’t feel any different they weren’t
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*unable to do it. So I think it was just so varied that they could engage at any level and their symptoms were a lot better as a result actually.*” CMHT representative [297].

The 2016 economic evaluation used the Short Form 12 survey to assess the health related quality of life outcomes of participation and to derive Quality Adjusted Life Year (QALY) values of the intervention [298, 299]. The evaluation found that participation in Branching Out resulted in improved mental health, social participation and general vitality. The evidence relates to the short-term outcomes (owing to difficulty in collecting longer term data from users). The cost per participant of Branching Out was estimated to be £392 and the programme was found to be cost-effective with a cost per QALY of £17.3K (NICE’s benchmark of cost-effectiveness is £20K per QALY) [298]. The evaluation also found that Branching Out had high retention rates, comparable to or higher than other similar programmes.

The Branching Out partners have produced a comprehensive set of resources for new Branching Out delivery, helping ensure both the transferability of a consistent intervention between settings and the ongoing sustainability of the approach [295]. Key programme components include:

- Flexibility in delivery
- Process of evidence based and self-evaluative intervention design
- The resource manager/delivery body (FCS) working in partnership with the health services (commissioner) to design, deliver and grow the intervention offer [292]
- Standardisation of the intervention
- Production of robust evaluations of outcomes and cost-effectiveness
- Matching intervention activities to the needs of the user groups

6.4. Case study: Natural Resources Wales’ Come Outside! Programme

<table>
<thead>
<tr>
<th>Characterising Natural Resources Wales’ Come Outside! Programme</th>
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<tbody>
<tr>
<td>(for more detail on the intervention characteristics see Section 4)</td>
</tr>
</tbody>
</table>

**Type of actions:**
- Natural environment interventions
- Social Interventions
- Organisational actions

**Type of exposure to natural environment:**
- Intentional use

**Type of health outcome:**
- Targeted prevention
- Therapeutic

**Stage:**
- Indirect
- Direct

The three year Come Outside! programme, funded (£1.1 million) by Big Lottery Fund, Welsh Government and Natural Resources Wales and involving over 260 public, voluntary and community organisations, focused on enabling people experiencing multiple forms of deprivation to engage with
outdoor, nature based activities which had the potential to 1) increase rates of physical activity and 2) improve health and wellbeing [95].

The Come Outside! Programme used a behaviour change model to guide the design and implementation of the programme (Figure 4):

**Figure 4. Come Outside! behaviour change model**

Mechanisms of action operated at the individual service user level, but also within referral/delivery organisations. Key mechanisms included: developing a multi-agency and -organisational structure through which people in deprived groups could be facilitated to engage with the natural environment (organisational networks and partnership working, increasing leader skills, community co-production); increasing participant awareness, confidence and motivations to use the natural environment for physical activity; addressing key barriers to use of the natural environment; and reducing social isolation.

Examples of the activities provided through Come Outside! included [300]:

**Box 4. Increasing awareness of and providing training in outdoor activities to expand opportunities offered under the National Exercise Referral Scheme, Swansea.**

The National Exercise Referral Scheme (NERS) is an initiative which aims to support people, referred through primary care, to increase their levels of physical activity and improve their health and wellbeing. Typically, NERS activities take place within indoor settings, however a desire to increase outdoor provision led to the development of a short intervention, targeting NERS providers and leaders, to increase awareness of the potential of the natural environment as a setting and their confidence to use the natural environment. One NERS provider is quoted as saying: “I didn’t have a clue what this was all about but now I can see how this would really interest some of my groups”.
Box 5. Change Steps: Improving wellbeing for veterans suffering from PTSD, Swansea.

The charity Change Steps helps veterans who are dealing with drug and alcohol misuse associated with post-traumatic stress disorder. A five-week mixed group programme of foraging, bushcraft and canyoning was provided in a quiet safe environment. Participation resulted in increased wellbeing, confidence, and physical activity, and reduced social isolation. The experiences of the ex-service men with PTSD were often profound and likely to be long lasting: ‘He brought the hawks down...it may sound daft, but a lot of us have seen some pretty nasty things in our lives and touching this hawk really gave us a lift. It landed on my arm and I was looking into its eyes and I thought I want to be a bird, I want to feel and see what it does – I got totally lost in the experience’.

Box 6. 3Gs Men’s Project: Geocaching as an engagement and learning tool to mobilise community groups, Methyr Tydfil.

Facing difficulties in engaging with unemployed, older and ex-offender men, and in forming a community with those men who did attend Communities First services, the programme leaders designed and provided taster sessions in geocaching, historical walks and bushcraft/survival days. The activities were well received and encouraged participation from some of the more hard-to-reach individuals. The activities resulted in a range of outcomes, both in relation to health and wellbeing, confidence, and social contact, but also to additional participation, such as the development of a specific geocaching route in a local park, volunteering with Keep Wales Tidy, and a new self-managed allotment gardening group.

Outcomes

The project evaluation reported positive reception to the programme and moderate to high levels of self-reported behaviour change (e.g. increases in physical activity) and wellbeing, and some change in self-reported perceptions of the barriers to using and accessing the natural environment. Greater improvements in self-reported behaviours and perceptions were seen in those attending a greater number of sessions (direction of effect cannot be assessed).

Similarly to many of the natural environment based health interventions discussed in this report, the Come Outside! programme appears to have been successful at achieving multiple outcomes which contribute to better health and wellbeing. One of the quotes provided in the evaluation report demonstrates these multiple outcomes (e.g. increased awareness and engagement with nature and community, confidence, reduced isolation, physical activity, desire to learn new skills and to seek employment) that such programmes can result in [95]:

“Prior to joining the Men’s project I was constantly at home playing on the PC, rarely going out, only to go shopping. I had approximately 18 months of nothing of interest to me. I had lost my job, but I managed to get by, as my father had recently died and left me money. On a visit to the local fish shop I noticed a poster for men to join the group. I immediately went in and spoke to someone about getting involved, which I did the very next week. At first, we did historical walks, learning about the area in which we live, then moved on to geocaching around the local valleys and then starting the Bear Grylls course. I took part in all activities, pushing myself to the limit. In time I would like to learn more skills so that I can help support groups such as these. This project has reintegrated me into the community and into a system of socialising which has given me the impetus to seek employment.”
The Come Outside! programme evaluation provides useful evidence of how different groups engaged with the programme. The programme achieved the highest rates of attendance from adults with physical and/or mental disabilities, and young people not in work, education or training. The lowest levels of engagement were found in homeless people, young people and young parents.

The evaluators used a social value methodology to estimate the value of the activities through increased wellbeing, reporting that between £5 and £18 value was delivered for each £1 spent (these values are based on the self-reported retrospective survey instrument).

A number of process outcomes were identified which could inform future intervention design and delivery [95, 300]:

- To achieve change, Regional Coordinators need to be skilled at delivering across the community, health and outdoor sectors.
- It takes more time and resources to enable people to overcome multiple barriers but the impact can be significant.
- Programmes need to be long enough to enable sedentary participants to build up to regular activity, which is when they gain the most benefits.
- Those who have most to gain from outdoor activity can be reached through the community, health and social care sectors.
- Outdoor activity can be embedded into service provision if the benefits to service users are demonstrated.
7. Improving our understanding of what works in natural environment based health interventions

This review (and others [7-9]) has demonstrated that there is a wealth of natural environment based health intervention activity taking place across the UK. This is despite the structural issues regarding the funding, commissioning and sustainability of activity, issues which are partly due to, but also contribute to the lack of a good quality evidence base.

