Valuing Nature Report March 2018

Understanding and quantifying the health and wellbeing value of the East Devon Pebblebed Heaths and exploring the potential of partnership working involving private sector organisations

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Executive summary

This Valuing Nature placement was hosted by Clinton Devon Estates and supervised by Dr Rebecca Lovell, from the European Centre for Environment and Human Health. The placement aimed to: understand and quantify the health and wellbeing value of the East Devon Pebblebed Heaths using existing visitor data collected by Footprint Ecology[1] and other secondary data; facilitate knowledge exchange amongst stakeholders; clarify pathways to valuing and developing health and wellbeing outcomes; and increase the researcher's knowledge of policy, research and practice in this area. The key activities for the placement were a literature review, an economic valuation using a range of tools; interviews with stakeholders and a workshop.

The main conclusion is that the Pebblebed Heaths are associated with **an important health and wellbeing value of at least £446,000** (between £0.4 and 0.6m) relating to the physical activity linked to their recreational use (regular visitors only). **The economic value based on the travel cost (willingness to pay) is around £1.9m** (£1.7 – 1.9m) for the estimated annual visits (all visitors)**.** Economic valuations are provided here for the areas in which figures are available, principally relating to the recreational value based on visitor numbers from Footprint Ecology data.

The travel cost and ORVal valuation methods give broadly similar results and are based on a comparable method. The HEAT and MOVES results also give similar values to each other, and both measure the health impact of regular physical exercise conducted on the Heaths by a subset of visitors, giving a significantly lower value to the travel cost and ORVal estimates (see below).

The headline results are as follows:

Valuation method	**Total annual economic value**	**No. of visits / visitors estimate based on**	**Age range** (if applicable)	**Notes & distinguishing features of tool**
Travel cost method	**£1,879,003 (£1.9m)**	422,495 (estimated visits)	N/A	Willingness to pay model; based on petrol cost to get to & from site
Outdoor Recreational Valuation (ORVal)	**£1,722,636 (£1.7m)**	571,919 (estimated visits)	N/A	Based on MENE data & travel cost; uses complex algorithms & socio-economic data
WHO Health Economic Assessment Tool (HEAT)	**£446,310 (£0.4m)**	3097 (estimated regular visitors – 3 x 30 mins per week)	20-74 yrs	Epidemiological model; assesses value of health impact of exercising; calculates for brisk

[1] Liley, Panter and Underhill-Day 2016.

				walking (or cycling) intensity only
MOVES tool (University of East Anglia / Sport England)	**£556,766[2] (£0.6m)**	3097 (estimated regular visitors – 3 x 30 mins per week)	16-61+	Similar to HEAT but measures in Quality Adjusted Life Years (QALYs); assesses brisk or slow walking intensity & other activities ('brisk' used here); differentiates between age groups

Notes: Estimates are averages based on visitor numbers (or low estimates). The MOVES tool and HEAT estimates assume participants are walking briskly (~3 miles per hour) for 3x30mins per week. Travel cost is based on median distance travelled (10.8km round trip; from visitor data). Median route length was ~3km.

These estimates **do not include the important value of the mental health benefits** associated with visiting the Heaths, since tools to calculate these are currently being developed.

The MOVES estimates also show that the health and wellbeing benefits as measured by economic value **are much greater for older people**. It is likely that increased targeting would therefore yield greater health and wellbeing benefits.

The **return on investment** for the **health economic impact** only (measured by HEAT and MOVES) is in excess of **28%** (between 28 and 59%); and for the **overall economic impact** (measured by travel cost and ORVal) it is at least **392%** (between 392% and 437%), although this does not take capital or infrastructure costs into account.

The visitor data[3] shows that there is currently **relatively little awareness of the conservation importance of the Pebblebed Heaths amongst visitors**, and a poor understanding of some of the restrictions on access that are in place (particularly that dogs should be on leads during the breeding season).

Therefore, any increased access **would need to be balanced with the implementation of appropriate education / awareness raising activities and visitor management and mitigation measures** to ensure the environmental protection of the site.

Qualitative values

Although there is some data from the visitor surveys on motivations for visiting the site there is relatively little about the qualitative values and experience (including the aesthetic, social and cultural values, and feelings of pleasure, experiencing beauty and wonder), and therefore there is scope for further research and synthesis of evidence in this area. Reported motivations for visiting the site are varied, with the greatest being scenery and variety of views. Workshop participants from

[2] The range for this figure is: £326,894 – 682,554 based on different values for walking intensity - 'slow' to 'cross country / hills'. This value is the middle value, brisk walking intensity (4.65 METs).
[3] See Liley, Panter and Underhill-Day 2016.

stakeholder organisations emphasised that many visitors value the solitude / tranquillity that can be found there, whilst others value the social opportunities afforded.

Potential for partnership to increase health and wellbeing benefits

The project placement enabled identification of several areas with the potential for increasing benefits. Clinton Devon Estates and similar land-based private sector organisations are likely to be well-placed to deliver partnership benefits because of their extensive stakeholder and community networks and the flexibility they have in terms of implementation on their own land. Partnership working could therefore increase the health and wellbeing benefits through:

- **strategic planning** at county, district and organisational level – this could include identifying strategic theory of change and evaluation for interventions (behaviour change models);
- **better coordination** of existing activities on the Heaths;
- **consultation of key stakeholders** e.g. disability groups on access – paths, gates etc.
- **increased work around targeting of activities** to determine the relevant local target groups and to include disadvantaged groups and older people; and
- **increased education and walks information for the public and inclusive training** for walks leaders – helping to build confidence and allay safety concerns.

Further research – gaps, opportunities and next steps

The following evidence gaps, opportunities and next steps have been identified:

- **Refining the methodology** for how visitor data could be used to estimate health and wellbeing economic impact and what additional data is needed; including the length of time doing a specific activity relates to the health recommendations for physical activity and more accurate estimates for substitution and attribution to this site.
- **Informing design of future visitor surveys** so that they can be used for better calculating health and wellbeing benefits / value.
- **Identifying and utilising other data sources** more effectively to inform interventions.
- **Quantifying mental health benefits** of visiting natural environments.
- Calculating travel cost using the **zonal travel cost method**.
- **Collecting qualitative data** about people's experiences of visiting the Pebblebed Heaths and associated health and wellbeing benefits.

Policy relevance and influence

There is evidence from the literature that **use of natural environments encourages higher levels of physical activity**, and that there are **additional beneficial effects to doing physical activity outdoors** compared to indoor activity.

The economic valuation of £0.4m for the health-related economic value of the Heaths (and 1.9m for the broader economic value based on travel cost) is **robust across different valuation methods**. It is therefore recommended that policy makers **take these public values into account when planning future funding mechanisms** for this site and for similar natural environments. This type of valuation could also be extended to other sites using visitor data in a cost-effective way. However, it is

important that economic valuations are used **combined with a better understanding of the qualitative, mental health and non-use values of such sites**.

Acknowledgements

This placement was funded by the Natural Environment Research Council as part of the Valuing Nature Programme. This research programme aims to better understand and represent the complexities of the natural environment in valuation analyses and decision making, by considering the economic, societal and cultural value of ecosystem services. A Programme Coordination Team is running activities to help build an interdisciplinary research community capable of working across the natural, biological and social sciences, and the arts and humanities, and to build strong links with research users through the Valuing Nature Network.

The researcher would like to acknowledge the assistance of staff at Clinton Devon Estates, the academic supervisor of the project, Dr Becca Lovell and other staff at the European Centre for Environment and Human Health (ECEHH), and various other organisations who gave generously of their time and information, including the Devon Wildlife Trust, the RSPB, Active Devon, the Naturally Healthy Group (Local Nature Partnership), and various University of Exeter staff. Thank you also to all those who participated in the workshop and / or in interviews for their invaluable and constructive input.

Contents

1. Introduction and aims of the placement

This Valuing Nature placement funded by the Natural Environment Research Council (NERC) is entitled:

Understanding and quantifying the health and wellbeing value of the East Devon Pebblebed Heaths and exploring the potential of partnership working to improve those benefits

This Valuing Nature placement aimed to understand and quantify the health and wellbeing value of the East Devon Pebblebed Heaths[4] (or within this report, 'the (Pebblebed) Heaths') using existing visitor and other secondary data, in partnership with Exeter University (Politics Department; the European Centre for Environment and Human Health (ECEHH)), Clinton Devon Estates (CDE) and key stakeholders. It also aimed to facilitate knowledge exchange amongst stakeholders, clarify pathways to valuing and developing health and wellbeing outcomes, and allow the candidate to be exposed to policy, research and practice in this area.

The health and wellbeing values of accessible, high-quality greenspace are increasingly recognised by government and society. There is, however, uncertainty as to how to balance and value these benefits within existing funding models, which are predominantly aimed at promoting conservation and wildlife. There is a pressing need to clarify how health and wellbeing value can be incorporated along with wildlife support into public funding analyses – given the likely future economic challenges for agri-environment schemes. Consideration of these funding challenges has also led to increased recognition of the potential role of private sector organisations as key stakeholders and of the need to explore partnership working amongst stakeholders.

The specific objectives of this placement were therefore as follows:

- To **understand and evaluate the health and wellbeing value of the East Devon Pebblebed Heaths** as a place of recreation and exercise using primary visitor and other secondary data sources (including MENE data, Census data from 2011, the ORVal tool, etc).
- To attain **greater understanding of the tension between the rationale and values behind existing funding models for conservation and wildlife support**, and a desire to also promote the broader **wellbeing/health ecosystem service values** provided by such sites.
- To **clarify how health and wellbeing values can be incorporated** along with conservation and wildlife support into public funding analyses – given the likely future economic challenges for agri-environment schemes and the shifting emphasis towards public value as seen with the forthcoming DEFRA 25-year Plan for the Environment.
- To examine the **policy and practice dimensions of health and wellbeing valuation**, including engaging with practitioner organisations such as Budleigh Salterton Health and Wellbeing Hub.
- To gain insight into the **role of partnerships involving private sector organisations** in promoting health and wellbeing outcomes from nature sites.

Activities carried out on this placement

The key activities for the placement were a literature review, an economic valuation using a range of tools; interviews with stakeholders and a workshop. The completing of the combination of the

[4] Mutter's Moor has been excluded from this analysis because it was not included in the visitor surveys and does not have European environmental designation of SAC or SPA.

valuation and public engagement work in the timescale enabled the placement holder to fulfil the project objectives. See sections 4 and 5 for further details and findings.

2. About the site – management, biodiversity and land cover

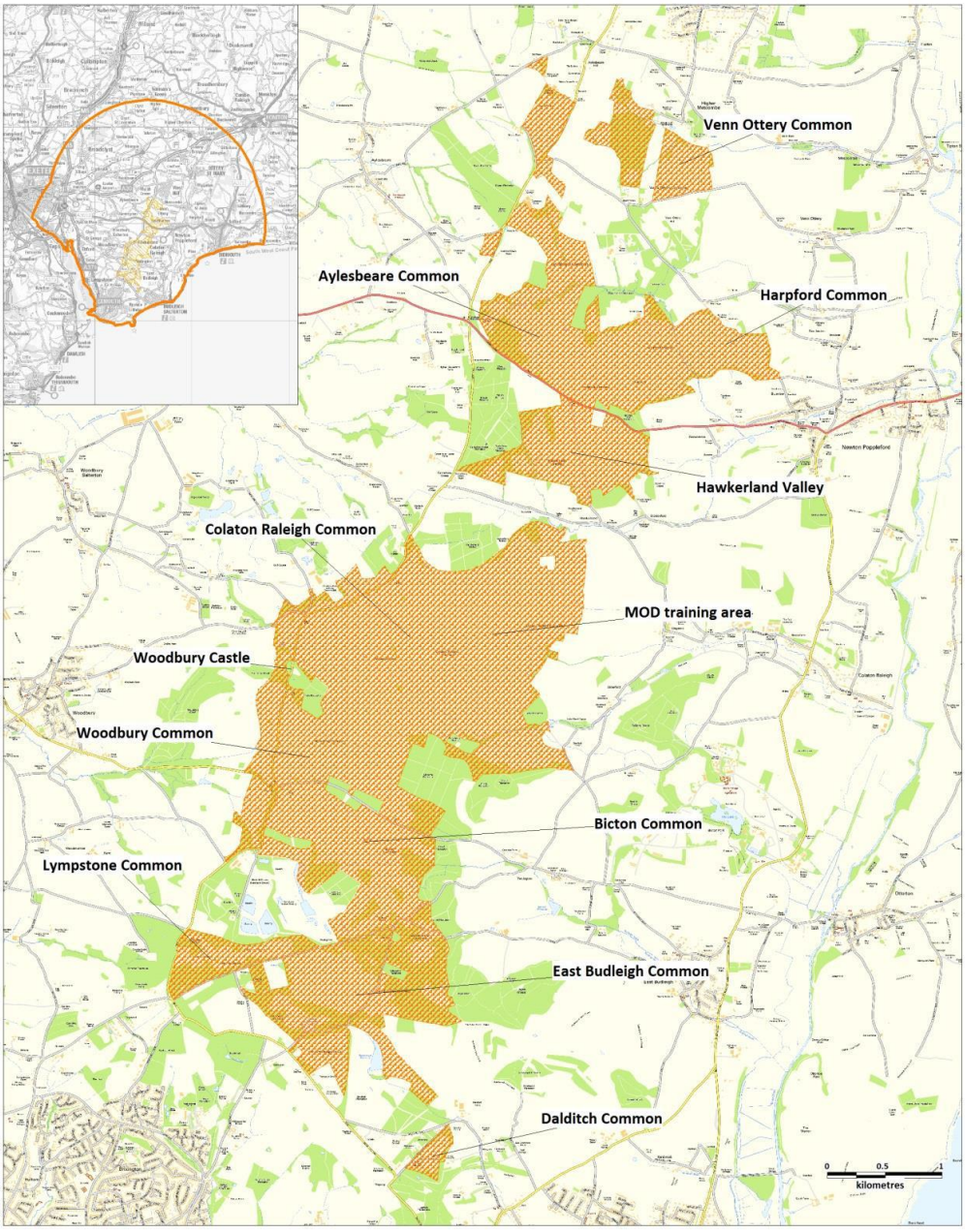
The East Devon Pebblebed Heaths represents one of the region's most significant nature conservation areas, covering around 1,100 hectares of open access common land, and is one of the most important recreational sites within reach of Exeter and Exmouth. The Pebblebed Heaths has European environmental designated status of Special Area of Conservation (SAC) and Special Protection Area (SPA) and UK environmental designation as a Site of Special Scientific Interest (SSSI). The Pebblebed Heaths currently get approximately 500,000 visits each year from the surrounding population, which includes some disadvantaged areas.

The area is owned by Clinton Devon Estates, managed by the East Devon Pebblebed Heaths Conservation Trust (PHCT), which manages the Heaths for the benefit of wildlife and to promote the public enjoyment and appreciation of the Heaths. Some areas are leased or owned by the RSPB (Aylesbeare Common; part of Venn Ottery Common) and other areas are privately owned and managed by the Devon Wildlife Trust (Bystock; part of Venn Ottery Common).

The Pebblebed Heaths make up the largest block of lowland heath in Devon. While heathland is widely distributed in the uplands, in the lowlands heathland has been lost to development, forestry and agriculture and the little that now remains tends to be fragmented and isolated. The Pebblebed Heaths therefore represent an important example of inland Atlantic-climate lowland heathlands of Britain and north-west Europe. A significant feature of the site is the diversity of heathland associated communities, including dry through to wet heaths and mineral-rich flushes, related to its large area and the range of substrates and topography (Liley, Panter and Underhill-Day 2016).

Specific areas totalling 1,119 ha of the Pebblebed Heaths are designated as a SSSI. The SAC designation is for the north Atlantic wet heaths with cross-leaved heath (*Erica tetralix)*, European dry heaths and the populations of southern damselfly (*Coenagrion mercuriale)*, for all of which the Pebblebed Heaths were considered one of the best areas in the UK. Both wet and dry heaths are listed in the Habitats Directive and are considered to be of global importance, while the southern damselfly is listed under Annex II and the population is considered to be of national importance. The Pebblebed Heaths are also classified an SPA qualifying under Article 4.1 as the area regularly supports 2.4% (1992 figures) of the UK population of breeding nightjar (*Caprimulgus europaeus)*, and 8% (1994 figures) of the UK population of breeding Dartford warbler (*Sylvia undata)*. The SPA covers approximately 1,120ha, matching the SAC boundary (Liley, Panter and Underhill-Day 2016).