The growing interest in and demand for robust, evidence based, natural environment based interventions underlines the need for an ongoing effort to better understand what works, for whom and in what contexts. Future research needs to be of a high quality if it is to be used by health care commissioners to guide decision making. Although a rigorous assessment and integration of the quality of the evidence base was out of the scope of this review, past systematic reviews have found the evidence base to be ‘biased and of poor quality’ [7]. The relatively small, and poor quality, evidence base indicating what works, for whom, and in what circumstances, is a result of a number of factors including the relatively high costs (in terms of money, time and expertise) of intervention research and evaluation. However, shifts in approaches to public health research and harnessing of opportunities to gather good quality, transferable evidence could address this deficit.

The following factors may help improve our understanding of natural environment based health interventions.

7.1. A focused effort to identify what works for whom, in what contexts and for what outcomes

This brief scoping review has focused on identifying any evidence of effective natural environment based health intervention practice. Unfortunately, a more extensive and comprehensive examination of the evidence was not possible within the timeframe; it was not possible to examine, specifically and systematically, what works for whom, in what contexts and for what outcomes. There would be great value in continuing this work to identify which interventions are effective in tackling specific health challenges, which are most effective in, or acceptable for particular social sub-groups, and which are most appropriate for different settings. Identifying the types of evidence needed and used by key decision makers would also be of benefit, as would be a concerted effort to identify or develop a common outcome framework. This latter action would help with the comparison of the effectiveness of different programme types and across different settings.

There is clearly a wealth of activity with much evaluative work and reflection undertaken, but little attempt to gather it all together, synthesise what was learnt, and then use this knowledge to inform future activity, commissioning and funding. Systematic collation of evidence of good practice would be of particular value in informing future intervention activity. Additionally, there is a need for greater efforts to translate evidence regarding ‘what works’ into meaningful formats suitable to inform policy and practice decision makers. Useful approaches have been undertaken by the What Works centres; see, for instance, the interactive online toolkit and evidence summaries produced by the Educational Endowment Foundation.

To some degree this is happening through bodies such as Greenspace Scotland and the Outdoor Recreation Network, however it is still difficult to find succinct summaries of what has worked, for whom and in what contexts. The evidence on how to up-scale programmes is also limited, though bodies such as The Conservation Volunteers are working on this. It is recognised that it is difficult to gather and translate this information out of sector (e.g. for academics looking to develop/evaluate initiatives). A Knowledge Exchange partnership may be one mechanism through which this could be achieved.

Theory driven systematic reviews also have the capacity to effectively transform the substantial body of existing evidence into new knowledge. Bringing together evidence from different disciplines
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provides opportunities to build generalisable understandings of how natural environment based health interventions impact on the QoL, health and wellbeing of different socio-demographic groups in different contexts.

There is a need to improve the evidence base on both the impacts of natural environment based health interventions but also in terms of process; the design, implementation and sustainability/scalability of interventions. The need is at all stages; from development and coordination of ongoing activity and increased generation of primary evidence, through to greater syntheses of the existing evidence. Further work on the effectiveness of different funding, delivery and sustainability strategies is also needed.

7.2. Promoting the value of good quality intervention evaluations

In order to better understand what works there needs to be greater emphasis on, and support for good quality intervention evaluations. Recognition of pluralistic approaches to what constitutes good evidence is also important [148, 301].

There are a number of evaluation frameworks which have been designed to be applied to public health interventions, some specifically in relation to natural environment based activities:

- A key resource is the Medical Research Council’s guide to complex health intervention evaluation [234]. There is supplementary guidance on Randomised Control Trials (RCTs)46, and Natural Experiments. These documents provide a rigorous, robust approach to intervention design and evaluation.
- Evaluability assessments [302] provide a framework through which providers, funders and others can assess if and how to evaluate the health impacts of an intervention. The approach prompts potential evaluators to consider where an intervention is situated within wider programmes of delivery, how an evaluation would affect delivery and other decision making, and whether it is practical to evaluate the intervention.
- The WHO Europe’s Health Economic Assessment Tool (HEAT) estimates the economic savings resulting from reductions in mortality as a consequence of regular cycling and/or walking48. HEAT enables users to estimate the value to health of new infrastructure, policies or programmes.
- Greenspace Scotland worked with a range of partners including Health Scotland to develop a Health Impact Assessment framework for greenspace intervention evaluation [303].
- General guidance on the evaluation of social and health programmes can be found from Evaluation Support Scotland49 and from the Big Lottery’s Wellbeing Evaluation Tools guidance [304].
- The Green Infrastructure Valuation Toolkit50 from Green Infrastructure Northwest provides an assessment tool relating to green-infrastructure interventions.

Greater articulation of the theory of change underpinning any intervention will help future evaluation [235, 305].

7.3. Understanding the impacts of ‘simple’ interventions within complex systems

Rutter and Clonti argue that there needs to be a shift in the ways in which we address public health problems such as the rise in obesity [306]. They advocate a move away from simplistic, reductionist linear models of public health research to recognising and reflecting the complexity of systems. In addition to this shift in focus they suggest that many other changes will be necessary including the adoption of different models of research funding to new conceptual models of health promotion at the systems level. Of particular relevance to this report is their argument that:

“There is a pressing need to change the focus of research and action to tackle complex public health problems. Research funding must address the challenges of evaluating not only complex
interventions, but also simple interventions within complex systems. The tools required to do this are still in the early stages of development, but we need to rebalance our approach to public health research to encompass complex systems science and methods in addition to more traditional biomedical approaches” [306].

Many natural environment based health interventions could be described as relatively simple activities taking place within complex systems. Rather than seeking to understand exactly what that particular activity, in isolation from the setting and system in which it takes place, results in, we should, arguably, try to understand what that activity contributes within the setting and system.

7.4. Understanding how to use interventions to respond to specific health sector needs

Despite the evidence of positive effect, there is a need to clarify how natural environment based health interventions could be best used to respond to current priorities within the health system. The NHS 5 Year Forward View strongly recommends an enhanced focus on preventative healthcare, and a greater use of asset based, community centred and integrated care approaches [307], all key features of many natural environment based health interventions. Use of existing assets available to communities, such as shared garden spaces, provide opportunities to promote equity and increasing people’s control over their lives and health. Natural environment based health interventions could also contribute to the NHS’s sustainability concerns. Beyond the primary health services, Local Authorities need guidance regarding whether physical natural environment based health interventions (such as park creation, greenways, and street trees) are suitable for funding through Section 106 allocation or Community Infrastructure Levy mechanisms. The Social Value Act [31] ‘requires people who commission public services to think about how they can also secure wider social, economic and environmental benefits’ (40).

7.5. Specific research needs

Urban greenspaces:

- Clarify which types of new urban greenspace interventions are the most effective in improving health, wellbeing and quality of life outcomes (e.g. street trees, greenways, new parks etc.)
- Better understand what types and degrees of interventions are most effective in encouraging sustained use of urban natural environments
- Clarify how interventions should be designed and implemented so as to be appropriate for different socio-cultural groups and not increase or exacerbate multiple forms of inequalities
- Understand how to support and embed interventions so that they are sustainable and effective in the longer term.