Map 1: The Pebblebed Heaths site including the different Commons areas

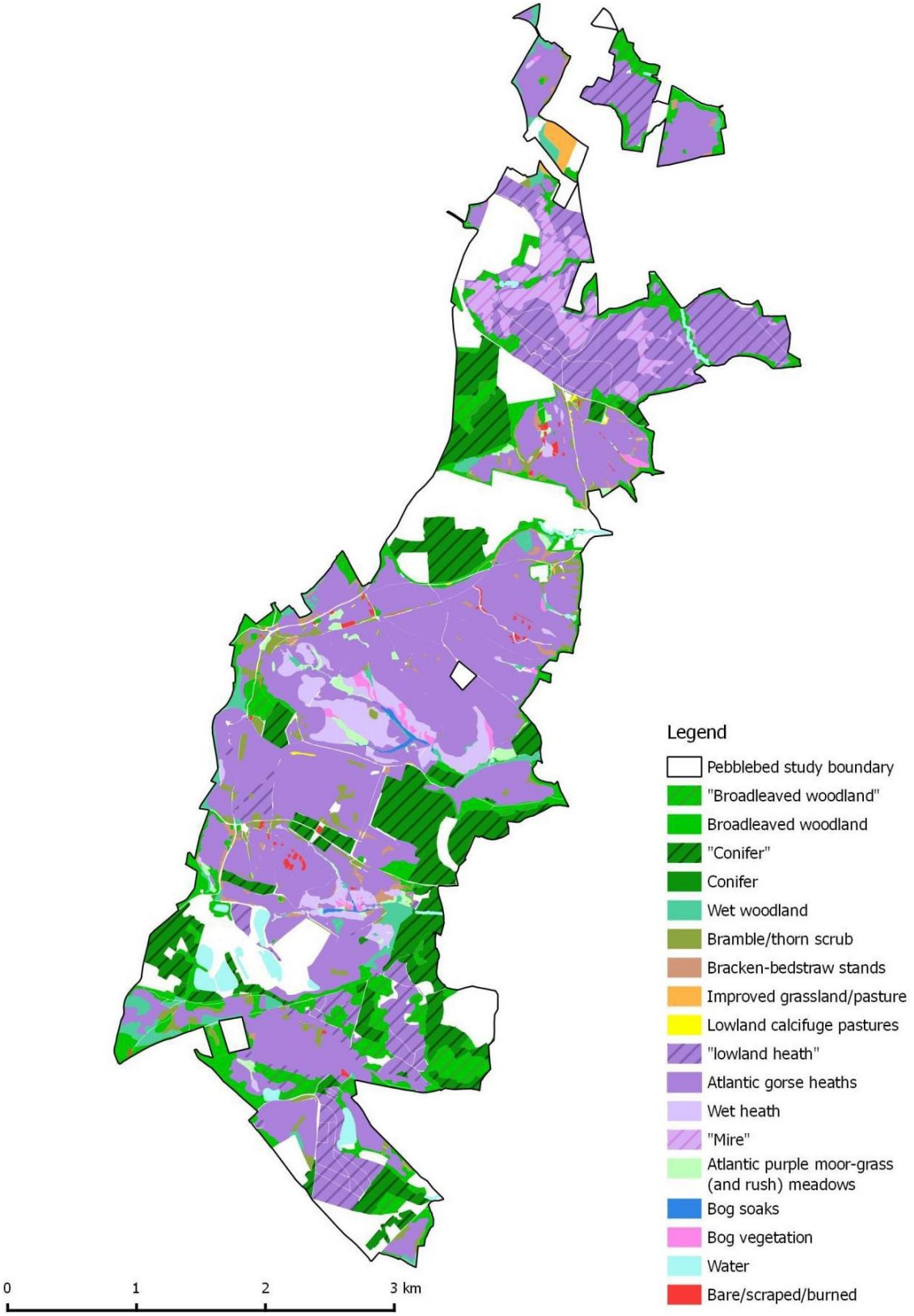


Map 1: Overview of area including European site boundary (inset showing wider area and 10km buffer cut to Exe Estuary)

SPA/SAC

Reproduced from Liley, Panter and Underhill-Day 2016: 13.

In terms of land cover type, although broadly classed as heathland, the Pebblebed Heaths consists of a mosaic of environment types – heath (wet and dry), bog, mire, broadleaf and coniferous woodland, (semi-natural) grassland and water features (including streams, lakes and ponds), and is surrounded by arable land / improved grassland (see map below of habitats and vegetation types). It is located within a few miles of the coast with views of the sea from several places on the Heaths.



Map 2: Habitats and vegetations types.

Reproduced from Liley, Panter and Underhill-Day 2016: 76.

3. Review of the literature

A summary of the literature

This section explores and summarises the relevant literature on the environment-health and wellbeing nexus. The links between the natural environment and health and wellbeing have attracted considerable policy attention in the UK and elsewhere. The new UK Defra 25-year environment plan indicates significant policy attention to the health and wellbeing benefits of connecting with nature (DEFRA 2018). This coincides with concerns by government, public health bodies and policy makers about health inequalities and low levels of physical activity influencing high levels of a range of physical and mental health conditions such as diabetes, high blood pressure, obesity, cancer and depression (Natural England 2016a). At the same time the global population is increasingly disconnected from nature, spending the vast majority of their time indoors with detrimental effects on mental health and wellbeing (United Nations 2015; Frumkin 2017).

As a result, there is increasing policy and research interest in the potential salutogenic or 'health creating' effects of natural environments for tackling a wide variety of health issues, including obesity, mental health, mortality, perceived general health, specific morbidities including cardiovascular disease and musculoskeletal complaints, birthweight, and recovery from surgery. Improving access to natural environments has also been proposed as a tool to help reduce socio-economic health inequalities. The mechanisms (see figure 2) proposed for these relationships include psychological processes of attention restoration and stress reduction, opportunity and motivation for increased physical activity, reduced exposure to air pollution, immunological function associated with exposure to 'healthy' ecosystems and opportunities for social contact (Wheeler et al. 2015: 2).

There is a growing body of evidence that adequate access to and contact with natural environments and green spaces promotes and encourages increased physical activity, and that outdoor activity has a positive effect on the physical and mental health of the population over and above that of exercising indoors (for summaries of the evidence see below and Natural England 2016a; Frumkin 2017). In addition, there is increasing evidence that shows a positive association between a) population level exposure to natural environments and b) individual use of natural environments, with a variety of positive mental health outcomes. These impacts differ according to socio-economic status and other demographic factors such as age or gender. Interventions which make use of natural environments as settings for mental health promotion or therapy tend to show weak but positive outcomes and are found to be cost effective (see Natural England 2016b). Accessing natural environments therefore makes a significant contribution to protecting and improving the mental and physical health of the population and there is therefore a strong policy imperative to protect and promote access (see Mitchell 2013).

However, there are a number of research gaps and areas where the evidence is patchy or thin. In particular, there is a need to clarify causal mechanisms relating to the natural environment and physical and mental health, i.e. whether exposure to natural environments causes better health outcomes or whether people with better health tend to visit nature more often or live in greener areas (Natural England 2016b).

In addition, recent work has emerged that differentiates between the health and wellbeing benefits relating to distinct types of greenspace, rather than bracketing them together as one (see Alcock et al. 2015; Wheeler et al. 2015). The lack of differentiation in many studies may also to some extent explain the mixed nature of the available evidence to date on health and wellbeing benefits from

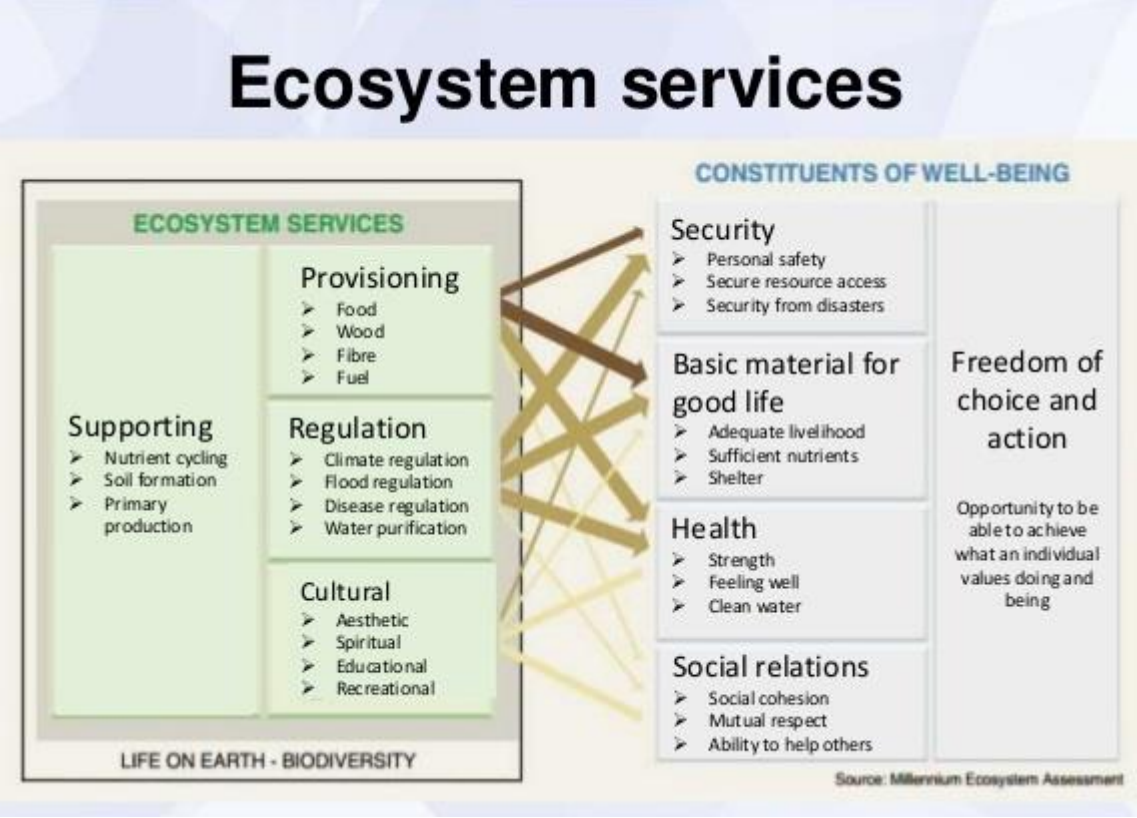
outdoor environments (Wheeler et al. 2015). Some of the analysis includes heathland (*ibid*), therefore this strand of work is particularly relevant to this study.

Mechanisms and models for the links between environment and human health

Ecosystem Services model

The Ecosystem Services model provides an overall framework for health and wellbeing aspects relating to the environment. The following diagram (fig.1) illustrates how services provided by ecosystems contribute to different constituents of health and wellbeing, the latter broadly defined to include health, social relations and freedom of action. According to this model, human contact with nature and outdoor exercise and recreation fit primarily into cultural ecosystem services. However, other components also clearly influence health and wellbeing in this context, such as water purification, and climate, disease and flood regulation, but these are largely outside the scope of this study due to time and data availability considerations.

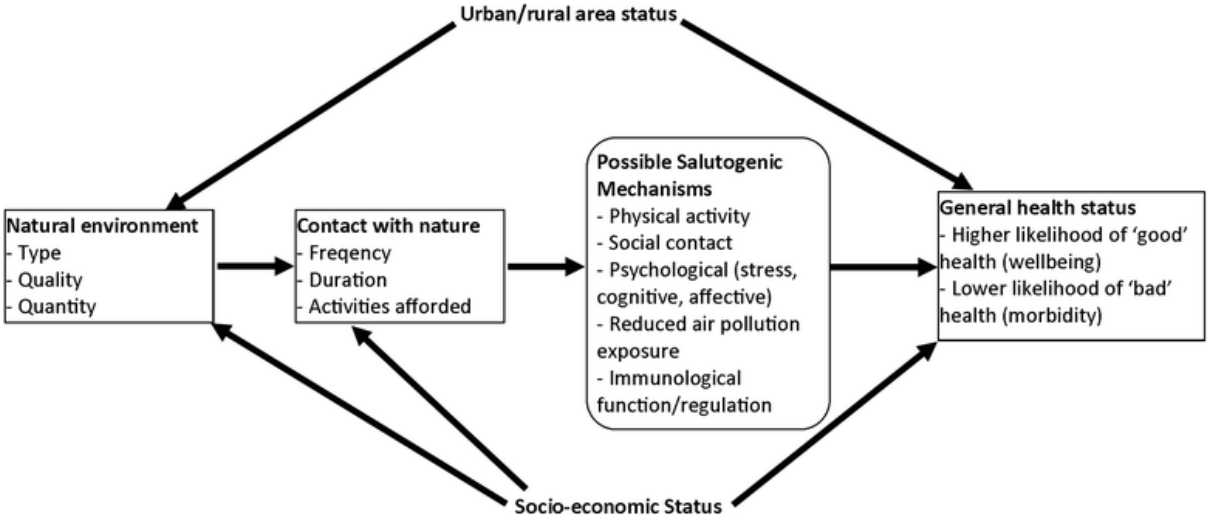
Figure 1: Ecosystem Services Model



Model of pathways between different types of environment and health outcomes

The following diagram (fig. 2) represents a conceptual model outlining hypothesised pathways between different types and quality of natural environments and health. Socio-economic status and urban/rural status are included both as potential confounders and effect modifiers for this model (figure adapted from Hartig et al. (2014)).

Figure 2: Pathways between different types of environment and health outcomes



Source: Wheeler et al. 2015: 5 (figure 1).

The Policy Landscape

Despite some uncertainties in the evidence base, the nature, health and wellbeing nexus is now prominent in policy documents across Europe. In the UK, the 2011 Public Health white paper (Department of Health 2011) highlighted the value for public health of access to greenspace, and the Department of Health (2012) Public Health Outcomes Framework includes an indicator of activity in outdoor environments. The 2011 Natural Environment white paper (DEFRA 2011) linked new Health and Wellbeing Boards and Local Nature Partnerships, and emphasised the value of nature for health (Wheeler et al. 2015). The new Defra 25 year environment plan (DEFRA 2018: 25) includes the following health and wellbeing commitments:

We will:

- Help people improve their health and wellbeing by using green spaces including through mental health services.
- Encourage children to be close to nature, in and out of school, with particular focus on disadvantaged areas.
- 'Green' our towns and cities by creating green infrastructure and planting one million urban trees.
- 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 and improve the environment.

The quality and accessibility of greenspace is also covered in policy guidelines. For instance, the UK National Institute for Health and Clinical Care Excellence (NICE) guidance on environment and physical activity recommends that authorities "Ensure public open spaces and public paths are maintained to a high standard. They should be safe, attractive and welcoming to everyone" (NICE 2008:10). The importance of the quality of natural environments is highlighted by the Accessible Natural Greenspace Standard (Natural England 2010), but these policies largely reflect the evidence in that they refer to greenspace in generic terms (Wheeler et al. 2015). International policy also reflects the increasing consideration of linkages between environmental type and quality and human health and wellbeing. At the European level, strategies such as those relating to green infrastructure (European Commission 2013) and biodiversity (European Commission 2011) make reference to the wider health and wellbeing impacts of related policy and decision making. At a global level, efforts have been made to recognise health and wellbeing within the 1993 Convention on Biological Diversity (Wheeler et al. 2015).

Evidence on the potential for contact with natural environments to protect or enhance human mental health

A significant body of research now provides evidence for the potential for contact with natural environments to protect or enhance human mental health. This includes a systematic review and a number of experimental studies (Thompson Coon et al. 2011; see also Mitchell 2013). Experimental studies have demonstrated positive effects of contact with natural environments on both biological markers and self-reports of stress, mood and reported levels of fatigue (see Bowler et al. 2010; Hartig et al. 2003; Ward Thompson et al., 2012; Mitchell 2013). The evidence suggests that these restorative effects operate at least partially through psychological-neurological-endocrine mechanisms whereby the perception of a natural environment by the brain triggers positive psychological and physiological reactions (see Mitchell 2013). A number of studies have also examined the relationships between natural environments and physical activity and there is some evidence pointing to synergies between the well-established physiological and psychological benefits of physical activity, and the restorative effects of contact with a natural environment (Hug et al. 2009; Pretty et al., 2007; Thompson Coon et al., 2011; Mitchell 2013). The available evidence suggests that physical activity in a natural environment may produce greater mental health benefits than physical activity elsewhere (see Natural England 2016a and below). Experimental studies have also shown restorative effects of natural environments. However, these studies have largely been small scale and short-term (Bowler et al., 2010; Thompson Coon et al., 2011), and have usually been carried out in homogenous, healthy and young participants where contact with natural environment is controlled rather than being part of, prompted by, or perhaps restricted by, everyday life (Mitchell 2013:130).

Evidence on the effects of physical activity on physical and mental health and wellbeing

In England 66 percent of men, 55 percent of women, 21 percent of boys and 16 percent of girls met the Chief Medical Officer's recommended levels of physical activity for good health (based on 2012 figures). Relevant physical activity and health statistics are summarised below, and are based on a robust evidence base (from Natural England 2016a: 1):

- Insufficient physical activity is responsible for 1 in 6 deaths (i.e. the same as smoking) and up to 40 percent of many long term conditions such as Type 2 diabetes. This is estimated to cost the UK £7.4bn per year, including £900m to the NHS alone.

- Physical activity is beneficial throughout the life course and even small changes such as an additional ten minutes of activity can improve health. Health benefits accrue at whatever age a person starts being active.
- Systematic reviews of the evidence have established links between adequate levels of physical activity and good health including reduced rates of type 2 diabetes, colon and breast cancers, hip fractures, and depression.
- Interventions using physical activity can also be effective at preventing, treating or in promoting recovery from a range of conditions including childhood asthma, cerebrovascular disease, depression, and cancers.

Evidence on how use of the natural environment promotes and encourages higher levels of physical activity

Research assessing the actual use of natural environments have tended to show that they promote and facilitate higher levels of physical activity. However, this evidence is drawn from a variety of different study types, some of which tend to have multiple sources of bias. The relevant research is summarised below (adapted from Natural England 2016a: 2-3):

- Research from the UK has shown that **use of natural environments is particularly important in supporting a variety of different forms of physical activity**, from walking, gardening to children's play (Sanders et al. 2015; Wheeler et al. 2010).
- **Distance from greenspaces appears to influence frequency of use for physical activity**. For instance, 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 (Coombes, Jones and Hillsdon 2010). The type of natural environments (White et al. 2014), perceived accessibility, feelings of safety, and the presence of others (social opportunities) (Hillsdon, Jones and Coombes 2011; Carver, Timperio, and Crawford 2008; Ding et al. 2011; McCormack et al. 2010) have also been shown to have positive associations with rates of physical activity.
- The *Monitor of Engagement with the Natural Environment* (MENE) dataset shows that in 2013–2014 around **1.3 billion visits were made to the natural environment motivated by health or exercise reasons**. 1.5 billion visits involved walking with a dog and further 775 million visits involved walking without a dog (Natural England 2014).
- Several studies suggest that **people enjoy physical activities more when undertaken in greener environments** (Thompson Coon et al. 2011; Crust, Henderson and Middleton 2013). A systematic review found evidence that people were more satisfied following physical activities in the outdoors (compared to indoors) and reported a greater intention to repeat the activity at a later date (Thompson Coon et al. 2011). A review of older people's physical activity found that opportunities to spend time in natural environments was one of the factors which encourages participation (Van Cauwenberg 2011). The study by Crust, Henderson and Middleton (2013) also found significantly higher levels of enjoyment by older people walking in countryside environments than in urban green spaces. A desire to be physically active has also been shown to facilitate engagement with the natural environment. In studies of the motivations for the use of urban parks, physical activities such as walking or children's play are commonly cited (Irvine et al. 2013).

Evidence on the additional beneficial effects of physical activity in the outdoors compared with indoor physical activity

There is some evidence that suggests that physical activity in natural environments may be more beneficial than activity in other environments (Thompson Coon et al. 2011; Roe and Aspinall 2011; Mitchell 2013; Natural England 2016a; Hartig et al 2003). However, the current evidence is limited

both in extent and reliability, e.g., experimental studies have often used samples of young adults and have not been representative of the population. The available evidence is summarised below (adapted from Natural England 2016a: 3-4):

- A study carried out in Scotland based on data from the Scottish Health Survey 2008 showed that **physical activity in natural environments is associated with a reduction in the risk of poor mental health** to a greater extent than physical activity in other environments and that those who regularly used woods and forests for physical activity were significantly less likely to experience poor mental health compared with those who did not use such environments (Mitchell 2013).
- A systematic review of the relevant literature and clinical trials found that compared with indoor activities, **physical activity in natural environments is associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger and depression, and with increased energy** of those undertaking the physical activity (Thompson Coon et al. 2011). However, the majority of the 11 clinical trials (833 adults) that were included were carried out on young adults therefore more research is needed on other population groups.
- Experimental evidence from Roe and Aspinall (2011) suggests that **walking in natural environments has restorative effects**. This study compared the restorative benefits of walking in urban and rural settings in two groups of adults with good and poor mental health and found that the walk in a rural setting was advantageous to affective and cognitive restoration in both health groups when compared to an urban walk. The findings also showed that beneficial change took place to a greater extent in the poor health group (Roe and Aspinall 2011).
- An experimental study by Hartig et al. (2003) compared psychological and physiological signs of stress recovery and attention restoration in natural and urban field settings (in 112 randomly selected young adults). The study found that **walking in a nature reserve led to greater stress reduction than walking in the urban surroundings**, measured by blood pressure readings. Attention as measured by a test increased for the walk in the nature reserve, whilst it declined in the urban setting; and this performance gap persisted after the walk. Positive emotions increased and anger decreased in the nature reserve by the end of the walk; whereas the opposite pattern emerged in the urban environment.

Who uses natural environments for physical activity?

Socio-demographic characteristics appear to influence use of natural environments for physical activity, associations differ according to health status, age, ethnicity, and socioeconomic status (see for example Burt et al. 2013). The evidence suggests that certain socio-demographic groups, including those with a long-term illness or disability, aged 65 and over, and of Black or Minority Ethnic origin, are consistently less likely to use the natural environment for physical activity (Ward Thompson and Aspinall 2011). The following is a summary of the relevant evidence (adapted from Natural England 2016a: 3):

- Use of natural environments is particularly important in supporting physical activity in **certain population sub-groups such as those living in urban settings and boys** (Wheeler et al. 2010). A UK study of children's activity showed that about half of their weekend moderate-vigorous activity took place in greenspace (Lachowycz et al. 2012).
- Qualitative research undertaken in the South West of England highlighted that despite awareness of health benefits, not all families are motivated to regularly use natural environments (Ashbullby et al. 2013). **Barriers such as lack of interest, limited time, lack of**

car access, cost of parking, unsuitable paths, and cold weather have been identified in several studies (Hillsdon, Jones and Coombes 2011; Van Cauwenberg et al. 2011).

What are the impacts of activity or time spent in natural environments on mental health?
Most of the relevant studies show that spending time in or being active in natural environments is associated with positive outcomes for attention, anger, fatigue and sadness (Bowler et al. 2010; Thompson Coon et al. 2010). They are also associated with higher levels of positive affect (mood/emotion) and lower levels of negative affect (McMahan and Estes 2015); and lower levels of physiological stress (Haluza, Schonbauer and Cervinka 2014). There is generally positive evidence relating to the impacts of activities in natural environments on children's mental health and their cognitive, emotional and behavioural functioning (adapted from Natural England 2016b: 2). Specific findings include:

- A study found that regular use of natural environments has been shown to be associated with lower risk of poor mental health (Mitchell 2013).
- A study of the behaviour of children with Attention Deficit Hyperactivity Disorder in different environments found better concentration in woodlands in comparison to urban places (van den Berg and van den Berg. 2011).

Research on the health and wellbeing benefits of practical conservation work

Research has also been done on specific types of nature-based activity, such as practical conservation work. For instance, a report by The Conservation Volunteers (TCV) (2016) on their Green Gym programme in England suggests that practical conservation activities, if done regularly, can have a significant beneficial effect on health and wellbeing that can be related to a number of indicators in the Public Health Outcomes Framework (Department of Health (Department of Health 2012)[5]. Such conservation programmes tend to be low cost and inclusive and may attract and retain participation by groups who are classified as 'hard to reach' and / or would otherwise not be as active outdoors, e.g. the un- or under-employed, those from deprived backgrounds, and those with physical and / or mental health issues, etc (TCV 2016)[6]. A systematic review of the benefits of conservation activities such as the TCVs Green Gym showed that exposure to natural environments, achievement, enjoyment and social contact were important pathways to positive mental health outcomes (Lovell et al. 2015; see also Natural England 2016a).

[5] Relevant Public Health Outcomes Framework (PHOF) indicators identified in this report were the following:
- 1.16 Utilisation of outdoor space for physical activity/health
- 1.18 Social isolation
- 2.12 Excess weight in adults
- 2.13i & 2.13ii Active and inactive adults
- 2.14 Smoking prevalence
- 2.17 Recorded diabetes
- 2.23 set – Self-reported wellbeing
- 4.04 set – CVD mortality rate

[6] The objectives of the Green Gym programme are to support improvements in two areas: 1) Health and wellbeing – by increasing or maintaining fitness, reducing isolation and supporting better mental wellbeing; and 2) Employability – by increasing knowledge, skills and confidence. Participants may turn up on their own volition, or can be referred by local health, social care and voluntary sector partners. Projects are managed and led by TCV for up to two years with the aim of making the group self-sufficient by the end of the two years. Green Gym activities are typically 3-4 hrs duration, with between 6 and 20 participants.

Moving beyond generic 'greenspace' and evidence on health and wellbeing relating to heathland

The vast majority of health and wellbeing studies relating to the environment have looked at greenspace in a generic sense and have not adequately distinguished between different types of greenspace. Therefore, greenspaces with different functions, levels of biodiversity and recreational value such as a sports pitch, an empty field where local people walk their dogs, and a nature reserve, have often been bundled together. More recently however, work has emerged that differentiates between distinct types of greenspace (see Alcock et al. 2015; Wheeler et al. 2015).

Types of greenspace have been categorised in different ways in the literature, broadly speaking according to objective criteria based on land cover type / environmental characteristics; and perceived criteria based on *perceptions* of environment type, preference and aesthetics (summarised by Wheeler et al. 2015: 2-4). The study by Wheeler et al. (2015), for example, based on residential proximity found positive associations between good health prevalence and the density of the following greenspace types: 'broadleaf woodland', 'arable and horticulture', 'improved grassland', 'saltwater' and 'coastal', after adjusting for potential confounders including deprivation and urban/rural status. Their research categorised heathland as part of 'mountain, heath and bog' and did not find significant beneficial health effects[7]. As in other greenspace research this study found that associations were strongest in the most deprived areas although there is some variation by land cover type. In the Wheeler et al. (2015) study protected / designated areas[8] also showed a positive association with good health status. Previous research has also highlighted the environment types above (and particularly coasts and woodlands) as having the strongest associations with happiness and psychological restoration (Wheeler et al. 2015; MacKerron and Mourato 2013; White et al. 2013b).

Some studies have focused on residential proximity to different types of greenspace and others on visits. While this is a useful distinction for exploring the literature, there is convincing evidence that residential proximity to specific greenspaces also encourages more frequent visits: data for England (2012/13) indicated that 66% of visits to 'nature' were within 2 miles /3.2 km of home (Natural England 2013), and coastal residents were shown to be 15 times more likely to have visited the coast in the week prior to being interviewed than those living more than 20 km inland (White et al. 2014; Wheeler et al. 2015).

Research from the UK suggests that different types of urban greenspace (e.g. using the basic typology 'sports' / 'natural') may promote or encourage physical activity to different extents (Lachowycz et al. 2012). Research carried out in the Netherlands that looked at self-reported general health, specific symptoms and mental health in relation to nearby greenspace, divided into 'urban green', 'agriculture' and 'forest and nature' areas supported positive health effects of proximity to 'greenspace' overall and found some variation across these three types of 'greenspace' (de Vries et al. 2003). Evidence of the health and wellbeing effects of exposure to 'blue spaces' (coastal and inland water features and environments) is also mounting, and suggests a positive association (see for example White et al. 2013a; Wheeler et al. 2012). Swedish research (Annerstedt et al. 2012) found an association between women's mental health, via physical activity mechanisms, and environment types classified as 'serene' and 'spacious', in a factor analysis of perceived environmental characteristics (Wheeler et al. 2015: 2).

[7] Interestingly this study showed a beneficial association between health and mountain/ heath/bog land cover only in the most deprived quintile.

[8] These included Sites of Special Scientific Interest (SSSI), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Local Nature Reserves, National Nature Reserves and Ramsar designated wetlands designations but not Areas of Outstanding Natural Beauty or National Parks.

Research on visits to natural environments has used self-reported classification of environment type, and indicated different strengths of association with psychological wellbeing outcomes (White et al. 2013b; Wheeler et al. 2015). Some research has also been carried out on preference for particular characteristics of natural spaces. However, the evidence is limited in terms of relationships with specific health outcomes (see for example White et al. 2013b). Some types of landscapes appear to be appreciated to a greater degree than others, with the distinction between 'wild' and more ordered and managed landscape types appearing consistently. Expressed preferences have also been found to vary according to factors such as prior experience, context, culture and demographic characteristics (Wheeler et al. 2015; van den Berg and Koole 2006).

Although effect sizes showing the benefits of environmental quality or type on health and wellbeing have often been found to be relatively small, especially when compared to the influence of socio-economic status, small effects distributed widely across a population have the potential for creating substantial public health impacts (Wheeler et al. 2015: 14). Access to high quality greenspace may even disrupt the usual association between social deprivation and health inequalities and represent a useful tool for tackling health inequalities, particularly in urban areas (Mitchell et al. 2014; Wheeler et al. 2015).

Environmental quality and biodiversity

A number of studies have looked at the quality of greenspaces in relation to health outcomes using characteristics such as recreational value (social amenity), extent / absence of litter, supportiveness for physical activity, perceived naturalness, accessibility, maintenance, safety and water quality (which is indicative of broader landscape quality) (see Wheeler et al. 2015). Several studies (see Wheeler et al. 2015; Gregory et al. 2003; Birdlife International 2013) have also used bird species occurrence as a simple indicator of biodiversity with readily available data.

Research to date on the effects of biodiversity on health outcomes indicates a positive relationship, but the evidence is currently both sparse (a systematic review identified only 17 studies) and mixed – with some inconsistent results according to whether the biodiversity measures were objective or perceived. (In addition, some of these studies focused on very specific aspects such as potential sources of new medicines, food provision and / or infectious diseases.) Further research is therefore much needed in this area (Lovell et al. 2014; Wheeler et al. 2015).

Measures of health among the general population

Census 2011 health data has been used in the literature as a comparative measure at lower super output area [LSOA] level data (see Wheeler et al. 2015). This study reports the levels of physical inactivity as a comparison for the HEAT calculations, table 1. There is evidence that the simple self-reported categories used in the census for health status: Very good; Good; Fair; Bad; Very bad are strongly associated with more complex dimensions of physical and psychological health as well as objective measures such as mortality. Both 'good' and 'bad' health status are of interest because they are not necessarily the simple inverse of each other and these measures have been used in previous studies (Wheeler et al. 2015; Mavaddat et al. 2011; Wheeler et al. 2012). [Mid-level data available for East Devon and Exeter do not differentiate 'fair' from 'good' or 'very good' (residual category) and have categories 'bad / v bad'; 'limited' and 'limited a lot']. However, more research is required to link these measures with East Devon and Exeter population and health figures as this is beyond the scope of this study.

Other health and wellbeing benefits from the natural environment

Health and wellbeing benefits also accrue from living near greenspaces and biodiverse natural environments as indicated by evidence on health inequalities, including increased water quality, reduced air pollution, etc. Due to the lack of available data and time considerations these aspects are not covered in this report.

Barriers and constraints to health and wellbeing benefits from natural environments

This section and the two succeeding ones on interventions and behaviour change draw extensively on DEFRA's What Works report on nature-based health and wellbeing interventions (DEFRA 2017[9]). There are numerous individual-level barriers to the uptake of interventions reported in the literature such as: lack of awareness of opportunities; a lack of motivation; issues with accessibility of the schemes in terms of equipment, facilities or knowledge; and the financial costs of participation (Hobbs and White 2012). Other studies highlight that despite awareness of health benefits, not all families are motivated to regularly use natural environments (Ashbullby et al. 2013). Barriers such as lack of interest, limited time, lack of car access, cost of parking, terrain / unsuitable paths, needing a purpose (e.g. walking the dog), and cold weather have been identified in a number of studies as mentioned above (see Hillsdon, Jones and Coombes 2011; Van Cauwenberg et al. 2011; Natural England 2016a; Mind 2007). Barriers and constraints may differ substantially according to age and family situation. Accessibility is a major issue particularly for socio-economically deprived populations and those with disabilities and / or mobility issues accessing nature-based interventions – both in terms of transport (availability of public transport and cost) and physical infrastructure (paths etc).

Droomers et al. (2014) argue that area based health interventions typically demonstrate little effect because they are often 'unfocused, unsubstantial, and short-term'. In the UK this is currently exacerbated by funding cuts and shortages and a resulting tendency towards the fragmentation of and short-term nature of provision. In addition, the need to provide appropriate intervention options for specific groups can further fragment provision and risk missing sub-groups in need (Hanson, Guell, and Jones 2016). Therefore, there is a need to find a balance between targeting of a programme and achieving a greater reach (Droomers et al. 2014).

Effectiveness of interventions can be improved by clearer identification of the targets of programmes. For instance, Sports England (2015) have used a segmentation approach to define key populations of interest and to improve understanding of the different groups' needs, desires, motivations and constraints. The use of Health Impact Assessments (HIAs) when planning interventions has also been shown to be effective in identifying the likely range of potential health, wellbeing and quality of life impacts of an intervention (Landscape Institute 2013), allowing effective targeting and refining of interventions (Chadderton et al. 2012). For instance, the HIA approach has been used in multi-agency interventions such as the Stepping Stones to Nature programme in Plymouth (Richardson et al. 2013).

There are also numerous funding barriers to intervention, including cuts and fragmentation of funding. Despite significant work on social and green prescribing (see Polley et al. 2017; Health Education England 2016), which enables people to be referred to nature-based interventions via both physical and mental health routes (as either treatment or prevention), the funding mechanisms for this seem to be poorly developed in many areas (with a few notable exceptions).

[9] This is a draft report – the final version was not yet publicly available at the time of writing.

Evidence on components of successful nature-based health and wellbeing interventions

The evidence from a range of nature-based health interventions (see The Mersey Forest 2016; Hansen, Guell and Jones 2016; Shephard & Moyes LTD and Trilein. 2016) suggests that successful interventions are those that:

- Are **flexible in approach** rather than adopting a one-size-fits-all approach;
- Acknowledge **multiple drivers of participant involvement** including social aspects and health outcomes; and
- Involve **community engagement and local needs analysis**.