Deprived and disadvantaged groups:

- Clarify which types of targeted natural environment interventions are the most effective in improving the health, wellbeing and quality of life of deprived and disadvantaged groups in different contexts
- Clarify how interventions should be designed and implemented so as to be appropriate for the needs and desires of different socio-cultural groups and not increase or exacerbate multiple forms of inequalities
- Clarify how to balance the (sometimes competing or conflicting) needs and desires of different users of spaces
- Better understand how to engage communities in decision making around the suitability, design and implementation of natural environment based interventions
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Children and young people’s natural environment based physical activity:

- Clarify which types of targeted natural environment interventions to promote physical activity in children and young people are the most effective and how these may differ according to physical contexts or socio-cultural background
- Clarify how interventions should be designed and implemented and identify which actors need to be involved
- Better understand how to engage children and young people in decision making related to the design and implementation of natural environment based physical activity interventions
- Clarify how to make best use of available assets such as parks
- Clarify how to embed behaviours in childhood to influence adult behaviours and health

In relation to all types of intervention there is a need to better understand how to fund, support and embed interventions so that they are sustainable and effective in the longer term. In addition, there is a need to identify interventions which are scalable and transferable to other contexts.

Future reviews of the evidence should take greater account of the reliability of the evidence (e.g. appropriateness of the evaluation approach, reliability of the methods and reporting) and any sources of bias (e.g. publication bias, funding bias etc.).

There is an acute need to better understand the cost-effectiveness of natural environment based health interventions.
8. Natural environment based health interventions: a workshop on 'what works' and the role of Government

On the 13th November 2017 a workshop was held with 25 professionals with an interest in nature based health interventions from environmental charities, Public Health England, Local Authorities, several Governmental Departments, and from academia. The aims of the workshop were to reflect on experiences from across the sector and to identify needs and priorities for the future. The following topics were discussed:

1. What is the role of Government (national and local) in supporting the use of natural environments for health purposes?
2. Where should leadership come from (is leadership even needed or wanted)?
3. How can evidence of the potential of natural environments to promote health support Government policy and delivery priorities? How do we in practice integrate this evidence into different and emerging policy agendas (including contributing to the work of the new Parks Action Group)?
4. What else is needed to support and enable improved practice?

The results of the discussion are summarised below.

8.1. What is the role of Government (national and local) in supporting the use of natural environments for health purposes?

- There was agreement that there is a lack of leadership on nature based health interventions within Government (national and local). It was suggested that it might be helpful if one Department was nominated to take a leadership role in nature based health interventions. More broadly, there is a need for influential voices backed up by policy drivers and departmental mandates to be present at high levels where decision making, particularly about allocation of resources, is taking place.
- Although it was suggested that one department should take ownership, it was felt that identification of cross-sectoral and departmental shared interests, and common drivers and institutional needs was crucial and would help find synergies and facilitate activity. Understanding the key forums, such as the Conservative Environment Network, could be beneficial and would help target messages.
- At a local government level, the health, social care and environment portfolios are also held separately, there is rarely anyone with the responsibility to identify and make links. Mandating for such a role could provide much needed local leadership and drive more action.
- In Wales the Future Generations Act has provided a context and driver for inter-sectoral and departmental working. Although there have been challenges the Act has prompted changes in how environment and health departments work together. It has facilitated a two-way conversation to find the ways in which departments could work together to achieve shared goals and priorities.
- There is a need for more strategic horizon scanning activities at all levels of government and within other institutions and organisations. This is of particular relevance as we face Brexit and start to plan for the implications of new regulatory frameworks and so on. Funding mechanisms will also likely change. Questions relating to how to respond will be asked and it would be beneficial to have some idea of what could be achieved and how, so as to be in the right place to capitalize on any opportunities.
- Potential facilitating suggestions regarding the role of the government were put forward by participants at the workshop, one key idea was to put the achievement and maintenance of a
healthy population on the same footing as achieving and sustaining economic growth. It was argued that this would be an enormous leap forward and would open doors for public health.

- **Health in All Policies** (and the complementary **Environment in All Policies**) is another mechanism which could be better used, particularly if there was a central mandate and coordination. It could help foster trust and direct dedicated resources from a high level. Additionally links should be made with high level efforts to reduce spatial, social and economic inequalities.

8.2. Where should leadership come from (is leadership even needed or wanted)?

- It was felt that the **real leadership is coming from the grassroots level**, charities are leading much of the work and are spearheading the more innovative approaches. Currently it is not a functioning top down system nor is there an identifiable figurehead.
- **The leadership solution will be collaborative** and will involve public, third and private sector. The question is how to facilitate this to happen, how to identify and put in place the structures that will allow this to be effective within the constraints of our political and fiscal environments/systems.
- There is a **need for leadership in different guises and that which operates between and within different sectors.** Key voices in key settings could help achieve a groundswell of interest and facilitation.
- There was a concern that **there is a lack of a coordinated voice** which can help steer where intervention funding, as well as research and evaluation resources, is directed. This is important because it is a fragmented field spanning many different sectors. There is little understanding of what key decision makers or influencers (such as PHE, Local Authorities, and so on) need in terms of a unified strategy.
- There was discussion of whether the **necessary (structural) conditions for effective policies and practice** are clear. For instance, some questioned whether we know what the most appropriate power structure that would be effective in supporting activity is? The Local Nature Partnerships (LNPs) are one example of an attempt to create a leadership structure, with complimentary bodies for health (Health and Wellbeing Boards) and local economies (LEPs). It was suggested that the LNPs have been effective in some areas and have provided leadership, with activity coalescing around and supported by them, however in other areas they have been ineffectual and have failed to provide any form of sustained leadership. The effectiveness of some LNPs was attributed to the presence of key people or organisations rather than the structure itself.

8.3. How can evidence of the potential of natural environments to promote health support Government policy and delivery priorities?

- **Whether or not the evidence base is strong enough to justify and support the funding and provision of nature based health interventions** was questioned by some in the workshop. Some asked whether it was ethical to promote nature based health interventions if there isn’t yet a robust evidence base. It was suggested that scarce resources could be better targeted at other better understood health interventions. This position was countered, however, with some arguing that although there are many gaps in the evidence base (see many of the points below) the trend of the evidence is supportive and that many sectors, including the health sector, are (to some degree) convinced. It was suggested that perhaps the question is, instead, where is the evidence good enough to support activity?
- It was argued that, on the whole, relevant sectors, such as planners, understand and accept the evidence base but are constrained by a **lack of evidence which indicates what to do, where and**
How. For example, there was a perception among those who have worked with planners that they need case studies which 1) demonstrate what can be achieved and 2) have sufficient information to enable the translation of that case to other situations. Others suggested that the lack of robust evidence on the effectiveness of different natural environment interventions for specific health outcomes constrains health sector activity.

- **Identifying and agreeing on shared evaluation frameworks and a common set of outcomes measures** would be beneficial. This would provide some consistency across research and evaluation and would help identify the relative contribution of environmental interventions to health promotion (in comparison to other types of health interventions). Consistent evaluation evidence would be helpful in informing the activities of organisations, such as the NHS, that work across settings. However, there is a need to be cautious. Key tools such as Warwick-Edinburgh Mental Wellbeing Scales (WEMWBS), while validated and robust, are not necessarily appropriate across different types of interventions and may fail to detect the types of change that are likely to occur. There is a need to have a national conversation as to how to best assess health outcomes so that they are comparable and aggregable.

- Initiatives such as the NHS Healthy New Towns need evidence which can indicate the longer-term impacts of interventions. There is very little information on the duration of the impacts of interventions or of the amount of resource needed to achieve positive change. It was acknowledged that it is currently very difficult to adequately fund longer term and more robust evaluations.