Public health interventions are complex, and may be subject to multiple feedback loops and unintended consequences (Craig et al. 2008). Effectiveness of interventions can be improved by clarity of articulation of what the provider is trying to achieve and how, through a 'Theory of Change' (ToC) model, specifying the framework for intervention development and proposed evaluation, completed in consultation with stakeholders (Breuer et al. 2016).

Developing effective public health interventions is best understood as an iterative process, with new interventions ideally being built on lessons learned from previous efforts. Whilst health promotion can be highly context dependant there has been considerable work on identifying transferable components of interventions and best practice. For instance, Ng and de Colombani (2015) completed a systematic review of public health intervention strategies that can be used to inform a framework of best practice. These highlighted the following main important components (Ng and de Colombani 2015: 163):

- Ensuring relevance to the needs of the community and the setting;
- Carrying out community participation and stakeholder engagement;
- Ensuring interventions are ethically sound;
- Replicability in other settings;
- Effectiveness (able to achieve desirable outcomes and improve public health);
- Efficiency (including minimisation of resource use and wastage); and
- Sustainability (including identifying ongoing funding sources).

Behaviour change

Many natural environment-based health interventions are effectively behaviour change interventions. The behaviour change literature is well developed and there is a large body of evidence which identifies effective practice. For instance, a review of behaviour change techniques, including those used in nature-based health promotion, undertaken by Forest Research (Morris et al. 2012) concluded that the most effective approaches are interventions which:

- Target the social environment, rather than just the individual;
- Involve direct contact between those delivering the intervention and the participant;
- Take a multi-faceted approach (mixing different types of interventions);
- Make use of specific behaviour change techniques including goal setting, self-monitoring, feedback, and motivational interviewing; and
- Avoid relying on passive provision of information which has been found to be ineffective.

Useful guidance on effective and accessible behavioural change techniques also includes the Behaviour Change Wheel, developed by Michie, van Straalen and West (2011), a synthesis of 19 behavioural change frameworks. This model highlights the importance of context and describes the three key conditions for change: capability, opportunity, and motivation. The model also illustrates nine intervention types or 'functions' (Education, Persuasion, Incentivisation, Coercion, Training, Restriction, Environmental restructuring, Modelling, Enablement) and seven key policy and delivery instruments (Communication / Marketing, Guidelines, Fiscal (tax) measures, Regulation, Legislation, Environmental / social planning and Service provision).

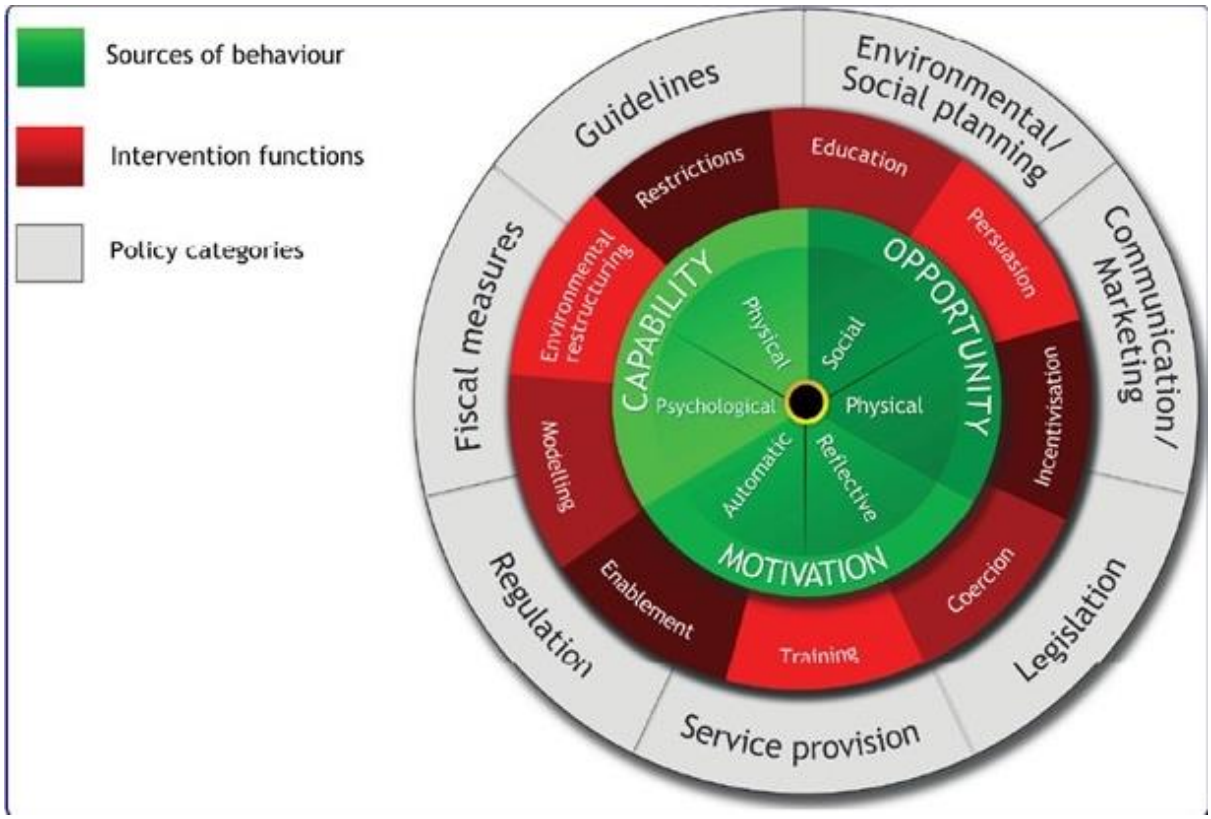


Figure 3: The Behaviour Change Wheel by Michie, van Straalen and West (2011:1).

Economic valuation: principles, tools and models

Economic valuation has become increasingly important in the environmental field, reflecting policy interests in ecosystem services and natural capital approaches. Economic valuation approaches also overlap to a certain extent with economic appraisal (see Valuing Nature 2016; HM Treasury 2013).

The Natural Capital Approach and Economic Valuation

The UK's natural environment has been managed for more than a century primarily using the nature conservation approach, centred around the protection of specific wildlife species, natural habitats and ecosystems from the most damaging effects of human activity. While this approach has led to some successes, it has not been effective in reversing the long-term trend of ecosystem decline and habitat and species loss. Over the past decade, the natural capital approach has gained ground, aimed at presenting an economic rationale for investing in the maintenance and improvement of natural environmental systems, and assigning a value to natural assets and the ecosystem services and benefits they supply to society, as reflected in the UK Natural Environment White Paper 2012 (House of Commons 2012). The nature conservation and natural capital approaches have often been

understood to be in opposition to each another. In addition, natural capital and economic valuation approaches have attracted criticism relating to both the ethics and efficacy of putting a value on nature. Concerns have also been expressed that viewing solutions solely through a business lens may lead to a retreat of state involvement and the neglect of environmental issues and attributes for which there is no clear business case. In turn, natural capital advocates have sometimes been dismissive of nature conservation approaches. However, there is evidence to suggest that these two types of approaches may be complementary and that neither may enough on its own. Therefore, a strategic combination of both, including an increased role for the state where there is no clear business case or market value, may be a more effective route to managing environmental challenges (Brown, Andrews Tipper and Wheeler 2016). In some cases, economic valuation evidence may be useful in capturing some of the value currently ignored by markets, such as the costs of environmental pollution (Valuing Nature 2016).

Economic valuation approaches are of particular interest as applied to the health and wellbeing-environment nexus since in public health (both physical and mental health) economic impact approaches are relatively well developed (such as the Health Economic Assessment Tool (HEAT) and the MOVES tool which measures economic value in terms of Quality Adjusted Life Years), and in which value for money is of vital concern.

The total economic value refers to the sum of both use values and non-use values. Use values in this case consist of the value of environmental goods or services (e.g. crops, soil quality, clean water and air) that we directly use or have the option to use (the option value). Non-use values represent the benefits that we do not directly experience but that may benefit others (altruistic value), future generations (bequest value) or for the sake of nature in itself (existence value) (Valuing Nature 2016).

Not all environmental goods and services have market value, therefore some use and non-use values are likely to be difficult to quantify. Therefore, a walk in a natural biodiverse environment may be quantifiable in terms of the health impact of the associated recreational outdoor exercise and even to some extent its restorative impact on mental health, but the aesthetic, social and cultural value (e.g. feelings of pleasure, experiencing beauty and wonder) may be hard to put a value on.

Use values can be calculated using a range of principles and methods based on willingness to pay, for example market prices (where there is a clear market value), revealed preferences (including assessing what people are willing to pay to travel to a recreational site, i.e. the travel cost; or what people are willing to pay to live in a specific area e.g. next to greenspace – termed hedonic property pricing). Other methods can be used to determine both use and non-use values, including stated preferences (where respondents are questioned about their preferences and choice options; using for example contingent valuation or choice modelling). Economic valuations can be carried out using existing evidence, adjusting for the context and aims of interest – termed value or benefit transfer. Economic values relating to the environment by necessity vary according to context – by condition and location, according to the level of scarcity and substitutability, the direction, scale and timing of change (negative changes may be valued more highly than equivalent positive changes), as well as differences at an individual level (Valuing Nature 2016).

A range of valuation tools are available, with the various tools differing in their applicability and suitability for different contexts (see Natural England 2013b). Specific information about the relevant valuation tools used and their limitations – the Travel Cost Method, the Outdoor Recreational Valuation Tool (ORVal) and the Health Economic Assessment Tool – is provided in the section on economic valuation below.

4. Economic Valuation for the Pebblebed Heaths

Notes on sources, assumptions and available data

This study uses visitor data collected by Footprint Ecology in 2014 and 2015 (Liley, Panter and Underhill Day 2016) supplemented by data from Ecology Solutions (2012) (and background secondary data from Census 2011 data). The Footprint Ecology study assessed the impacts of recreational use on the Pebblebed Heaths in the context of planned development of settlements in the area, and included recommendations for suitable visitor management and mitigation measures. For the purposes of this project, this data also provides useful information for exploring the pathway in the opposite direction, i.e., the benefits of the heaths for visitors' health and wellbeing. The visitor data provides a variety of data on numbers of visitors, type of activity undertaken at the site, length of visit, frequency of visits, and the most frequented paths (see Annexes 4 & 5). The data also includes information on access points – important for general accessibility of the site and transport links. This type of data is often missing from studies drawing on statistical data (Wheeler et al. 2015).

Some of the health and physical activity data drew on East Devon Council Health and Wellbeing[10] data (based on Census 2011 data). Urban/rural status for this study is determined using the standard government classification of urban areas as 'physical settlements' with a population of 10,000 or more (ONS 2011).

Unfortunately, no demographic data was collected as part of the Footprint Ecology survey apart from the gender of the respondent and of individuals in the groups counted. Nor was any data collected specifically related to health conditions or outcomes. Some basic demographic data e.g. on gender, age, and residence in a house or flat was collected for the Pebblebed Heaths by Ecology Solutions (2012) (see Annex 4) and this has been drawn on where applicable. Because of the gaps in socio-demographic and health data, background Census 2011 data was used to supplement the visitor data. It had been envisaged that Natural England's Monitor of Engagement with the Natural Environment (MENE) data would be used to aid valuation estimates, however, there were only 15 data points relating to the Heaths, and all of these pertained to visitors from outside of the area, so were not representative of the majority of visitors to the site.

The HEAT tool assumes that any walking assessed is of at least moderate pace, i.e. about 4.8 km/hour (3 miles/hour), which is the minimum walking pace necessary to require a level of energy expenditure considered beneficial for health; for cycling, this level is usually achieved even at low speeds.

Adjustments for Footprint Ecology visitor data:

492 people surveyed in total; **1272** modelled total daily visits; equating to 464280 annual visits. Adjustment for the 91% arriving by car gives: **422,495** annual visits.

Initial valuation results and data analysis

Calculating the travel cost

The travel cost method is a frequently used method for economic valuation of leisure and recreational activities, and represents a use value (revealed preference) – i.e. it represents how much people spend on travelling to a certain location (in this case the Pebblebed Heaths) for

[10] http://www.devonhealthandwellbeing.org.uk/jsna/profiles/msoa/

recreation (see Valuing Nature Programme 2016). What people pay to travel is at least how much they value the recreational benefit, otherwise they would not make the trip. In this calculation the estimated cost attributed to the value of their travel time (£3.47 for a trip of 5-20 miles) is also included based on Department for Transport (2015) figures, in order to bring it in line with the methodology used for ORVal (see Day and Smith 2017). This is valued differently to the equivalent working time or pay, and equates to just over half the current hourly minimum wage (£7.50).

Calculation for average (median) travel cost by car based on Footprint Ecology figures

See Annex 2b for the full calculation and Annexes 3 & 4 for the data used for calculations.

Footprint Ecology figures of 1,272 visits per day[11] give an estimate of 464,280 visits per year, 91% of which are estimated to be by car[12] = 422,494.8.

Median distance of 5.4km (one way – home postcode to survey point); round trip 10.8km.

Estimated total travel (petrol) cost by car (Footprint Ecology figures) = £412,946 per year

Estimated travel (petrol) cost by car per visit (Footprint Ecology figures) = £0.98

Estimated total non-work travel time value = £1,466,057

Total estimated travel cost value (Footprint Ecology figures) (1466057 + 412946) **= £1,879,003**

Estimated total travel cost value per visit (Footprint Ecology figures): £4.45

Limitations of this method:

This is a simple travel cost estimate as only the median travel distance was used to calculate these figures. A more sophisticated model could use the zonal travel cost approach[13].

Outdoor Recreational Valuation (ORVal)

ORVal is a mapping tool (both descriptive and predictive) based on an underlying econometric model (see Day and Smith 2017 for a fuller description of the methodology). Based primarily on Natural England's extensive Monitor of the Natural Environment (MENE) dataset it puts an outdoor recreational value onto different local areas across the UK, based on a modified travel cost valuation, and the different choices of sites available. It can be used to predict the increase or decrease in recreational value attributed to changes in use or infrastructure, e.g. housing developments. Some figures for the Pebblebed Heaths are available via this model, and these are included below for comparison with the other methods used here.

'Welfare' (economic use) value:

[11] The modelling predicts a total of 1,272 visitors daily over the 99 access points based on existing data.
[12] This is similar to the figure obtained by Ecology Solutions Ltd. in their 2012 survey report on travel to the site with 93.4% arriving by car.
[13] See, for example http://www.ecosystemvaluation.org/travel_costs.htm

These figures are based on 9p per km estimate of average family car (using the AA figures as above) and include values for non-work travel time costs based on Department for Transport (2015) figures[14] (Day and Smith 2017).

Hawkerland = £300,413; estimated visits 68,916 = £4.36 per visit

Woodbury Common, Colaton Raleigh Commons and Bicton Common = £901,063; estimated visits 203,307 = £4.43 per visit.

East Budleigh Common = £303,025; estimated visits 68,879 = £4.40 per visit

Calculation of total: £1,504,501 for estimated 341,102 visits

Average value per visit = £4.41

However, this tool is currently reported to be being amended with these estimates being revised upwards slightly in the new version[15] to:

£1,722,636 (£1.7m) for an estimated 571,919 visits

This equates to £3.01 per visit**.**

Limitations of the ORVal data for the data analysis in this case:

The figures obtained using ORVal for the overall value are similar to the travel cost valuation but are slightly lower than for travel cost (£1,722,636 as opposed to £1,879,003 (see below). The valuations within ORVal only rely primarily on transport costs and travel time estimates (with socio-economic and substitution adjustments) – there is no other valuation of the social, health or wellbeing value of the Pebblebed Heaths. In addition, the model is incomplete for this site - no values were available at the time of compiling this report in the ORVal model for two areas of the Pebblebed Heaths: Aylesbeare Common and Harpford Common; these are not marked on the model as visited sites and the protected designations are missing. This may explain the slightly lower value given by the ORVal tool for the overall 'welfare' value.

The Health Economic Assessment Tool

The Health Economic Assessment Tool for Walking and Cycling (WHO HEAT 4.0)[16] was developed by the World Health Organization to provide estimates on the value of health effects from walking and cycling with a view to informing transport planning. The HEAT aims to answer the following question:

If x people walk for y minutes on most days, what is the economic value of the health benefits that occur as a result of the reduction in mortality due to their physical activity?

It is based on published data from epidemiological studies comparing the mortality rates of walkers and non-walkers, and applies this to the volume of walking in the study area. This is used to estimate the reduction in the number of deaths that might occur as a result of regular walking. These deaths are then valued using the standard economic approach within transport appraisal of the value of a statistical life, based on willingness to pay. Further details on the methodology and examples of its

[14] The values used in the ORVal calculations were £2.30 per hour for trips under 8km, £3.47 per hour for trips between 8km and 32km, £6.14 per hour for trips between 32km and 160km and £9.25 per hour for trips greater than 160km (based on Table 7.18 of DfT 2015 report).
[15] Revised figures from Prof Brett Day, LEEP, University of Exeter at VN placement workshop, 28/2/2018.
[16] http://www.heatwalkingcycling.org/#start_tool

application are available (see Kahlmeier et al. 2011; Cavill Rutter and Gower 2014; White et al. 2016; the PASTA project[17]).