- There is also a need to **aggregate and meta-analyse across research, case studies and evaluations**. Such aggregative synthesis could help identify what works, where and for whom, and may indicate how effective initiatives and interventions could be transferred to other settings. Utilising wider bodies of evidence would help address gaps in knowledge.

- Linked to the previous points, it was felt that there is a still a need for **facilities for sharing data** that are accessible to all those with an interest.

- There is still a **lack of trans-sectoral research** which can inform decision making around complex questions such as how to respond to the SDGs, urban living partnerships and so on. Currently the research sector is not sufficiently trans- or inter-sectoral.

- It was also argued that the ongoing use of specific valuation methodologies such as valid and robust Return on Investment (RoI) analyses would help strengthen arguments. It was acknowledged that RoI analyses have been undertaken but that the methodologies used have, in some cases, been questionable and not of a standard to take to the health service.

- There was a concern that there is almost **no evidence on the health and other impacts of the withdrawal of funding** from parks and so on. The group questioned whether anyone has undertaken a Health Impact Assessment (HIA) on the spending cuts, sell-offs and other changes to urban greenspaces. The group discussed what kind of evidence could help prevent this loss of resource. Economic arguments can help but they haven’t prevented the current situation.

### 8.4. What else is needed to support and enable improved practice?

- **Identifying and focusing on a small number of key issues that are of concern to the health service and wider society** (such as obesity or mental health) would help clarify and communicate what could be achieved. Agreeing on a set of priorities would provide structure and coordination within a fragmented landscape.

- A focus on **public relations** would be beneficial. As noted repeatedly during the workshop, there is currently very little coordination and commonality between those involved in nature based
What Works briefing on natural environment based health interventions

health interventions (of any kind) and the aims of their strategies, activities and so on. It was suggested that identifying a simple message such as ‘five a day’ could be hugely powerful.

• It was pointed out that competing priorities, such as the need to achieve new housing targets for planners and developers, eclipses any interest in addressing the links between environments and health for some sectors. This means that opportunities to build natural environment based health promotion into people’s lives, such as through active and sustainable transport or the education system, are missed.

• However, there are many initiatives and organisations, such as the NHS Sustainable Development Unit and the Town and Country Planning Association (TCPA), which are working to shift and balance priorities within specific sectors and systems. The TCPA, for example, are leading efforts to mainstream Green Infrastructure and Healthy Planning approaches.

• There was consensus that there is a need to better understand how to fund, sustain and deliver interventions. In particular there are still many questions regarding how to ensure they are sustainable and can become independent.

• It was argued that one of the key opportunities to embed the opportunities the natural environment provides within health services planning and delivery, the Sustainable Transformation Plans, has largely been missed. Recent reviews have shown they do not address prevention adequately.

• The culture of medicine and the medical model also has little space for preventative healthcare and for harnessing the potential of the natural environment. Some of the group had had discussions with planners but had failed to persuade planners that health promotion and prevention was actually in their job role. Shifts in how preventative healthcare and population health are approached at a structural level could help facilitate practice.
9. Conclusions

This brief scoping review has provided an overview of what is known about what works in relation to natural environment based health interventions. It has shown that:

1) There is currently a significant amount of natural environment based health intervention activity, supported and funded through various mechanisms. There is a plurality of approaches, however many interventions share certain characteristics, these relate to: the nature of action; the type of exposure to natural environment; the type of health promotion; and the stage at which intervention happens.

2) There is evidence to suggest that health outcomes can be improved through good quality urban greenspace interventions, that the health and wellbeing of deprived and disadvantaged groups can be improved through targeted interventions, and that interventions can be effective in promoting and facilitating children and young people’s natural environment based physical activity. However, in terms of robust, reliable evidence of what works in nature based health interventions, for whom and in what contexts, our understanding is still relatively poor. There is not yet enough evidence to evaluate the relative value of different natural environment based interventions: a) for addressing different health outcomes (especially in relation to specific NCDs); b) for different social groups [61]; or c) in relation to the costs, or health savings.

3) Numerous evaluations and project reports give us a good sense of effective approaches to nature based health intervention delivery and implementation. However, again this evidence is patchy and has yet to be brought systematically together to inform transferal and scaling of programmes between contexts and populations. There is a need for more good quality evaluation and research on the impacts and process of natural environment based health interventions and in relation to their cost effectiveness. Existing evidence should be brought together using systematic approaches which take account of potential biases.

4) Many of the key challenges to effective sustainable practice relate to the lack of leadership, constrained financial context, and to the lack of focus on and direction of resources to preventative healthcare.

9.1. Implications for policy and service delivery

In early 2018 the Government published its new 25 Year Plan to Improve the Environment [308]. The strategy details the Government’s intentions to:

1) Help people improve their health and wellbeing by using greenspaces including through mental health services

2) Encourage children to be close to nature, in and out of school, with a particular focus on disadvantaged areas

3) ‘Green’ our towns and cities by creating green infrastructure and planting one million urban trees

4) Make 2019 a year of action for the environment, working with Step Up to Serve and other partners to help children and young people from all backgrounds to engage with nature.

The explicit focus on health outcomes is welcomed and this brief scoping review has detailed evidence which supports the intentions and a number of the specific ambitions relating to health and wellbeing interventions in the Plan. In the following section this review is used to identify evidence-based strategies which would contribute towards achieving some of the stated aims:

We will scope out how we could connect people more systematically with green space to improve mental health, using the natural environment as a resource for preventative and therapeutic purposes.

- Go beyond individual level drivers and work at a population level.
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- Identify settings where incidental exposure to greenspaces could be enhanced (e.g. in work places, shopping centres, schools, health care settings).
- Recognise that potential solutions will likely be highly contextual and locally specific.
- Recognise that interventions will likely need to be plural, involving changes to physical spaces in addition to complementary social programmes.
- Fund (or advocate the funding of) further exploratory interventions into what works in encouraging different types of people to connect with greenspaces.

We will consider how NHS mental health providers in England can establish new working arrangements with environmental voluntary sector organisations to offer appropriate therapies – such as gardening, outdoor exercise and care farming – in natural settings to people with mild to moderate mental health conditions and who may be struggling to overcome loneliness and isolation.

- Use horizon scanning techniques to identify the specific mental health challenges populations will face and systematically identify appropriate intervention and delivery options.
- Ensure that systems are in place to sustain activities in the long term to allow continuity of service.
- Work with CCGs and other commissioners to identify how local providers can organise themselves to provide the types of services required.
- Explore whether accreditation and quality standards are needed for specific delivery types to encourage use within the health care system.
- Consider the wider context of the provision of opportunities; can people access them (e.g. are there adequate transport options to the activity), are they affordable, do people with mild to moderate mental health difficulties consider environmental interventions a suitable treatment option.
- Look beyond primary health care and focus also on preventative health (locally and at scale), work with PHE and local Public Health to identify how local resources can be best used.
- Develop and ensure use of suitable evaluation and outcome frameworks which support the systematic and coordinated gathering of evidence across activities.
- Regularly review progress in supporting or setting up opportunities, and in the achievement of objectives and respond as necessary.

We will launch a three-year ‘Natural Environment for Health and Wellbeing’ programme, focused on supporting local authorities, health organisations, health professionals, teachers and planners in promoting the natural environment as a pathway to good health and wellbeing.

- Provide programme leadership, nationally and locally, with authority and credibility. Promote awareness that most departments have a stake and something to contribute.
- Ensure adequate buy-in from key decision makers such as CCGs.
- Work in partnership to identify and map shared needs and goals across departments and organisations (nationally and locally).
- Clarify the potential gains from working in partnership across shared needs.
- Identify, at the institutional, organisational, and strategic level, the barriers to activity which promotes or makes use of the natural environment as a pathway to good health and wellbeing.

We want to encourage more investment [in urban green infrastructure], in part by doing a better job of explaining what ‘good’ green infrastructure actually looks like. We will do this by defining a set of standards in close consultation with stakeholders, including the Parks Action Group.

- Consider why there is a lack of investment and act on upstream drivers.
- Address the fiscal challenges faced by those managing green infrastructure in the long term.
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- Improve evidence of what constitutes good green infrastructure for multiple health outcomes, with particular consideration of equity concerns.
- Re-visit the suitability of space standards and guidance such as the Accessible Natural Greenspace Standard and find ways in which they can be achieved.
- Re-visit the suggestion from the CLG select committee that there should be a statutory duty on local authorities and Health and Wellbeing Boards to prepare and publish parks and green space/infrastructure strategies. As the committee noted this could encourage joint working within local authorities, increase the profile of parks and green spaces and their contribution to wider local authority objectives, and facilitate the contribution by other service areas to parks and green space services.

*We will focus on the simple things that people can do, and how these also support good health.*

- Focus also on the simple things that institutions and those with power to make decisions could do to facilitate people to take simple actions.

9.2. Next steps

In addition to the specific suggestions above, other useful next steps might include:
- Identifying and focusing on a small number of key issues that are of concern to the health services.
- Increased coordination and commonality between those involved in nature based health interventions (of any kind) and the aims of their strategies, delivery and evaluative activities.
- A focus on mitigating competing priorities, such as the need to achieve higher density of housing for planners and developers.
- Harnessing the opportunities presented by the many high-profile initiatives and organisations, such as the Sustainable Transformation Partnerships, NHS Sustainable Development Unit and the Town and Country Planning Association (TCPA), which are working to shift and balance priorities within specific sectors and systems.
- Finding more sustainable ways in which to fund, support and deliver interventions.
- Advocate and support intervention evaluations with suitable process evaluations to inform the development of future activity.

9.3. Key evidence informed intervention strategies

Finally, in Figure 5 and Table 6 the evidence for key intervention strategies to improve health outcomes are summarised. Figure 5 was first developed for previous work for Defra [309].
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Figure 5. Key intervention strategies to improve health outcomes

- Global, regional, national and local environmental context
- Global, regional, national and local political context
- Global, regional, national and local socio-cultural context

Pathways/Mediators
- Environmental states
  - Physical (air quality, precipitation, temperature, etc.)
  - Biological (infection agents, invasive species, etc.)
  - Management

Health, wellbeing and behaviours
- Health and wellbeing status
  - Intentional or incidental physical activity (Type, Duration, etc.)
  - Quality of life (availability of nature, etc.)

Social and cultural
- Neighbourhoods
  - Environmental impacts

Sense of place
- Familiarity, belonging/raptness
  - Nature connectedness
  - Perceptions of lived environment

Knowledge, Capacity and Capabilities
- Skills
  - Knowledge/education

Personal Drivers/Opportunities for use/Ease of use
- Capacity to access
  - Access ability
- Perceptions and awareness of environmental resources
  - Intentions and preferences
- Choice
  - Use reasons

Socio-cultural
- Social/cultural context and influences

Outcomes

<table>
<thead>
<tr>
<th>Shorter term</th>
<th>Longer term</th>
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| Mental health/well-being
  - Meaningfulness
| - Positive emotions
  - Self-esteem
  - Cognitive function
  - Reduced aggression |
| Experienced/psychological
| - Perceived stress
  - Self-reported wellbeing
  - Quality of life
  - Self-reported health |
| Physical health
| - Reduced risk factors
  - (BMI, blood pressure, etc.)
  - Reproductive health
| - Mortality
  - Morbidity
  - Endocrine and immune function |

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### Table 6. Evidence for key intervention strategies to improve health outcomes

<table>
<thead>
<tr>
<th>Intervention point</th>
<th>Intervention type</th>
<th>Summary of the evidence for potentially effective nature based health interventions</th>
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</table>
| 1                  | Modifications to the *quantity, quality and qualities* of the environment | • There is some evidence to suggest that increasing the amount and quality(ies) of different types of natural environment (typically in close proximity to homes) results in health gains for some groups (esp. deprived and disadvantaged groups).  
• There is some evidence that inequalities may be exacerbated by poorly targeted interventions. There is little evidence on long term outcomes and differential of impact between groups. |
| 2                  | Interventions targeting **how people engage** with natural environments | • There is some evidence to suggest that increasing exposure (at all levels – passive, incidental and active) to natural environments is associated with improved health outcomes, particularly mental health and wellbeing, for some groups.  
• Targeted and dual-strategy (e.g. increase amount and promote spaces/activities) interventions appear to be most effective.  
• There is evidence to suggest that certain delivery modes (e.g. social prescribing) and specific facilitated or led activities (e.g. walking groups, community gardening, and therapeutic interventions) which make use of the natural environment as a setting or context can be effective for improving health and wellbeing outcomes. |
| 3                  | Interventions promoting **physical activity** in natural environments | • There is some evidence to suggest that interventions (including improved infrastructure/state, facilitated use, community events) can be effective in encouraging and facilitating nature based physical activity, with some evidence of this leading to improved health.  
• Dual strategies (increase in good quality accessible resource and promotional activities) and targeted interventions are most effective. |
| 4                  | Interventions promoting **social contact** through natural environments | • There is some evidence which suggests that targeted community events in natural environments can encourage greater use, changing people’s perceptions and likelihood of use.  
• Family is an important driver of use, with some evidence that interventions which target the family unit can be effective.  
• Community based efforts to improving the state of the spaces can also encourage greater use potentially leading to health and quality of life gains. |
|   | Interventions promoting **sense of place** through natural environments | • There is some, limited, evidence to suggest that highly targeted interventions which seek to address perceptions and attitudes towards natural environments, particularly those which seek to promote a sense of ownership may be effective in improving some wellbeing and quality of life outcomes.  
• The long-term outcomes of such interventions are not clear. |
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<td></td>
<td>Interventions relating to <strong>knowledge of or understanding</strong> of natural environments</td>
<td>• There is little evidence that interventions which aim to improve understanding of or knowledge about, or which develop skills relating to the natural environment are effective in improving health outcomes*.</td>
</tr>
</tbody>
</table>
|   | Interventions addressing **socio-cultural mediators** of use of, or benefit from natural environments | • There is some evidence which suggests that interventions which aim to address the multiple social/individual mediators of health benefit from natural environments are effective.  
• Good evidence relates to reducing socio-cultural barriers (particularly for deprived and disadvantaged groups) to the use of natural environments.  
• Targeted and systems-based approaches appear to be effective. |
|   | Interventions aiming to increase **everyday exposure to and use of** natural environments | • There is some evidence that suggests that addressing ease of access and facilitating the incidental use of natural environments, e.g. built into everyday activities, such as green active transport routes, can be effective in improving health outcomes and pathways to health improvement.  
• Generally, such interventions should be designed so as to reach and meet the desires and needs of specific groups.  
• There is little evidence on the long-term impacts of such interventions. |
|   | Interventions addressing **personal drivers of use or exposure to** natural environments | • There is evidence to suggest that interventions which seek to address personal drivers regarding the use of natural environments are effective in improving some health, wellbeing and health behaviour outcomes via changes in attitudes and motivations.  
• The adoption of behavioural change intervention techniques can be effective in increasing the likelihood that people will use the natural environment to improve health outcomes.  
• Some interventions which seek to reduce internalised barriers to use can be effective.  
• The long term and stability of outcomes of such interventions are not clear. |
|   | Interventions addressing the **wider socio-economic, policy and delivery** context | • There is little evidence of the impact of interventions which seek to change socio-political contexts, drivers and policy tools on health outcomes relating to the natural environment*. |
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<td>- Wider public health evidence suggests that interventions which seek to address the socio-economic-cultural and structural context, however, are fundamentally important upstream intervention points and are likely to result in the greatest improvements across populations.</td>
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<tr>
<td>11</td>
<td>Interventions addressing the international socio-economic, policy and delivery context</td>
<td>- There is little evidence of the impact of interventions which seek to change global, national or regional socio-political contexts on health outcomes relating to the natural environment*.</td>
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</table>
| 12 | Interventions targeting mental health outcomes | - There is some evidence to suggest that mental health outcomes can be improved through urban greenspace interventions, targeted promotional interventions.  
- There is growing evidence that some mental health outcomes could be improved through the use of targeted therapeutic interventions.  
- Impacts vary between socio-demographic groups.  
- The longer-term stability of outcomes is not clear. There is the potential to increase inequalities through poorly designed interventions. |
| 13 | Interventions targeting physical health outcomes | - There is some, relatively limited, evidence to suggest that some specific physical health outcomes can be improved through urban greenspace interventions, targeted promotional interventions, and through targeted therapeutic interventions.  
- Impacts vary between socio-demographic groups. The longer-term stability of outcomes is not clear. |