HEAT results

The results of the HEAT assessment are provided in table 1 below. Further details are provided in Annex 2.

Estimated number of regular visitors per year (1271 per day; 3 x 30mins per week): **3097** (after adjustments):

HEAT economic impact for 3097 participants: £2,349,000

Adjusted to 19% for substitution:
HEAT annual economic impact: **£446,310**

Table 1: HEAT assessment results.

Activity	Economic impact (£) (over 5 yrs)	Annual economic impact (£)	Annual per person economic impact (£)	No. of people estimate included
Walking results (including dog walking; average 3 times a week)	11,745,000	2,349,000	758	3097
Adjusted walking / dog walking estimate (accounting for 19% substitution figure)	2,231,550	**£446,310**	144	3097
Conservation activities#	347,600	69,520	497	145
Royal Marines[18]	2948000	589600	786	750
Mid-level population average activity levels (Census 2001 data)*	52360000	10472000	255	41080

Assumes conservation activities equivalent to brisk walking in intensity.
*Based on 30 mins per week (average of 4.3mins per day).

Overall the economic impact for regular walking and dog walking for the predicted Footprint Ecology visitor numbers surveyed is £11,745,000 over 5 years and £2,329,000, equating to £758 per person per year, based on an estimate of 3097 people walking on average 30 mins three times a week.

Adjusted estimate for substitution:

[17] http://www.pastaproject.eu/heat-tool/

[18] For the Royal Marines the economic impact is estimated at £589,600 per year (approx. 750 people), based on an average of 1.05 hrs per day completed on the heaths (30% of their training time spent on the Heaths; 750 per year; 32 weeks of the year). However, because of the likely large amount of time spent exercising by this group of people the HEAT tool may not be suitable for assessing this group.

However, this activity may not all be attributable to the Heaths as people may have otherwise walked elsewhere therefore an adjustment needs to be made for substitution. Here we have used a figure of 19% based on a similar HEAT assessment on the Wales Coast Path (Cavill Rutter and Gower 2014). Therefore, with the adjustment to 19% to account for the proportion of people who would not have walked elsewhere if not on the Heaths:

Adjusted estimated annual economic impact of the health & wellbeing benefits directly attributable to visits to the Pebblebed Heaths:

£2,231,550 over 5 years; equating to

£446,310 annually

Adjustments and limitations of HEAT for this case:

The limitations of HEAT include its use of a simple approach to assessing the mortality benefits of regular walking. It uses relative risk figures and applies these to a standard-aged population, excluding differences in impact by age, and other health benefits of walking such as improved mental health or reduced incidence of disease, such as obesity or diabetes. Although HEAT has been used in a number of situations and settings, there are still relatively few examples of its application in recreational settings, but those that have been completed so far appear to support its use in leisure settings with the caveats mentioned (see Cavill, Rutter and Gower 2014; White et al. 2016; and the PASTA project). Discounting of 3.5% per year (HMT 2013) has been applied within HEAT for future years since the value of benefits in the future is less than those at the current time.

The HEAT applies only to adults age 20 – 70 so data on visitors outside of this age range had to be excluded from the analysis. HEAT is also only suitable for determining the economic value of regular exercise – it cannot be used to determine the value of more infrequent exercise or one-off activities and events, which excluded a large proportion of the activities on the Pebblebed Heaths. It is also not suitable for assessing the value of exercise over 1.5 hrs per day, therefore it is questionable whether it can be used for the data on the Royal Marines (although the average time spent on the heaths is approximately 1 hr per day when averaged over the year).

Adjustment for intensity of exercise:

The HEAT assumes a walking speed of 3 miles per hr (4.8km per hr), corresponding to brisk walking that succeeds in raising the person's heart rate (moderate activity level). There are as yet no accurate estimates of how much of people's normal walking and dog walking activity correspond to this level at this site or more generally. Here we assume that not all of this activity is achieving the threshold for moderate physical activity (brisk walking). In line with White et al. (2016) and congruent with the average estimate from the Footprint Ecology visitor data (2.9 visits per week) this is adjusted to three visits of 30 mins per week.

MOVES tool

The MOVES 2.0[19] tool is a downloadable epidemiological excel tool developed by Sport England and the University of East Anglia's Medical School Health Economics Consulting Group. It is designed to show the return on investment for health of sport and physical activity, based on the evidence that

[19] Available on: https://www.sportengland.org/our-work/health-and-inactivity/what-is-moves/moves-tool/

increased physical activity reduces the risk of a number of diseases, including cardiovascular disease and diabetes. It is based on UK epidemiological data relating to population, age and gender, and the related disease rates for conditions that could be improved through sport and physical activity.

Notes on basis of calculations (Footprint Ecology figures):

1272 daily visits

1272 x 365 = **464280 annual visits**

Average no. of regular visitors (3 times per week): 464280/149.9 = **3097**

Divided into 4 age groups for Moves tool: 3097/4 = 774 per group

Values of exercise carried out inputted were as for HEAT final estimates - 3 x 30mins per week (mixed gender – 50% male).

Starting point: Some activity - defined as: reported 60-149 minutes per week of moderate physical activity, 30-74 minutes per week of vigorous physical activity or an equivalent combination of these. The estimates would have been higher if we had assumed a lower level of exercise as the starting point.

A Quality-adjusted Life Year (QALY)[20] is a measure of the state of health of a person or group in which the benefits, in terms of length of life, are adjusted to reflect the quality of life. One QALY is equal to 1 year of life in perfect health. QALYs are calculated by estimating the years of life remaining for a patient following a particular treatment or intervention and weighting each year with a quality-of-life score (on a 0 to 1 scale). It is often measured in terms of the person's ability to carry out the activities of daily life, and freedom from pain and mental disturbance.

Table 1: MOVES tool calculations[21]:

Walking speed / intensity	Slow	Brisk	Cross country / hill
Total value of QALYs gained (5 yrs)	£1,634,468	£2,783,829	£3,412,771
Annual value of QALYs gained	**£326,894**	**£556,766**	**£682,554**
No. of QALYs gained	81.6	139.2	170.5
Programme cost over 5 yrs (cumulative)	787695	£787,985	£788,287
Annual cost	£157,539	£157,598	£157,657

Notes: These figures account for 3097 regular dog walkers / walkers and covers the age range 16-61+ (the HEAT tool covers ages 20-74) and gives a similar figure to HEAT.

[20] See entry for QALY on https://www.nice.org.uk/glossary?letter=q

[21] Based on Footprint Ecology figures. Assumes participants split equally across all four age groups; outcomes calculated over a 5 year timeline (25 year time horizon for health outcomes); 3097 total participants; equates to 774 per age group (80% drop off → 619 after 5 years); age range 16-61+; 50% male (roughly Ecology Solutions figures); walking intensity (METs/hr) – slow (2.5); brisk (4.65); cross country / hills (6); frequency of 0.5hrs; 3 times a week.

Total annual value of QALYs gained:

Brisk intensity: £556,766

(this figure is used so that it is comparable with the HEAT results)

Range £326,894 – 682,554

Average of 3 values: £522,071

These figures are likely to be an underestimate as the figures below (table 2) show relatively large numbers of less frequent visitors taking part in external events annually (3339 participants). In addition there are many more informal events happening on the Heaths for which the number of participants is harder to quantify.

The MOVES detailed results (see annex 2a) show that the economic impact (and return on investment) is much greater for older people. Even at a slow walking pace there is still significant economic value as illustrated in the table above.

Return on investment

According to figures from the PHCT the annual costs for running the site (maintenance and staff costs) are around £350,000, including costs for the RSPB and Devon Wildlife Trust (this does not include infrastructure or capital costs, e.g. for path work, car parks, fencing, etc.).

The annual programme costs as calculated by the MOVES tool for a conventional (indoor) exercise programme are approximately £157,600 for the average figure of 3097 regular visitors (those visiting roughly 3 times a week). This does not include the costs for less frequent visitors therefore is not directly comparable.

The return on investment using the PHCT and health economic impact figures only is as follows:

HEAT estimate: (446310-350000)/350000 = 0.28 times the cost = **28%**

MOVES estimate: (556766-350000)/350000 = 0.59 times the cost = **59%**

The return on investment based on the overall economic impact measured by travel cost and ORVal is as follows:

Travel cost: (1879003-350000)/350000 = 4.37 times the cost or **437%**

ORVal: (1722636-350000)/350000 = 3.92 = **392%**

Activities and events on the Pebblebed Heaths

Data was collected from the various organisations about the various events taking place on the Heaths, and the number of participants, summarised as follows:

Table 2: Activities and events on the Pebblebed Heaths (2017)

No. of events	**814**
No. of participants	**3339**
No. of participant hours per year	**17931.5**

A total of 814 events and activities involving around 3339 people were organised on the Pebblebed Heaths in 2017. This includes only those events organised by any of the main participating organisations (PHCT, RSPB, DWT and EDDC) and those run by external organisations that gained permission from PHCT / CDE for the events, not the many informal events and trips which are harder to quantify.

Types of events included guided walks, practical conservation work, ecological surveys, livestock checks, horse riding, cycling, orienteering, educational activities and other events (family events and the Commando Challenge, a run / outdoor challenge). Livestock checks and ecological surveys, although they are numerous and together account for the majority in terms of numbers of events / of activities, are seasonal carried out by staff members and / or a small number of trained volunteers. Other events - includes family events (such as the Heath Sunday event) and the Commando Challenge) accounted for the vast majority of participants, followed by guided walks; then educational activities (PHCT is the only organisation doing these on the Heaths).

Table 3: Type of event / activity by number of events and no. of participants (all organisations)

Event / activity	No. of events / activities	No. of participants
Guided walks	23	435
Practical conservation work	109	145
Ecological survey	272	63
Livestock checks	380	16
Horse riding	4	80
Cycling	5	235
Orienteering	2	75
Educational activity (schools / FE colleges)	7	394
Other events (family etc)	12	1896
Total	**814**	**3339**

All organisations run a range of activities as presented in table 3. PHCT is the only organisation running educational visits and activities, i.e., primary, secondary school and Further Education / Sixth form college groups, and this accounts for a relatively large number of participants (394 in 2017).

These figures represent underestimates for a number of reasons, including events that would normally operate being cancelled in 2017 (e.g. the Bicton Duathlon), events happening on the Heaths that did not request or require permission from PHCT / CDE (numerous, but will tend to be mainly smaller events); and in some cases gaps in the availability of accurate and up-to-date figures e.g. on funds raised (see Annex 1 for further details).

Valuation of all events (travel cost method)
Total no. of participants: 3339
Total no. of events: 814
Travel cost calculation based on £4.45 per visit (see above)
Assumed rough average of 2 participants travelling together per car.
(Royal Marines training activities not included)
Calculation: (3339/2)*4.45 = 7429

Total annual valuation for all events for 2017: £7429

This is likely to be an underestimate - as we don't have the data to calculate the average no. of events that participants attended this is assuming each participant went to one event during the year only.

Total external money raised

Total no. of participants: 2,330

Total money raised donated to external organisations: £80,750

Donations went to the Devon Air Ambulance, Royal Marines Charity, Hospice Care and ME Research Devon.

(Money raised that went to participating organisations RSPB, DWT, PHCT was not included.)

Qualitative health and wellbeing benefits

Clearly there are a range of less quantifiable benefits of accessing and living near to a biodiverse natural environment such as the Pebblebed Heaths (as people who live nearby are more likely to visit). Qualitative research has found that first hand experiences of wildlife are meaningful and important, contribute to quality of life, and result in feelings of well-being that include spiritual aspects and / or those that cannot be expressed through words (Curtin 2009; see also Natural England 2016b). A number of studies have looked at the participant experience using a range of qualitative methodologies (see e.g. Bell et al. 2015). Others have explored participatory and deliberative methods for evaluating qualitative and non-monetary ecosystem services, including those relating to health and wellbeing (Fish et al. 2011a; 2011b).

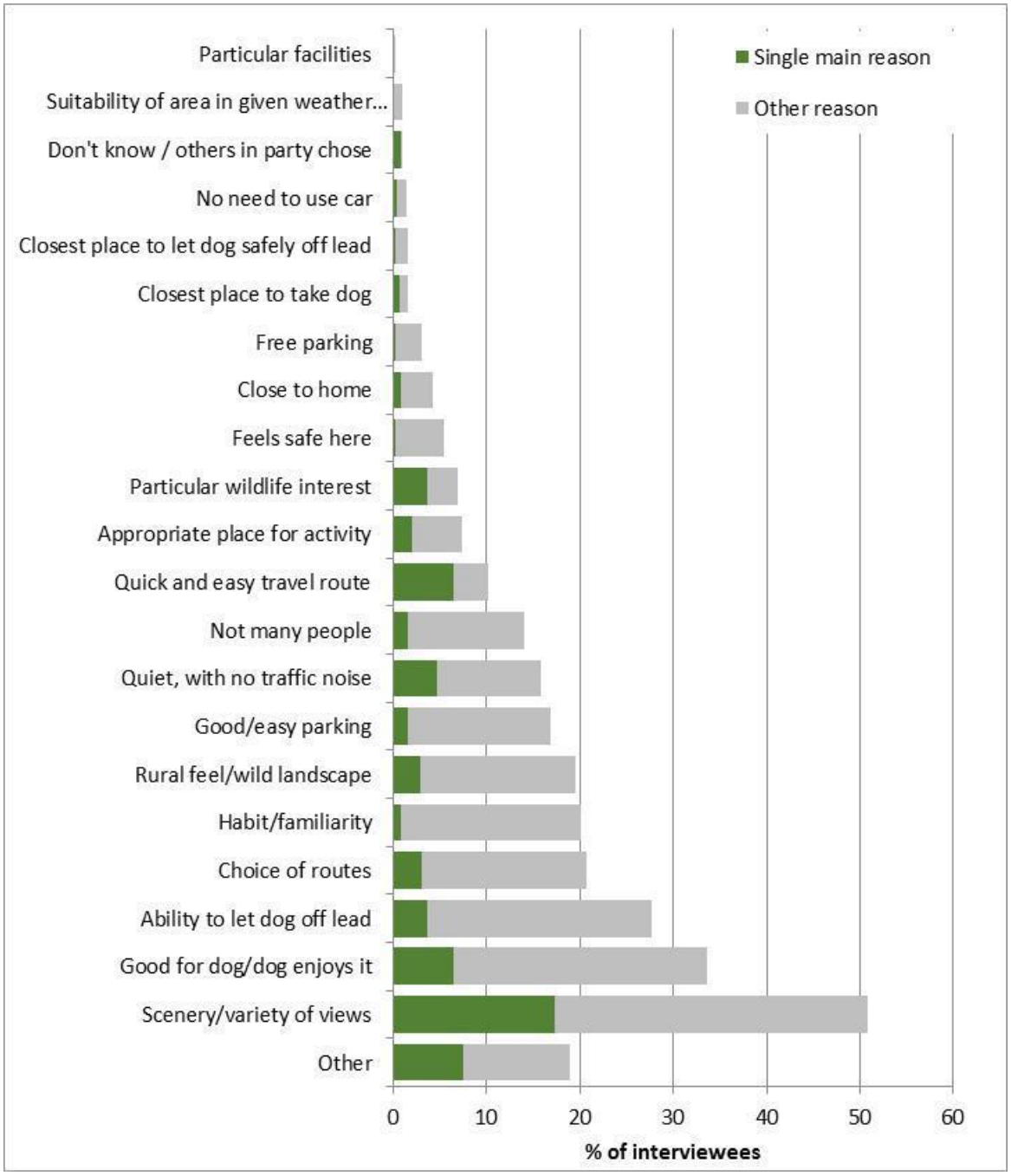
A study by Rawluk et al. (2017) using interviews synthesises a number of approaches and examines a range of qualitative values that people associate with their immediate environment[22]. These values range from the abstract to the concrete, and are formed through relationship to place and each other (e.g. place attachment; relational and felt values).

The visitor data from the Pebblebeds collected by Footprint Ecology (summarised below) gives a flavour of reasons and motivations for visiting the site as follows but lacks data about the qualitative experience:

Interviewees were asked for a single main reason but could give a range of 'other' reasons. The 'scenery/variety of views' was the most frequently cited main reason and was cited as a main or other reason by 51% of interviewees. Dog related reasons – 'good for dog/dog enjoys it' and the 'ability to let dog off lead' – were the next most frequently cited reasons. 'Quick and easy travel route' was notable in that, taking all responses together, it was ranked relatively low compared to other reasons (cited by 10% of interviewees). However, it was the second most frequently cited main reason.

Figure 4: Reasons for choosing to visit the site where interviewed rather than an alternative location

[22] In this case relating to a disaster scenario – bushfires in Australia – but many are applicable to other settings.



Source: Liley, Panter and Underhill-Day 2016: 42.

MENE data for 2015-16 (Natural England 2017:10) indicates that health and exercise continues to be one of the most frequently cited motivations for visiting the outdoors across the UK, and is increasing in importance. The proportion of visits where this was cited as a motivation rose from around a third of visits in year one (34 per cent) to just under half in year seven (47 per cent). In terms of other visit motivations, just under half of visits in this year were taken to exercise a dog (47 per cent), while around three in ten were taken to relax/ unwind and/or to enjoy fresh air or pleasant weather (30 per cent).