*This does not suggest that such strategies do not improve health, rather that little evidence has been conducted or that existing evidence is equivocal.
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300. Shephard & Moyes LTD and Trilein, *Come Outside! Case study*. 2016, Communities First; Welsh Government; Natural Resources Wales; Big Lottery


Appendix 1. London Workshop

Held 13th November 13:00 to 16:00 at Nobel House, London

The aim of the workshop was to discuss the findings of the What Works briefing on natural environment based health interventions and to clarify implications for Government policy as well as for practice on the ground. The workshop was intended for those developing and delivering policy relating to health and natural environments as well as those providing services to communities. It was attended by representatives of national Government departments and delivery agencies, Local Government, environmental and health non-governmental organisations, private sector, and academics.

During the workshop the participants consider three key questions:

1. What is the role of Government (national and local) in supporting the use of natural environments for health purposes? Where should leadership come from (is leadership even needed or wanted)?

2. How can evidence of the potential of natural environments to promote health support Government policy and delivery priorities? How do we in practice integrate this evidence into different and emerging policy agendas (including contributing to the work of the new Parks Action Group)?

3. What else is needed to support and enable improved practice?

Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tr>
<td>12:30</td>
<td>Arrival</td>
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<td>13:00</td>
<td>Introductions, background to project and aim for the day</td>
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<td>13:10</td>
<td>Sharing the results of the review</td>
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<td>1. Evidence of benefit – Children, Urban, Marginalised Groups;</td>
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<td></td>
<td>2. What works? Delivery, Cost-effectiveness, Challenges</td>
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<td>13:30</td>
<td>Policy and practice context</td>
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<td></td>
<td>• Defra</td>
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<td>• Dorset Public Health</td>
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<td>• The Conservation Volunteers</td>
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<td>13:45</td>
<td>Responses and questions</td>
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<td>14:00</td>
<td>Discussion of key questions</td>
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<td>• What is the role of Government (national and local) in supporting the</td>
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<td>use of natural environments for health purposes?</td>
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<td>• Where should leadership come from (is leadership even needed or wanted)</td>
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<td>• How can evidence of the potential of natural environments to promote</td>
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<td>health support Government policy and delivery priorities? How do we</td>
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<td>in practice integrate this evidence into different and emerging policy</td>
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<td>agendas (including contributing to the work of the new Parks Action</td>
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<td>• What else is needed to support and enable improved practice?</td>
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<th>Time</th>
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| 15:30 | Identify key actions or needs for different sectors  
      |   - Leadership                           |
      |   - Role of government                   |
      |   - Facilitation of and support for activity |
      |   - Evidence                             |
| 15:45 | Next steps and Actions                  |
| 16:00 | Close                                   |
Appendix 2. Examples of natural environment based health interventions

A brief survey of natural environment based health interventions conducted for this review shows that there is a considerable amount of activity. Using the same format and approach as in Table 2, Error! Reference source not found. 7 provides illustrative examples of different natural environment based interventions.

Included actions may not explicitly have been described as ‘health interventions’, however it might be that mechanisms included in the intervention or the delivery strategies may plausibly lead to improved health outcomes. A number of interventions are included more than once as the activities may operate at, or have outcomes at multiple levels. For example, the inclusion of Forestry Commission Scotland’s ‘Woods In and Around Towns’52 intervention in many categories demonstrates the multiple levels at which this, as with many other natural environment based health interventions, operate.

Empty cells do not indicate that there are no examples of this type of activity, rather, that none were found within the timeframe of this review. The majority of entries are hyperlinked to more information on the intervention.
### Table 7. Examples of natural environment based health interventions

<table>
<thead>
<tr>
<th>Remote exposure (through window, TV)</th>
<th>Population level health promotion</th>
<th>Targeted prevention</th>
<th>Therapeutic</th>
</tr>
</thead>
</table>
| Natural environment intervention     | • Natural Estates - getting green in London's housing heartland (Urban greening around homes, workplaces; Increase biodiversity of NEs)  
• Lost Effa, collaborative environmental improvement programme (Greening home, work, education environments; Increase biodiversity of NEs) | • Natural Estates - getting green in London's housing heartland (Targeted urban greening around homes, workplaces; Increase biodiversity of NEs) | • Bringing the Outdoors Indoors (Greening care home/hospitals grounds; Increase visible biodiversity of NEs)  
• NHS Scotland Greenspace projects (Creating new greenspaces; modifying existing greenspaces) |
| Built environment intervention       |                                    |                     |             |
| Social intervention                  |                                    |                     |             |
| Organisational intervention          | • Space standards (e.g., ANGST) (Increase understanding of benefits of presence of NEs around home/workplace to health in key professions; Modify practice and space/building standards) |                     | • Use of Virtual Reality in health care settings |
| Incidental exposure/use              | • Manchester City of Trees (Increasing street trees & greenery; Greening home, work, education environments)  
• Green active travel (green commuter routes)  
• Improving the River Wandle Park (Increase biodiversity; Modification) | • Woods In and Around towns (Improving quality of NEs)  
• NHS Scotland’s Greenspace Project (Increase greenspace; Improve connectivity and configuration of greenspaces to facilitate physical activity; Increase biodiversity) | • TCV Bringing the outdoors indoors (Greening care home/hospitals grounds)  
• NHS Scotland’s Greenspace Project (Increase greenspace; Improve connectivity and configuration of greenspaces to facilitate physical activity; Increase biodiversity) |
What Works briefing on natural environment based health interventions

<table>
<thead>
<tr>
<th>Built environment intervention</th>
<th>Social intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>• PECT’s Green Wheel (Improving physical access to NE)</td>
<td>• Art in the Park (Community events in NE)</td>
</tr>
<tr>
<td>• NHS Scotland’s Greenspace Project (Increase greenspace; Improve connectivity and configuration of greenspaces to facilitate physical activity; Increase biodiversity)</td>
<td>• Twenty’s plenty (Improving (perceptions of) safety of using and accessing NEs)</td>
</tr>
<tr>
<td>• Swansea Westway (Creation of greenways)</td>
<td>• Woods In and Around Towns (Community events in NE)</td>
</tr>
</tbody>
</table>

<p>| • Improving the River Wandle Park (Increase biodiversity; Modification of park features to meet needs of multiple user groups) | • Birmingham Parklives (Use of NE as non-specific setting for physical activity) |
| • River Crane restoration Increase greenspace; Improve connectivity and configuration of greenspaces to facilitate physical activity; Increase biodiversity) | • Paths for all (Use of NE as a non-specific setting for physical activity) |
| • Tree Planting for Wellbeing in Liverpool region ((Greening home, work, education environments) | • Woods In and Around Towns (Community events in NE; Use of NE as non-specific setting for physical activity; Improving (perceptions of) safety of NEs) |</p>
<table>
<thead>
<tr>
<th>Organisational intervention</th>
<th>Intentional use</th>
<th>Natural environment intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woods In and Around Towns (Increase understanding of benefits of NEs to health in key professions (e.g. planning))</td>
<td>Pro-Active Minds (Conservation activities for people at risk of poor mental health)</td>
<td>Pocket parks project (Increasing urban park number and proximity)</td>
</tr>
<tr>
<td>Space standards (e.g. ANGST) (Increase understanding of benefits of presence of NEs around home/workplace to health in key professions; Modify practice and space/building standards)</td>
<td>Ecominds (gardening and conservation activities for people at risk of poor mental health)</td>
<td>Green active travel (green commuter routes)</td>
</tr>
<tr>
<td>Space standards (e.g. ANGST) (Increase understanding of benefits of presence of NEs around home/workplace to health in key professions; Modify practice and space/building standards)</td>
<td>RHS Community gardening (NE based physical activity)</td>
<td>Bristol park connectivity and facilities (Improve connectivity and configuration of greenspaces to facilitate physical activity; Modification of park features (e.g. tree cover, flower beds) to meet needs of multiple user groups; green commuter routes)</td>
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<td></td>
<td>Sensory trails (Targeted improvement of access to the natural environments)</td>
<td>Commwater Community Greenway (Improve connectivity and configuration of greenspaces to facilitate physical activity; Increase biodiversity; Modification of park features to meet needs of multiple user groups; green commuter routes)</td>
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<td></td>
<td>Walking with Wheels (Improving accessibility of NE)</td>
<td>Improving Ladywell Fields (Increase biodiversity of NEs (MH, QoL))</td>
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<td></td>
<td>Woods In and Around Towns (Improve connectivity and configuration of greenspaces to facilitate physical activity; Improving accessibility of NE)</td>
<td>Connswater Community Greenway (Improve connectivity and configuration of greenspaces to facilitate physical activity; Increase biodiversity; Modification of park features to meet needs of multiple user groups; green commuter routes)</td>
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<td></td>
<td>River Crane restoration Increase greenspace: Improve connectivity and configuration of greenspaces to facilitate physical activity; Increasing biodiversity</td>
<td>Sensory trails (Therapeutic NE based activity)</td>
</tr>
<tr>
<td></td>
<td>NHS Scotland Greenspace projects (Creating new greenspaces; modifying existing greenspaces)</td>
<td>Pro-Active Minds (Conservation activities for people at risk of poor mental health)</td>
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<td></td>
<td>Walking routes around Ninewells hospital site (NE based physical activity)</td>
<td>Branching Out (Therapeutic conservation activities)</td>
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<td></td>
<td>Care farming for drug and alcohol dependency rehabilitation and recovery at Uncillys farm (Therapeutic NE based activities)</td>
<td>Ecominds (Therapeutic horticulture, conservation activities etc.)</td>
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<td></td>
<td>Inclusive volunteering project (Conservation activities)</td>
<td>Sensory trails (Therapeutic NE based activity)</td>
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<td>Sensory trails (Therapeutic NE based activity)</td>
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<td>Woods In and Around Towns (Improve connectivity and configuration of greenspaces to facilitate physical activity; Improving accessibility of NE)</td>
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<th>Built environment intervention</th>
<th>Social intervention</th>
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</table>
| • Improving the River Wandle Park  
  (Increase biodiversity; Modification of park features to meet needs of multiple user groups)  
• Natural Estates - getting green in London's housing heartland (Urban greening around homes, workplaces; Increase biodiversity of NEs)  
• The Greenlink in North Lanarkshire  
  (Increase greenspace; Improve connectivity and configuration of greenspaces to facilitate physical activity; Modification of features to meet needs of multiple user groups; green commuter routes)  
• NHS Scotland’s Greenspace Project  
  (Increase greenspace; Improve connectivity and configuration of greenspaces to facilitate physical activity; Increase biodiversity; Modification of features to meet needs of multiple user groups; green commuter routes) | • Open access legislation (Increasing 'access' to an environment through legislation or policy change)  
• Actif Woods Wales (Targeted promotion of NE for at risk; Targeted promotion of use of NE for specific outcomes; Targeted specific  
• A Dose of Nature (Nature based social prescription activities) |
| Connswater Community Greenway  
  (Improving physical access to NE; Improving facilities (benches, toilets, lighting etc.) of NE) | The Greenlink (Improving physical access to NE)  
• Park/outdoor gyms (Improving facilities)  
• NHS Scotland Greenspace projects (new facilities in greenspaces) |
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<table>
<thead>
<tr>
<th>England Coast Path (Increasing access to an environment through legislation or policy change)</th>
<th>Environmental community events in Natural environments; NE based physical activity; Targeted promotion of use of NE for specific outcomes</th>
<th>Paths for all (Use of NE as a setting for targeted therapeutic physical activity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosaic for 16-25 year olds (Targeted promotion of use of NE for specific outcomes)</td>
<td>Mosaic for 16-25 year olds (Targeted promotion of use of NE for specific outcomes)</td>
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<tr>
<td>Forest Schools (Modifying work/educational practices to facilitate and integrate use to NE)</td>
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<tr>
<td>Paths for all (Use of NE as a setting for physical activity)</td>
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<tr>
<td>Woods In and Around Towns (Targeted specific environmental community events in Natural environments; NE based physical activity; Targeted promotion of use of NE for specific outcomes)</td>
<td>Woods In and Around Towns (Targeted specific environmental community events in Natural environments; NE based physical activity; Targeted promotion of use of NE for specific outcomes)</td>
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<tr>
<td>Offenders in Nature (Use of NE as a setting for skills etc. development)</td>
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</tr>
<tr>
<td>London Wildlife Trust’s Budding together (Targeted NE based activities for people at risk of poor mental health)</td>
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</tr>
<tr>
<td>Nature4Health (Targeted specific environmental community events in Natural environments; NE based physical activity; Targeted promotion of use of NE for specific outcomes; Targeted specific environmental community events in NE)</td>
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<tr>
<td>Growing Health projects (Targeted specific horticultural based physical activity; Targeted promotion of use of NE for specific outcomes)</td>
<td>Growing Health projects (Targeted specific horticultural based physical activity; Targeted promotion of use of NE for specific outcomes)</td>
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<tr>
<td>Paths for all (Use of NE as a setting for targeted therapeutic physical activity)</td>
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<tr>
<td>Mindscape (Engaging people with dementia with the NE)</td>
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<tr>
<td>Dandelion Time (Targeted therapeutic use of NE for children)</td>
<td>Dandelion Time (Targeted therapeutic use of NE for children)</td>
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</tr>
<tr>
<td>Wandering in the Woods (Use of NE as a setting for targeted therapeutic physical activity for people with Dementia)</td>
<td>Wandering in the Woods (Use of NE as a setting for targeted therapeutic physical activity for people with Dementia)</td>
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</tr>
<tr>
<td>Brightlife, Go Wild ((Nature based social prescription activities)</td>
<td>Brightlife, Go Wild ((Nature based social prescription activities)</td>
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</tr>
<tr>
<td>Growing Well project (Therapeutic environmental activities)</td>
<td>Growing Well project (Therapeutic environmental activities)</td>
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<tr>
<td>NHS Scotland’s Greenspace Project (Use of NE as a setting for targeted therapeutic activity)</td>
<td>NHS Scotland’s Greenspace Project (Use of NE as a setting for targeted therapeutic activity)</td>
<td></td>
</tr>
<tr>
<td>Phoenix futures recovery through nature (Targeted NE based recovery programme)</td>
<td>Phoenix futures recovery through nature (Targeted NE based recovery programme)</td>
<td></td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Organisational intervention</th>
<th>NHS and Ramblers Medal Routes (targeted led walking groups)</th>
<th>Southdowns NPA’s Green Open Spaces for Health (targeted NE interventions)</th>
<th>Eryri Walking Club for blind and visually impaired (targeted NE based physical activity project)</th>
<th>Wildspace, Yourspace (Targeted specific environmental community events in Natural environments; NE based physical activity; Targeted promotion of use of NE for specific outcomes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woods In and Around Towns (Increase understanding of benefits of NEs to health in key professions)</td>
<td>Space standards (e.g. ANGST) (Increase understanding of benefits of presence of NEs around home/workplace to health in key professions; Modify practice and space/building standards)</td>
<td>Woods In and Around Towns (Increase understanding (e.g. Provide training) of potential ways to use NEs to prevent poor health; Support staff to build intentional use of NE into working, educational practices)</td>
<td>NHS and Ramblers Medal Routes (targeted led walking groups)</td>
<td></td>
</tr>
</tbody>
</table>