MENE data for 2015-16 (Natural England 2017:11) also provides data relating to a number of statements about the qualitative experience of visits to the outdoors and assesses the proportion of people agreeing or agreeing strongly with these statements as follows:

Table 4: Qualitative experiences of visits to the outdoors from MENE 2015-16 data

Statement	Agree strongly (%)	Agree (%)
...I enjoyed it	48	49
...It made me feel calm and relaxed	31	57
...It made me feel refreshed and revitalised	31	55
...I took time to appreciate my surroundings	27	55
...I learned something new about the natural world	9	22
...I felt close to nature	24	51

Source: Natural England 2017:11.

There is considerable scope for collection of qualitative data about the health and wellbeing benefits of the Pebblebed Heaths as well as further synthesis of research in this area[23].

Insights on balancing environmental protection and access from the visitor data

The visitor data shows that there is currently relatively little awareness of the conservation importance of the Pebblebed Heaths amongst visitors, and a poor understanding of some of the restrictions on access that are in place (particularly that dogs should be on leads during the breeding season – only 28% of interviewees were aware of this restriction). Regarding dog fouling 72% were aware of the requirement to pick up. Nearly half (45%) of all the people interviewed were not aware that there was any environmental protection or designations that applied to the Pebblebed Heaths (Liley, Panter and Underhill-Day 2016: 1-2; 44).

This suggests that any increased access would need to be balanced with the implementation of appropriate education / awareness raising activities and visitor management and mitigation measures to ensure the environmental protection of the site. Increased health and wellbeing benefits could occur as a result of either increased numbers or more targeted access, such as targeting greater numbers of older people, disadvantaged populations and those with health conditions. An increase in visitor numbers creates challenges in terms of visitor management and mitigation measures, but such measures could use information and models provided by the visitor data to aid in concentrating and / or diverting visitors to and from certain areas (see Annex 4 Map 3).

5: Qualitative data collection - interviews and workshop

Interviews

Seven interviews were conducted (one of these by phone) with stakeholder organisations, and two meetings (the Naturally Healthy group [Local Nature Partnership]; and academics at ECEHH). The organisations interviewed included the Naturally Healthy group, which includes a range of public

[23] The next round of MENE data is reported to include piloting of indicators on nature connection.

health and environment county council and voluntary sector representatives, an ecological consultancy, voluntary sector physical activity organisations, academic institutes related to health and the environment and health providers (a health and wellbeing centre and a GP surgery) (some names have been withheld to preserve anonymity).

The interviews, combined with the workshop, provided a number of valuable insights which are incorporated into the findings below and into the conclusions.

Workshop

28 representatives from 17 different environmental and public health organisations attended the workshop on 28th Feb 2018. Organisations attending included Devon County Council, East Devon District Council and Budleigh Salterton town council, environmental organisations (RSPB, Devon Wildlife Trust, East Devon Area of Natural Beauty), Exeter University, GP surgeries (Sid Vale and Budleigh Salterton), physical activity, health walks and local countryside organisations (the Naturally Healthy Group, Active Devon, LED Walking for Health, the Otter Valley Association) and a disabled access organisation (Devon Countryside Access Forum). Around 10 more people had planned to attend but were unable to due to the snowy weather conditions elsewhere / forecast and / or other last-minute commitments. The workshop was held at Budleigh Salterton Health and Wellbeing Hub, which was a highly suitable venue for this event due to its role in local health and wellbeing and the range of groups (including target groups for health and wellbeing work) it serves. The first part of the workshop consisted of eight separate presentations by different stakeholder representatives, with the second part consisting of three discussion groups on the following themes: 1) Quantifying economic and health and wellbeing value; 2) Opportunities, barriers and constraints; and 3) Partnerships.

Useful insights and constructive input was provided on a number of aspects, including on the economic valuation, such as on the ORVal tool, substitution and use of the MOVES tool, which have been incorporated in the valuation section above.

The workshop discussions also highlighted the tension between the environmental protection of the site and improving its associated health and wellbeing value through increased (or more targeted) access, and the challenges in terms of mitigation measures increased access creates. This was also illustrated, for instance, by workshop participants highlighting the different motivations for visiting the site – solitude vs. increased access and social opportunities; and wild vs. managed. The need for a balance between the needs of locals vs. tourists was also underlined.

Opportunities, barriers and constraints

Several opportunities were identified at the workshop as follows, including potential for increased partnership working and some potential funding opportunities (see below):

- Increased walks / route information, way marking and guided access. Walks maps could include features – with appropriate targeting and grading information on difficulty of route; digital routes, etc.
- Suitable Alternative Natural Greenspaces (SANGs) could be used to increase access in less sensitive areas.
- Areas without statutory designation represent an opportunity as there are fewer restrictions for access, environmental sensitivity, and the types of path and car park surfaces etc.
- Path network audit of priority works.
- Assessing user understandings – why the site is special including its archaeology, plus health and wellbeing value.

Further opportunities identified in the interviews and meetings are provided below (in the section on partnership).

Several barriers and constraints were identified during the workshop. These included:

- Safety concerns (fear of getting lost) and lack of confidence in walking on the Heaths, not knowing enough about routes.
- Fragmentation and cuts in funding for interventions.
- Data gaps relating to visitor data e.g. demographic and health data.
- Increasing impact means that mitigation measures become even more important.
- Lack of public transport to the site.
- Legislation is a limiting factor in some cases [but also provides environmental protection].
- Funding availability.
- Local vs. tourism – balancing the needs of these groups.
- Statutory responsibility to protect site sometimes results in barriers to access e.g. path works [but is also to have a positive influence on the integrity and protection of the site].

Other barriers and constraints identified in the interviews and meetings include:

- Barriers to social / green prescribing were highlighted by health practitioners, e.g. safeguarding responsibility which still lies with the GP if referred, therefore the only feasible route is to signpost via voluntary organisations, unless it is through the mental health referral system.

The other main outcomes of the workshop are summarised as follows:

Greater partnership working across the range of different organisations could increase the health and wellbeing benefits through:

- identifying and plugging evidence gaps especially those needed to influence public health policy;
- strategic planning at county, district and organisational level – this may include identifying strategic theory of change and designing evaluation for interventions (e.g. using a behaviour change model);
- better coordination of existing activities;
- consultation of key stakeholders e.g. disability groups on access – paths (including a path audit), gates etc; increased targeting of activities; and
- clearer information for visitors (e.g. leaflets, interpretation) and inclusive training for walks leaders.

More detail on some of these specific points about partnership working is provided below.

Potential for partnership working to improve the health and wellbeing benefits of the Pebblebed Heaths

Clinton Devon Estates, who own the site, are well-placed to deliver partnership benefits because of their extensive stakeholder and community networks and the flexibility they have in terms of implementing and regulating activities on their own land.

The individual interviews and the workshop indicated that there is considerable potential for increased partnership working and more effective linkages to bring greater health and wellbeing benefits for this site. In particular, the following opportunities were identified:

- Partnership working with **Devon County Council (DCC) / East Devon District Council (EDDC) Public Health department and the Naturally Healthy group (Local Nature Partnership**) could assist in identifying priority target groups for environment-health and wellbeing interventions for the local area.
- Collaboration with e.g. the **RSPB, Devon Wildlife Trust (DWT), East Devon Area of Natural Beauty (AONB), DCC, EDDC and LED Walking for Health**, could assist with creating walks leaflets / interpretation with a grading system (including difficulty, roughness, etc) that would help inform visitors about suitable routes, inspire confidence and allay fears about safety and getting lost on the site.
- **Budleigh Salterton Health and Wellbeing Hub** (run by Westbank) houses a number of different groups (with a gym, physiotherapy clinic, health technology unit, a nursery for 0-5s, day centre for older people, employment training for adults with learning disabilities) and have a minibus that could be used for transport to the Heaths. Westbank also run Neighbourhood Friends, which do outreach work with older people linking with local GP surgeries. Creating better links and working closely with them could therefore potentially enable activities and events to target and work inclusively with these groups.
- **Active Devon's CAN project** is in its development phase and may have funding for developing more inclusive walks on the Heaths targeted at older people. They also provide training on how to run inclusive walks and other activities for guided walk leaders (staff and volunteers) that could enable walk leaders to increase their range of participants and guide them effectively.
- **LED Walking for Health** run health walks for older people and those with health conditions already on the Heaths, therefore partnership working and exchange of information with PHCT, RSPB and DWT could increase the impact of events already happening.
- The **MIND** Honiton group run walks and events which they might be interested in extending to include the Heaths. Partnership work with MIND is likely to lead to greater health and wellbeing impacts relating to the Heaths as they also have groups in Exmouth and Exeter.
- The **Devon Countryside Access Forum** (DCAF) could advise on the suitability of paths and access including cost effective measures to improve access (including gates etc) for people with disabled mobility scooters (trampers) and wheelchairs on the Heaths. An audit of paths and access points from a disability access point of view is likely to yield a number of simple measures that could be taken at relatively low cost that would improve access for this group.
- Partnership working with **East Devon District Council (EDDC) and the local parish councils** could assist in identifying small amounts of funding that could be used to improve local disabled access (e.g. the Parishes Together Fund).
- Collaborative working with **Devon County Council (DCC)** could assist them in refining their strategic objectives – there is potential for developing their intervention and evaluation strategy using an evidence-based theory of change and behaviour change approaches.
- There is also potential for working with a range of **public health partners, DCC / EDDC, the Naturally Healthy and Active Devon** in order to identify gaps in the evidence that is needed to influence policy and resource allocation on nature-based health and wellbeing interventions.

6. Conclusions

The main conclusion is that the Pebblebed Heaths are associated with **an important health and wellbeing value of at least £446,000 (£0.4m)** relating to their recreational use through regular physical activity. **The economic value based on the travel cost (willingness to pay) is around £1.9m** (for all visitors).

The travel cost and ORVal valuation methods give broadly similar results and are based on a comparable method. The HEAT and MOVES results also give similar values to each other, and measure the health impact of regular physical exercise conducted on the Heaths, giving a significantly lower value to the travel cost and ORVal estimates (see below).

Table 5: Economic valuation results

Valuation method	**Total annual economic value**	**No. of people estimate based on**	**Age range** (if applicable)	**Notes & distinguishing features of tool**
Travel cost method	**£1,879,003 (£1.9m)**	422,495 (estimated visits)	N/A	Willingness to pay model; based on petrol cost to get to & from site
Outdoor Recreational Valuation (ORVal)	**£1,722,636 (£1.7m)**	571,919 (estimated visits)	N/A	Based on MENE data & travel cost; uses complex algorithms & socio-economic data
WHO Health Economic Assessment Tool (HEAT)	**£446,310 (£0.4m)**	3097 (estimated regular visitors – 3 x 30 mins per week)	20-74 yrs	Epidemiological model; assesses value of health impact of exercising; calculates for brisk walking (or cycling) intensity only
MOVES tool (University of East Anglia / Sport England)	**£556,766[24] (£0.6m)**	3097 (estimated regular visitors – 3 x 30 mins per week)	16-61+	Similar to HEAT but measures in Quality Adjusted Life Years (QALYs); assesses brisk or slow walking intensity & other activities ('brisk' used here); differentiates between age groups

[24] The range for this figure is: £326,894 – 682,554 based on different values for walking intensity - 'slow' to 'cross country / hills'. This value is the middle value, brisk walking intensity (4.65 METs per hour).

Notes: Based on Footprint Ecology visitor data. Estimates are averages based on visitor numbers (or low estimates). The MOVES tool and HEAT estimates assume participants are walking briskly (~3 miles per hour) for 3x30mins per week. Travel cost is based on median distance travelled (10.8km round trip; from visitor data). Median route length was ~3km.

These estimates **do not include the important value of the mental health benefits** (or qualitative values) associated with visiting the Heaths, as tools are currently still being developed to calculate this.

The MOVES estimates also show that the health and wellbeing benefits as measured by economic value are **much greater for older people**. It is likely that increased targeting would therefore yield greater health and wellbeing benefits.

The **return on investment** for the **health economic impact** only (measured by HEAT and MOVES) is in excess of **28%** (between 28 and 59%); and for the **overall economic impact** (measured by travel cost and ORVal) it is at least **392%** (between 392% and 437%), although this does not take capital or infrastructure costs into account.

Balancing environmental and health and wellbeing objectives

The visitor data shows that there is currently **relatively little awareness of the conservation importance of the Pebblebed Heaths amongst visitors**, and a poor understanding of some of the restrictions on access that are in place (particularly that dogs should be on leads during the bird breeding season)[25].

Therefore, any increased access **would need to be balanced with the implementation of appropriate education / awareness raising activities and visitor management and mitigation measures** to ensure the environmental protection of the site. The stakeholder engagement work highlighted the tension between the environmental protection of the site and improving its associated health and wellbeing value through increased (or more targeted) access, and the challenges in terms of visitor management and mitigation measures increased access would create. Workshop participants also highlighted this tension when discussing the different motivations and benefits of visiting the site – for example, solitude vs. increased access and social opportunities; and wild vs. managed.

Qualitative values

Although there is some data from the visitor surveys on motivations for visiting the site there is relatively little about the qualitative experience. There is therefore scope for collection of qualitative data about the health and wellbeing benefits of the Heaths in combination with further synthesis of research evidence in this area. Motivations for visiting the site are varied and many value the solitude / tranquillity that can be found there, while others value the social opportunities afforded.

Potential for partnership to increase health and wellbeing benefits

The project placement enabled identification of several areas with potential for increasing benefits. Clinton Devon Estates and similar land-based private sector organisations are likely to be well-placed to deliver partnership benefits because of their extensive stakeholder and community networks and

[25] Liley, Panter and Underhill-Day 2016.

the flexibility they have in terms of implementation on their own land. Partnership working could therefore increase the health and wellbeing benefits through:

- **strategic planning** at county, district and organisational level – this may include identifying strategic theory of change and evaluation for interventions (behaviour change models);
- **better coordination** of existing activities;
- **consultation of key stakeholders** e.g. disability groups on access – paths, gates etc.
- **increased work around targeting of activities** to determine the relevant local target groups and to include disadvantaged groups and older people; and
- **increased walks information for the public and inclusive training** for walks leaders, helping to build visitors' confidence and allaying fears about safety.

Policy relevance and influence

There is evidence from the literature that **use of natural environments encourages higher levels of physical activity**, and that there are **additional beneficial effects to doing physical activity outdoors** compared to indoor activity.

The economic valuation of **at least £0.4m for the health-related economic value of the Heaths (and £1.9m for the broader economic value) is robust across different valuation methods**. It is recommended that **policy makers take this public value into account when planning future funding mechanisms** for this site and for similar natural environments. Economic valuation carried out in this way is congruent with natural capital approaches. This type of valuation could also be extended to other sites using visitor data in a cost-effective way. However, it is important that economic valuations are used **combined with a better understanding of the qualitative and non-use values of such sites**.

7. Further research – gaps, opportunities and next steps

Based on the conclusions and outcomes of the project, the following specific evidence gaps and areas have been identified – there is a need to:

- **Refine the methodology for using visitor data to estimate health and wellbeing economic impact** and what additional data is needed to demonstrate how this approach could be used elsewhere (including the following).
- **Informing design of future visitor surveys** so that they can be used for better calculating health and wellbeing benefits / value.
- Understand and more accurately quantify how the **length of time doing a specific activity relates to the health recommendations** for "moderate" or "vigorous" physical activity (e.g. using the Active 10 app[26]) – e.g. how much of the visitor activity already documented for the Pebblebed Heaths counts as exercise that has tangible health benefits.
- Obtain more **accurate estimates for substitution**, so that estimates are attributable to the site in question.

[26] https://www.nhs.uk/oneyou/active10/home#RhcBOxZUIiUuYEcw.97

- **Identify and utilise other data sources more effectively** e.g. health data, MENE data and the Exeter 10,000 project[27] to inform interventions.
- **Quantify mental health benefits** of visiting natural environments.
- **Calculate travel cost using the zonal travel cost method.**
- **Collect qualitative data about people's experiences** of visiting the Pebblebed Heaths and associated health and wellbeing benefits**.**

Research gaps from the literature

As highlighted in the literature section, there are a number of research gaps and areas where the evidence is patchy or thin. There is a need to clarify causal mechanisms relating to the natural environment and physical and mental health, i.e. whether exposure to natural environments causes better health outcomes or whether people with better health tend to visit nature more often or live in greener areas (Natural England 2016b). Other gaps identified (drawing heavily on Natural England 2016a and 2016b) include:

Research gaps on the links between natural environment and physical activity – there is a need to:

- Clarify whether, and to what degree, **physical activity is a key mechanism** explaining the health benefits of natural environments
- Explore if and how **interactions with the natural environment support physical activity**
- Explain the role of **other important mediating factors** (e.g. social or practical support etc.) in linking natural environments to physical activity behaviours.
- Clarify **which types of natural environment promote active lifestyles** in different populations
- Identify the **specific physical and experiential characteristics of the environment** that encourage, facilitate and support ongoing physical activity explaining how these characteristics and mechanisms vary within the population.