Key: NE (Natural Environment); MH (Mental health); PH (Physical health); QoL (Quality of life); HB (Health behaviours); Rcv (Recovery)
Appendix 3. Theory of Change for public health interventions checklist

**Table 8. Theory of Change for public health interventions checklist**

(reproduced from Breuer, et al., [235])

<table>
<thead>
<tr>
<th>1. Is the ToC approach defined?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Is a definition of ToC given by the authors?</td>
</tr>
<tr>
<td>b. Do the authors explain their reasons for using a ToC approach?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Is the ToC development process described?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Are the methods used to develop the ToC, such as stakeholder meetings and interviews, document reviews, programme observation, existing conceptual frameworks or published research, described?</td>
</tr>
<tr>
<td>b. Where stakeholders are involved, is it clear how many stakeholders participated, what their role is in relation to the intervention, how they were consulted (e.g. number of interviews, focus groups, ToC workshops) and the extent to which the consultations were participatory?</td>
</tr>
<tr>
<td>c. Is the method used to compile the data into a ToC described? (including how disagreements between stakeholders were resolved)</td>
</tr>
<tr>
<td>d. Is the extent to which stakeholders were able to validate the resultant ToC and were owners of the final product described?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Is the resultant ToC (or a summary thereof) depicted in a diagrammatic form and does it include?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. The long-term outcome or impact of the intervention</td>
</tr>
<tr>
<td>b. The anticipated short and medium term outcomes and the process of change</td>
</tr>
<tr>
<td>c. The intervention components which happen at different stages of the pathway</td>
</tr>
<tr>
<td>d. The context of the intervention</td>
</tr>
<tr>
<td>e. Assumptions about how change would occur</td>
</tr>
<tr>
<td>f. Additional ToC elements such as indicators, supporting research evidence, beneficiaries, actors in the context, sphere of influence and timelines where relevant.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Is the process of intervention development from the ToC described?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Are the methods of how interventions were refined from the ToC to something which can be implemented described? (For example, further stakeholder workshops, interviews, systematic literature reviews)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Is the way in which the ToC was used to develop and implement the evaluation described?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Are evaluation research questions generated from the ToC?</td>
</tr>
<tr>
<td>b. Is the role of ToC in the design, plan or conduct of the evaluation clear?</td>
</tr>
<tr>
<td>c. Does the paper describe the extent to which the key elements described in the ToC were measured in the evaluation (i.e. impact, short and medium term outcomes and the process of change, context, assumptions and the intervention)?</td>
</tr>
<tr>
<td>d. Does the paper describe whether and how process indicators were used to improve the quality of the intervention?</td>
</tr>
<tr>
<td>e. Is the role of the ToC in the analysis of the results of the evaluation clear?</td>
</tr>
<tr>
<td>f. Is the role of ToC in the interpretation of the results of the evaluation described? (including the breakdown of programme theory, unanticipated outcomes and causation including the strength and direction of causal relationships)</td>
</tr>
</tbody>
</table>
Endnotes

1 Professor Kevin Fenton: Public Health England National Director for Health and Wellbeing
2 Defined by the WHO as ‘an act performed for, with or on behalf of a person or population whose purpose is to assess, improve, maintain, promote or modify health, functioning or health conditions’
3 Ecominds
4 Heritage Lottery Fund Parks for People
5 Moor to Enjoy
6 SNH Green Infrastructure programme
7 Get Hooked on Fishing
8 Ways to Wellness
9 Wyre Forest learning and physical disability gardening project
10 MENE 2015-2016
11 UN SDGs
12 NPPF
13 Pocket parks research at Salford University
14 England’s Accessible Natural Greenspace Standard
15 Welsh space standard
16 New York Highline
17 Cuts to Birmingham Parks threatens Active Parks programme
18 UN SDGs
19 Scottish Government greenspace indicator
20 SNH Green Infrastructure programme
21 https://www.ruralhealthinfo.org/community-health/health-promotion/1/barriers
22 Physical Activity guidelines
23 Start Active, Stay Active
24 Everybody active, every day
25 MENE
26 NICE evidence statement 2009 (work is underway to update guidance on physical activity environments)
27 Get Hooked on Fishing
28 NICE guidance outdoor play in school setting
29 NICE settings based approaches to increasing children’s physical activity
30 MENE children’s indicator
31 NICE settings based approaches to increasing children’s physical activity
32 Scottish Government’s 5 step process for designing and evaluating behaviour change interventions
33 Grounds for learning play project
34 Walking for Health
35 Be Active aims
36 Be Active Scotland
37 Active Parks piloting
38 Park Lives
39 Beactive directory and Parklives directory
40 Equally Well - The Report of the Ministerial Task Force on Health Inequalities
41 The Five Ways to Wellbeing framework was developed by the New Economics Foundation for the UK Government’s Foresight programme. The Five ways are: 1) connect; 2) be active; 3) take notice; 4) keep learning; and 5) give.
42 Branching Out resources
43 The evaluators asked participants to report how they felt before and then after taking part in activities on the same survey form, it is not clear when the survey was completed by participants
44 Educational Endowment toolkit
45 Educational Endowment toolkit, outdoor education
46 MRC RCT guidance
47 MRC Natural Experiment guidance
48 HEAT
49 Evaluation Support Scotland
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50 GI NW toolkit
51 The Social Value Act
52 Woods In and Around Towns