Research gaps on links between natural environment and mental health:

- **Quantifying** the **mental health benefits**[28] of visiting the outdoors, including putting an economic value on these benefits.
- **Causal pathways and contributory mechanisms** linking mental health outcomes to natural environment exposure – research that can tell us whether exposure to natural environments causes better mental health outcomes or whether people with better mental health tend to visit nature more often or live in greener areas.
- The **cost-effectiveness, variation in any outcomes, and potential to ameliorate or exacerbate health inequalities** of natural environment interventions
- **Clarification** of **which types of natural environment promote mental health outcomes** in different populations.

[27] http://exeter.crf.nihr.ac.uk/extend

[28] There are plans for the Natural Capital InVEST tool to quantify the mental health benefits associated with visiting the outdoors but this is currently still being developed – see https://www.naturalcapitalproject.org/invest/

Research gaps on connection with nature:

- **Clarifying the benefits of connecting with nature** – less evidence is available on this aspect than on the links between the natural environment and physical activity. This area has clear overlaps with the links between natural environments and mental health.

8. Challenges and opportunities

This section outlines the main challenges and opportunities associated with this research project.

Challenges

The main challenges experienced (in addition to the short timescale) while undertaking this project were as follows:

- Crucial evidence gaps – e.g. what evidence that is needed to influence public health policy; & quantifying mental health benefits of outdoors.
- Gaps in visitor data – as the visitor data was not originally intended for health and wellbeing research purposes - e.g. socio-economic / demographic data.
- Engaging with public health and NHS professionals was challenging – they were often busy or not available.
- Finding funding for future research and strategic intervention work in this area is challenging. Interventions are currently fragmented and relatively poorly funded.

Opportunities:

The main opportunities identified were as follows:

- Interest in further research and follow-up work on this site from stakeholders including Clinton Devon Estates and partner organisations.
- Follow-up work with the range of council & voluntary sector organisations is likely to bring greater health and wellbeing benefits.
- Further work could help inform strategic objectives for Naturally Healthy group working with Devon County Council.
- The results provide a chance to inform design of future visitor surveys to plug gaps in health and wellbeing information.
- Valuation work could be extended to other sites using visitor data from elsewhere (with some refining of the methodology).
- Evidence gaps have been identified that could be addressed with further research.
- Use of further data sources could increase the robustness and applicability of the findings and extension to other sites or areas, e.g. health and MENE data, Active 10 app (measures intensity of exercise); & Exeter 10,000 project.

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Annex 1: Figures and breakdowns for economic valuation

Table A1a: Table of events and no. of participants by organisation

Total no. of events	Total no. of participants	Total no. of participant hours	Organisation
273	231	**5087.5**	RSPB
174	359	3862	DWT
11	**1330**	3935	External
352	920	4104.5	PHCT
4	499	942.5	Joint PHCT/RSPB/DWT/EDDC
814	**3339**	**17931.5**	**Subtotals**

(Highest numbers presented in bold within columns in this table)

In 2017 PHCT ran the most numbers of events and activities (352) compared to RSPB (273); DWT (174); external (11); and joint – PHCT / RSPB / DWT / EDDC – for Heath week (4) [although figures for Heath Week are likely to be an underestimate].

External events accounted for the most participant numbers at 1330 (primarily the Commando Challenge – approx. 1000); then PHCT (920) joint (449); DWT (359) and RSPB (231).

In terms of participant hours per year (2017); RSPB accounted for the most (5087.5); followed by PHCT (4104.5); then external events (3935 - mainly the Commando Challenge – approx. 3000); then DWT (3862); then joint (942.5).

Only five events had >100 participants – the highest no. of participants (estimate of 1000) was for the Royal Marines Commando Challenge (external). The second highest was around 400 for Woodbury Castle Heath Week event in July 2017 (jointly run by PHCT / RSPB / DWT / EDDC for the general public); the third highest was around 250 for DWT's Bystock discovery day, the fourth highest was 247 participants for an educational visit by FE college and the fifth highest, 120 for the Execel cycling event (British cycling). Most other events had 30 participants or less (see Annex 1 for further breakdowns).

Table A1b: Total no. of events and activities by organisation including external

	Guided walks	Practical conservation work	Ecological survey	Livestock checks	Horse riding	Cycling	Orienteering	Educational activity	Other events (family etc)	Total	Organisation
	6	62	59	144	0	0	0	0	2	**273**	RSPB
	4	26	47	96	0	0	0	0	1	**174**	DWT
	0	0	0	0	4	5	1	0	1	**11**	External
	12	21	166	140	0	0	0	7	6	**352**	PHCT
	1	0	0	0	0	0	1	0	2	**4**	Joint PHCT/RSPB/DWT/EDDC
Total										**814**	

Notes:

Educational activities include those involving primary / secondary schools and FE / 6th form colleges.

External events are those organised by other organisations than those named happening on the Pebblebed Heaths. They consist of only the official events that have gained permission from CDE / PHCT, therefore this figure will be an underestimate.

Joint PHCT/RSPB/DWT/EDDC (East Devon District Council) activities are those carried out as part of Heath Week (July 2017).

The category 'other events' includes the Commando Challenge (which was by far the largest external event).

Table A1c: Total no. of participants by organisation

	Guided walks	Practical conservation work	Ecological survey	Livestock checks	Horse riding	Cycling	Orienteering	Educational activity	Other events (family etc)	Total	Organisation
	90	45	26	10	0	0	0	0	60	**231**	RSPB
	56	40	9	4	0	0	0	0	250	**359**	DWT
	0	0	0	0	80	235	15	0	1000	**1330**	External

	256	60	28	2	0	0	0	394	180	**920**	PHCT
	33	0	0	0	0	0	60	0	406	**499**	Joint PHCT/RSPB/DWT/EDDC
Totals										**3339**	

See notes above.

Table A1d: Total no. of participant hours per year for 2017

	Guided walks	Practical conservation work	Ecological survey	Livestock checks	Horse riding	Cycling	Orienteering	Educational activity	Other events (family etc)	Total	Organisation
	135	3560	576.5	216	0	0	0	0	600	**5087.5**	RSPB
	152	1430	136	144	0	0	0	0	2000	**3862**	DWT
	0	0	0	0	510	380	45	0	3000	**3935**	External
	702	875	166	210	0	0	0	1854	297.5	**4104.5**	PHCT
	16.5	0	0	0	0	0	120	0	806	**942.5**	Joint PHCT/RSPB/DWT/EDDC
Totals		**5865**								**17931.5**	

See notes above.

Table A1e: Breakdown of external events 2017

Name of event / activity	Type	No. of participants	Times per yr	Total no. of hours per yr	Total no. of participant hours per yr	Donations to	Total raised 2017 (£)
East Devon Hunt	Horse riding	50	1	3	150		0
Execel cycling event (British Cycling)	Cycling (mountain biking)	120	1	1	120		0
Night Rider event	Cycling (mountain biking)	50	1	2	100		0
Somerset Mountain Bike Organisation	Cycling (mountain biking)	35	1	1	70		0
Devon Orienteering Club	Orienteering	15	1	3	45		0
Exe Equestrian Pleasure Rides	Horse riding	30	3	12	360		0
The Knobbler	Cycling (mountain biking)	30	1	3	90	Hospice Care Devon / ME Research Devon	750
Commando Challenge	Run / outdoor challenge	1000	1	16	3000	Devon Air Ambulance; Royal Marines Commando Challenge Trust; PHCT	80000
Subtotals		**1330**			**3935**		**80750**

Annex 2a: Detailed economic valuation figures

Travel cost method

Based on Footprint Ecology data; median distance travelled

Total estimated travel cost value (Footprint Ecology figures) = £1,879,003 (£1.9m) for estimated **422,495 visits**

Estimated travel cost value per visit (Footprint Ecology figures): £4.45

Total annual valuation for all external events for 2017: £7429

Based on travel cost method.

Total money raised donated to external organisations: £80,750

In 2017 these funds went to Devon Air Ambulance, Royal Marines Charity, Hospice Care and ME Research Devon.

ORVal tool:

Calculation of total: £1,504,501 (£1.5m) for estimated **341,102 visits**[29]

Average value per visit = £4.41

Updated figures:

This tool is currently being revised with these estimates revised upwards slightly in the new version to **£1,722,636** (£1.7m) for an estimated 571,919 visits.

HEAT assessment

Estimated number of regular visitors per year (1271 per day; 3 x 30mins per week): **3097** (after adjustments):

HEAT annual economic impact for 3097 participants: £2,349,000

[29] Brett Day, 28/2/2018.

Adjusted to 19% for substitution:
HEAT annual economic impact: **£446,310**

Assumptions:

Walking average 12.86 mins per day (3 x 30mins per week)
80% temporal & spatial adjustment (for seasonality)
Based on conversion rate 1 EUR = £0.87 (on 26th Mar2018)
Walking speed brisk (4.8km per hour)
Reference city: Plymouth (nearest).

MOVES tool:

84 out of 492 walk / dog walk daily = 17%
100 out of 492 go most days walking / dog walking = 20.3%
184/492 = 37.4% are dog walking / walking more than 3 times a week

287 out of 359 dog walking for 30mins or more = 79.9%
46 out of 53 walking for 30mins or more = 86.8%
Total dog walkers / walkers walking for 30mins or more = 333 (80.8% of total dog walkers / walkers)
26 out of 26 cycling for 30mins or more = 100%

Table for average calculations:

Calculated using mid-point of frequency range for each category (where applicable)

Table 2ai: Frequency of activity and average calculations (figures in brackets are row percentages):

	Daily [365]	**Most days (180+ visits) [mid pt 272]**	**1 to 3 times a week (40-180 visits) [mid pt 110]**	**2 to 3 times per month (15-40 visits) [mid pt 27.5]**	**Once a month (6-15 visits) [mid pt 10.5]**	**Less than once a month (2-5 visits) [mid pt 3.5]**	**First visit [ave 1]**	**Other/don't know/blank**	**Total**
Dog walking	76 (21)	96 (27)	127 (35)	20 (6)	22 (6)	5 (1)	13 (4)	0 (0)	**359 (100)**
Walking	8 (15)	4 (8)	7 (13)	8 (15)	8 (15)	8 (15)	9 (17)	1 (2)	**53 (100)**
Total dog walking / walking	84	100	134	28	30	13	22	1	412
All									492
Average calculation	84*365	100*272	134*110	28*27.5	30*10.5	13*3.5	1*22	0	
	30660	27200	14740	770	315	45.5	22	0	73752.5

149.9 **Average visits per year** (73752.5/492)

2.88 **Average visits per week** (149.9/52)

1272 daily visits

1272 x 365 = **464280 annual visits**

Average no. of regular visitors (3 times per week): 464280/149.9 = **3097**

Divided into 4 age groups for Moves tool: 3097/4 = 774 per group

Table 2aii: MOVES tool results for different walking intensities (regular visitors only):

Age range	16-61+	16-61+	16-61+
No. of participants	3097	3097	3097
Walking speed / intensity	Slow	Brisk	Cross country / hill
Total value of QALYs gained (5 yrs)	£1,634,468	£2,783,829	£3,412,771
Annual value of QALYs gained	**£326,894**	**£556,766**	**£682,554**
No. of QALYs gained	81.6	139.2	170.5
Programme cost over 5 yrs (cumulative)	787695	£787,985	£788,287
Annual programme cost	£157,539	£157,598	£157,657

Average of 3 values: £522,071

Brisk intensity: £556,766 (so comparable with HEAT)

Range £326,894 – 682,554

Assumptions for MOVES tool:

Assumes participants split equally across all four age groups.

Outcomes calculated over a 5 year timeline (25yr time horizon for health outcomes).

3097 total participants; equates to 774 per age group (80% drop off → 619 after 5 years)

50% male (this is roughly corroborated by Ecology Solutions figures)

Walking intensity (METs per hr) – slow (2.5); brisk (4.65); cross country / hills (6)

0.5hrs; 3 times a week.

Assumes willingness to pay £20,000 cost per QALY

Table 2aiii: Detailed MOVES tool results for brisk walkers

	Brisk walkers age 16-30	**Brisk walkers age 31-45**	**Brisk walkers**	**Brisk walkers**	**Totals**
Age range	16-30	31-45	46-60	61+	
Walking speed	Brisk	Brisk	Brisk	Brisk	
Total value of QALYs gained (5 yrs)	£118,690	£272,430	£929,408	£1,463,301	£2,783,829
Annual value of QALYs gained	**£23,738**	**£54,486**	**£185,882**	**£292,660**	**£556,766**

No. of QALYs gained	5.9	13.6	46.5	73.2	139.2
Incremental cost effectiveness ratio (cost per QALY)	£35,901	£12,865	£733	Cost saving	
Programme cost over 5 yrs (cumulative)	£228,629	£219,698	£192,705	£146,953	£787,985
Annual cost	£45,726	£43,940	£38,541	£29,391	£157,598

Annex 2b: Travel cost calculations

Calculation for average (median) travel cost by car based on Footprint Ecology figures:

Average car travel cost per mile running costs only: 23.19 pence per mile – running costs only; based on 2014 figures from the AA[30] = 37.32 pence per kilometre.

Median distance of 5.43km (one way – home postcode to survey point); round trip 10.8km.
[A total of 472 interviewees (96%) gave a full valid and useable postcode (for GIS). The distances travelled ranged from 0.92km to 392.1km, with a median distance of 5.43km. 75% of postcodes were within 8.2km.]. Only Exeter and Exmouth are classed as urban areas (population above 10,000).

Modelling by Footprint Ecology of the total number of daily visitors at access points predicted a total of **1,272** visitors to the 99 access points. [This gives 464,280 visitors per year (1272 x 365) 91% of which are estimated to be by car[31] = 422494.8.]

Calculation: 464280 x 5.43 x 2 x 0.09 = £453,787 per year

Adjustment for 91% car journeys = 91/100 x 453787 = 412946

Estimated total travel cost by car (Footprint Ecology figures) = £412,946 per year

Calculation per visit: = 412946/422494.8

Estimated travel cost by car per visit (Footprint Ecology figures) = £0.98

(Based on median distance travelled of 5.43 x 2 x 0.09 pence per km)[32]

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[30] http://www.theaa.com/motoring_advice/running_costs/advice_rcosts_guide.html ; average running costs (petrol car) = 14.55 pence per mile (equivalent to 9.04 pence per km). This is based on 2014 petrol prices of 129p per litre; standing costs are not included in these estimates; conversion factor 1 mile = 1.60934km.

[31] This is similar to the figure obtained by Ecology Solutions Ltd. in their 2012 survey report on travel to the site with 93.4% arriving by car.

[32] These are petrol costs only. If we include other running costs (tyres, service labour and replacement parts; but exclude parking or tolls) using the AA figures the cost per km is approx. 13 pence per km (12.94 based on 20.83 per mile). If these costs are included the figures using Footprint Ecology data rise to £596,478 per year and £1.28 per visit.

Non-work travel time value for average (median) visit (based on DfT 2015 figures): £3.47 per visit[33] (>8km) (see below)

Estimated total non-work travel time value for 464280 visits = £1,611,051 per year

Adjustment for 91% car journeys = 91/100 x 1611051

Estimated total non-work travel time value = £1,466,057

Total estimated travel cost value (Footprint Ecology figures) (1466057 + 412946) **= £1,879,003**

Estimated total travel cost value per visit (Footprint Ecology figures): £4.45

[33] DfT (2015) values a trip of 5-20 miles at £3.47.

Annex 3: Relevant Pebblebed Heaths visitor activity data (Footprint Ecology)

Table A3a: Number (and %) of interviewees by activity and visit duration (% by row). Data from question 5. Yellow shading reflects the cell with the highest value for each row

	<30 mins	**30 mins - 1 hour**	**1 - 2 hours**	**2-3 hours**	**more than 3 hours**	**Total**
Dog walking	72 (20)	177 (49)	102 (28)	5 (1)	3 (1)	**359 (100)**
Walking	7 (13)	12 (23)	15 (28)	11 (21)	8 (15)	**53 (100)**
Cycling	0 (0)	3 (12)	10 (38)	9 (35)	4 (15)	**26 (100)**
Wildlife / bird watching	0 (0)	2 (9)	8 (36)	8 (36)	4 (18)	**22 (100)**
Jogging / power walking	2 (25)	4 (50)	2 (25)	(0)	0 (0)	**8 (100)**
Outing with family / picnicking	2 (25)	3 (38)	3 (38)	(0)	0 (0)	**8 (100)**
Photography	0 (0)	0 (0)	2 (40)	3 (60)	0 (0)	**5 (100)**
Horse riding	1 (33)	2 (67)	0 (0)	0 (0)	0 (0)	**3 (100)**
Geocaching	1 (50)	0 (0)	1 (50)	(0)	0 (0)	**2 (100)**
Other	3 (50)	0 (0)	2 (33)	1 (17)	0 (0)	**6 (100)**
Total	**88 (18)**	**203 (41)**	**145 (29)**	**37 (8)**	**19 (4)**	**492 (100)**

Table A3b: Number (and %) of interviewees by activity and visit frequency (by row). Data from question 6. Yellow shading reflects the cell with the highest value for each row

	Daily	**Most days (180+ visits)**	**1 to 3 times a week (40-180 visits)**	**2 to 3 times per month (15-40 visits)**	**Once a month (6-15 visits)**	**Less than once a month (2-5 visits)**	**First visit**	**Other/don't know/blank**	**Total**
Dog walking	76 (21)	96 (27)	127 (35)	20 (6)	22 (6)	5 (1)	13 (4)	0 (0)	**359 (100)**
Walking	8 (15)	4 (8)	7 (13)	8 (15)	8 (15)	8 (15)	9 (17)	1 (2)	**53 (100)**
Cycling	0 (0)	1 (4)	13 (50)	7 (27)	1 (4)	1 (4)	3 (12)	0 (0)	**26 (100)**

Wildlife / bird watching	0 (0)	0 (0)	2 (9)	3 (14)	7 (32)	4 (18)	4 (18)	2 (9)	**22 (100)**
Jogging / power walking	1 (13)	0 (0)	5 (63)	1 (13)	0 (0)	0 (0)	1 (13)	0 (0)	**8 (100)**
Outing with family / picnicking	0 (0)	0 (0)	2 (25)	0 (0)	2 (25)	0 (0)	4 (50)	0 (0)	**8 (100)**
Photography	0 (0)	0 (0)	0 (0)	0 (0)	1 (20)	1 (20)	3 (60)	0 (0)	**5 (100)**
Horse riding	1 (33)	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	**3 (100)**
Geocaching	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	**2 (100)**
Other	1 (17)	0 (0)	0 (0)	1 (17)	0 (0)	3 (50)	1 (17)	0 (0)	**6 (100)**
Total	**87 (18)**	**103 (21)**	**157 (32)**	**40 (8)**	**41 (8)**	**23 (5)**	**38 (8)**	**1 (0)**	**492 (100)**

Annex 4: Footprint Ecology general visitor data and relevant questions

The visitor surveys were conducted from twelve survey points, predominantly main car parks but some informal car parks and foot entrances to the Pebblebeds. Each survey point was surveyed for a total of 16 hours, with survey effort split equally over a weekday and a weekend day[34]. A random sample[35] of 491 people in total over the 12 survey points were interviewed face-to-face using electronic tablet survey technology. In addition to the interviews, counts were made of groups and individuals entering and leaving the site at the survey point. A total of 705 groups and 1,150 people were counted across all survey locations and all visits, equivalent to 2.9 groups and 4.8 people per hour of survey work.

The relevant headline results from the visitor data are as follows:

- Routes were mapped for most interviewees and showed a median distance (all activities, all locations) of just over **3km**. There were significant differences between activities, with cyclists doing the longest routes and family outings and dog walking being the shortest.
- The median visit duration was short – between **30 minutes and an hour**.
- Distance travelled to the site: around **75%** of all interviewees who gave valid postcodes lived within an **8.2km** radius of the survey point and the **median** distance (home postcode to survey point) was **5.4km**. The settlement with the most interviewees by far was **Exmouth**, followed by **Woodbury** and **Newton Poppleford**.
- Main activity: almost three-quarters (**73%**) of all interviewees were visiting the site to **walk their dog**.
- Other activities stated included **walking (11%), cycling (5%), wildlife watching (4%), jogging (2%) and family outings (2%)**.
- Visitor numbers were **highest at Woodbury Castle** by a significant margin – e.g. around 25% of the total visitors during the spring surveys.
- The quieter locations tended to have a higher ratio of dogs per person.
- Most (**71%**) interviewees visited **at least weekly**.
- Visit patterns were fairly evenly spread across the day.
- The majority (**91%**) of interviewees had travelled to the interview location **by car or van**.
- The '**scenery/variety of views**' was the most commonly given reason for the choice of site (51% of interviewees). '**Quick and easy travel route**' was the second most frequently cited main reason. Other common factors included '**good for dog/dog enjoys it**' and the '**ability to let dog off lead**', '**quiet, with no traffic noise**', '**particular wildlife interest**' and '**choice of routes**'.
- Most (**61%**) of interviewees reported that the route taken that day was fairly **typical of their usual route length** (28% of interviewees didn't have a typical visit/weren't sure, 1% of interviewees had taken a much longer route than normal and 10% a much shorter route than normal).

[34] Surveys were conducted within the following time slots: 0700-0900; 1000-1200; 1300-1500; 1700-1900) to ensure coverage across the day, and all survey slots were covered on both a weekday and weekend day to give the 16 hours. Sensor data from four main car parks (Castle, Estuary, Four Firs, and Warren) indicate that 85% of visitors are on site between 0700 and 1900 hours and that surveys carried out within these periods are likely to capture around 52% of visitors, although the sensor data needs to be treated with caution due to limitations of the methodology (Liley, Panter and Underhill-Day 2016).

[35] The random sample was achieved through surveyors approaching the next person seen (if not already interviewing). No unaccompanied minors were approached or interviewed.

- Many visitors had been visiting the Pebblebed Heaths for a long time; over half of interviewees for at least 10 years. Access and route patterns are therefore often established and embedded, based on familiarity from years of visiting.
- The majority of visitors (**>95%**) to the site are **local residents** as opposed to holiday makers.
- Other sites visited by interviewees were often also within the Pebblebed Heaths. The Exe Estuary (including Topsham, Lympstone, Exmouth seafront etc.) was the most commonly named destination outside the Pebblebed Heaths. Other alternative locations include the River Otter and Haldon Forest. **Visitor engagement/awareness raising measures on the Pebblebeds and the Exe may well reinforce each other.**
- **Few visitors are aware of the site's conservation importance, and changing this may have implications for people's behaviour.** Nearly half (45%) of all the people interviewed were not aware that there was any environmental protection or designations that applied to the Pebblebeds and few interviewees were aware of important species or habitats (around a third (32%) could not name a habitat or species for which the Pebblebeds are important).
- Around three-quarters of interviewees (77%) indicated they were aware of who was responsible for looking after the site they were visiting, with 62% of all interviewees naming the Clinton Devon Estate or Pebblebed Heaths Conservation Trust.
- **Visitors are not aware of current restrictions relating to dogs on leads, the number of dogs and to some extent the need to pick-up.** When asked about access restrictions most interviewees were aware that lighting fires and wild camping were restricted (93% and 82% of interviewees respectively). Relatively few were aware of restrictions relating to the number of dogs walked or the need to keep dogs on leads during the breeding season (9% and 28% of interviewees respectively). For dog fouling around three quarters (72%) were aware of a requirement to pick up.
- A range of future management measures were scored by interviewees and parking measures (compulsory charging, closure of parking, permits) and the enforcement of dogs on leads during the breeding season were the most unpopular measures. More dog bins, more interpretation and more routes for particular activities were the most popular measures.

Frequency of visits:
Most (71%) interviewees visited at least weekly. Considering only dog walkers this increased to 83% visiting at least weekly. The most commonly given visit frequency was "one to three times a week", with one third (35%) of dog walkers giving this response. This was also the most commonly given response for cyclists, joggers and geocachers too (p.37).

Route length:
Route lengths varied from 152m to 21.6km, with an overall median of 3,096m (3km) (p.52).

Distance travelled to the site

This information was used to calculate the travel cost element of the valuation.

A total of 472 interviewees (96%) gave a full valid and useable postcode (for GIS). The distances travelled ranged from 0.92km to 392.1km, with a median distance of 5.43km. 75% of postcodes were within 8.2km.

There were significant differences based on the activity – for the four main activities with reasonable sample sizes (> 10 interviews) dog walkers were the most local (median distance 5.1km, 345

postcodes) followed by cyclists (6.0km, 26 postcodes), those wildlife watching/bird watching (7.5km, 21 postcodes) and walking (8.0km, 50 postcodes).

The number of interviewees by settlement (Devon settlements only) is shown in the table below (Table A5i). The settlement with the most interviewees by far was Exmouth (39%), followed by Woodbury (12%), Newton Poppleford (5%), Exeter (5%), Budleigh Salterton (4%), West Hill (3%) and East Budleigh (3%). For settlements within or nearest the Pebblebed Heaths boundary, the results indicate a comparatively high visit rate from Woodbury, Lympstone Commando Centre (Royal Marines), Newton Poppleford and East Budleigh.

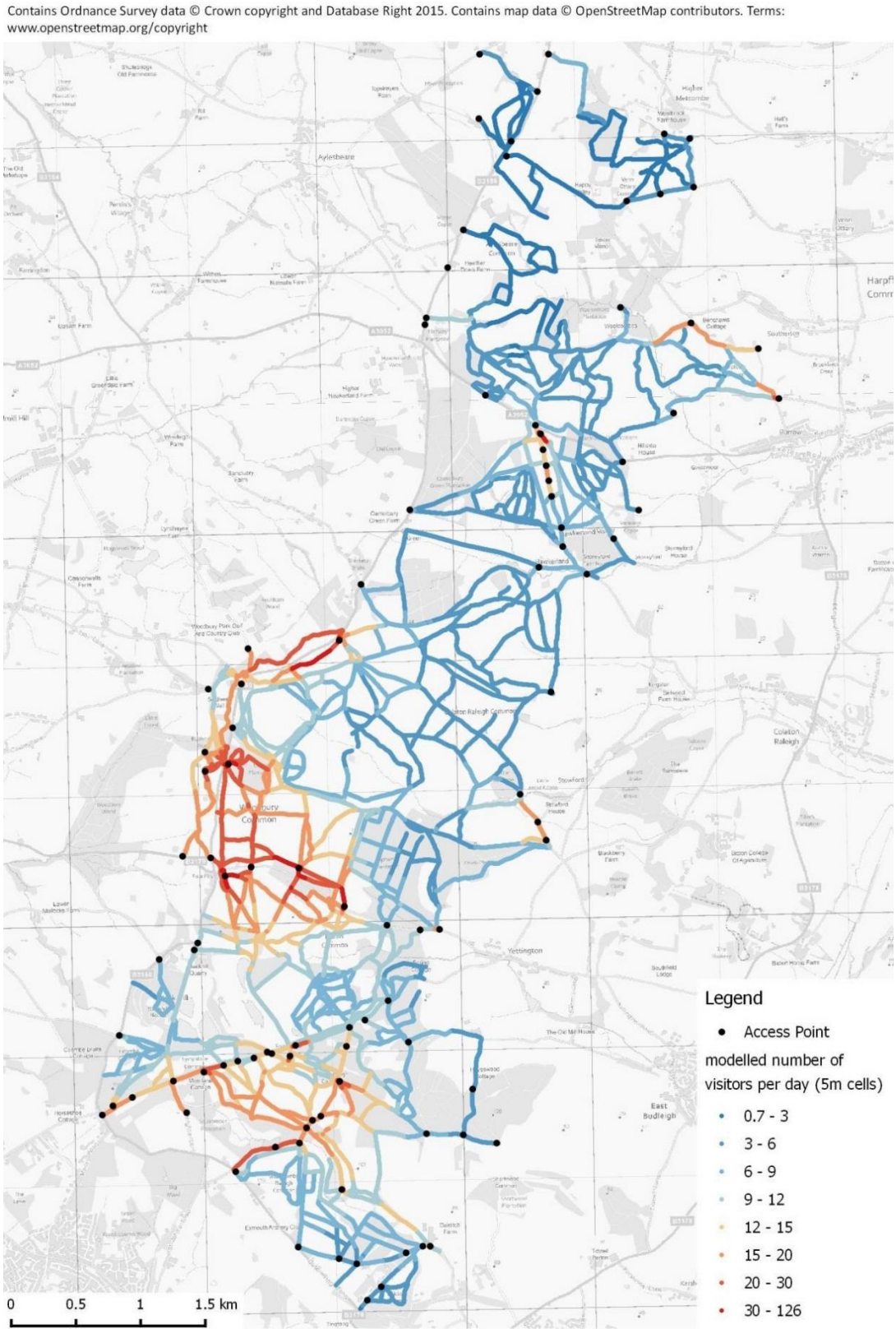
Table A4i: Number of interviewees by settlement (settlement boundaries based on 2001 built up areas open source data from Ordnance Survey). Number of residential properties is extracted from postcode data (from 2015). (adapted from Table 11: Liley, Panter and Underhill-Day 2016; here includes only those settlements with >3 interviewees (1% or more)).

Settlement	Number of interviewee postcodes	% of total	Number of residential properties within settlement
Exmouth	185	39	16,503
Woodbury	58	12	738
Newton Poppleford	25	5	800
Exeter	23	5	49,305
Budleigh Salterton	19	4	2,762
West Hill	16	3	784
East Budleigh	14	3	356
Exton	5	1	219
Ottery St. Mary	5	1	2,182
Lympstone	4	1	819

Map 3: Model of predicted number of visitors per day throughout the path network

The map below indicates modelling[36] of the concentration of visitors within the path network and most popular routes (red indicates higher concentrations of people, blue less). The map shows visitor preferences for the area around Woodbury Castle, and parts of East Budleigh Common.

[36] Limitations of this methodology (Liley, Panter and Underhill-Day 2016): The model assumes even distributions along paths and all path splits are given equal weighting. However, observation tells us that there are clear 'highways' which are much more frequently used, with an individual's actual path choice being informed by a wide range of factors such as path width, signage, path suitability, terrain, circular route options, routine and so on.



Map 3: Model of predicted number of visitors per day throughout the path network

Reproduced from Liley, Panter and Underhill-Day 2016: 68.

Modelling the total number of daily visitors at access points predicts a total of **1,272 [daily] visitors** to the 99 access points (Liley, Panter and Underhill-Day 2016: 65). [This equates to approximately **464,280** visitors per year].

Wording of relevant questions from original Footprint Ecology questionnaire:

Instructions to interviewer given in italics.

Q5 How long have you spent / will you spend here today? *Single response only. Do not prompt.*

less than 30 minutes

between 30 minutes and 1 hour

more than 1 hour to 2 hours

more than 2 hours to 3 hours

more than 3 hours

Don't know / not sure

Q6 Over the past year, roughly how often have you visited this location? *Tick closest answer, single response only. Only prompt if interviewee struggles.*

Daily

Most days (180+ visits)

1 to 3 times a week (40-180 visits)

2 to 3 times per month (15-40 visits)

Once a month (6-15 visits)

Less than once a month (2-5 visits)

Don't know

First visit

Other, please detail

Q8 Do you tend to visit this area more at a particular time of year for [*insert given activity*]? *Multiple answers ok.*

Spring (Mar-May)

Summer (Jun-Aug)

Autumn (Sept-Nov)

Winter (Dec-Feb)

Equally all year

Don't know

First visit

Q9 How did you get here today? *What form of transport did you use? Single response only.*

Car / van

On foot

Public transport

Bicycle

Other, please detail

Now I'd like to ask you about your route today. looking at the area shown on this map, can you show me where you started your visit today, the finish point and your route please. *Probe to ensure route is accurately documented. Use P to indicate where the visitor parked, E to indicate the start point and X to indicate the exit. Mark the route with a line; a solid line for the actual route and a dotted line for the expected or remaining route.*

Q10 Is / was your route today similar to your usual route when you visit here for [*insert given activity*]? *Tick closest answer, do not prompt. Single response only.*

Yes, normal

Much longer than normal

Much shorter than normal

Not sure / no typical visit

First visit
Q13 Could you name the one location you would have visited today for [*insert given activity*] if you could not visited here? *Do not prompt, tick closest answer.*
Not sure / Don't know
Nowhere / wouldn't have visited anywhere
Site Named [asked for site name]
Q22 What is your full home postcode? *This is an important piece of information, please make every effort to record full postcode correctly.*

Ecology Solutions 2012 basic demographic data

Ecology Solutions also carried out a visitor survey in 2012 on the Pebblebed Heaths for the purpose of mitigation of planned and proposed developments. The results are broadly similar to those of Footprint Ecology in some cases (e.g. proportion travelling by car; visit lengths), but differed in others (e.g. the overall predicted numbers of visitors was much higher than for Footprint Ecology, and the proportion of local visitors much lower) although there were some gaps in the Ecology Solutions data. Some data is included here as a comparison and because it supplements or complements that collected by Footprint Ecology (e.g. demographic data).

The proportion of visitors recorded as resident in Exmouth was 33.5% and in Exeter (EX5) was 15.1%. However, of those visitors who participated in the survey, only 47.7% provided their full postcode with 50.7% providing either a partial postcode (e.g. EX1) or named location (e.g. 'Exeter'). 1.6% did not state their postcode or give a location.

58.9% of visitors to the SPA / SAC live in the East Devon District. With an estimated population of 132,900, it was calculated that the proportion of people living in the East Devon District that visit the SPA / SAC per hour is 0.022%.

45.3% of respondents stated that they make a minimum of one visit per week to the SPA / SAC, with 19.7% visiting once a day and 13.1% visit once a month.

The majority of respondents (51.2%) visit the SPA / SAC for between half an hour and an hour, with 32.3% visiting for between one hour and three hours; and 15.1% visiting for under 30 minutes.

Of those individual respondents that participated in the survey 52.3% of respondents were male and 46.2% female (with 1.5% gender not recorded). The majority (47.4%) of visitors recorded[37] were aged between 41 and 65 years, 24.3% aged between 19 and 40 years, 15.9% of people over 65 and 12.4% under 18. The vast majority (83.2%) of visitors to the SPA / SAC stated that they live in a house, with 2.2% stating that they live in a flat.

[37] The age question was completed by the survey participant for the entire group they were visiting with that day.