Natural England Commissioned Report NECR233

Monitor of Engagement with the Natural Environment: developing a method to measure nature connection across the English population (adults and children)

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NATURAL ENGLAND

Acknowledgments:

This pilot was supported and delivered by an interdisciplinary Project Group drawn from the Strategic Research Groups for Learning in Natural Environments and for Outdoors for All and several of their strategic delivery partners. Data capture and analysis was commissioned from TNS.

Foreword

Natural England commission a range of reports from external contractors to provide evidence and advice to assist us in delivering our duties.

Background

The Monitor of Engagement with the Natural Environment Survey (MENE) was established in 2009 to provide a comprehensive dataset on people's relationship with the natural environment, capturing data from a representative sample of the English adult population on an annual basis, allowing trends to be monitored.

MENE asks questions on people's attitudes to the natural environment and about their participation in environmental activities, including their visits to natural environments. More recently, questions about children's visits to the natural environment have also been included in the survey (Hunt *et al*. 2016.)

Natural England commissioned the MENE survey and various analyses of the data to monitor changes in use of the natural environment over time, at a range of different spatial scales and for key groups within the population.

The results, including the findings from this study, are used by Natural England, its partners and data users to:

- Inform on-the-ground initiatives to help them link more closely to people's needs.
- Evaluate the impact and effectiveness of related policy and initiatives.
- Measure the impact of and inform policy relating to the natural environment.

In recent years there has been a growing interest, among the natural environment sector and the research community, in the relatively new but measurable construct of nature connection.

Strategic research groups with an interest in this area identified the need to better describe, monitor and report on levels of nature connection at a national scale, among the population of adults and children in England; so that information on nature connection could be assessed for its potential to complement insights already captured on people's relationship with the natural environment through surveys such as the Monitor of Engagement with the Natural Environment Survey.

A Project Group was established, with the partners funding and delivering a 1 year pilot project during 2015-16. The aim of this project was to develop and test a new measure for nature connection, one that is suitable for use on a national scale to monitor and report on levels of nature connection among adults and children.

The partners in the Project Group were Natural England, Historic England, members of the Strategic Research Groups for Learning in Natural Environments and Outdoors for All (the Department of Psychology, Canterbury Christ Church University; The European Centre for Environment and Human Health, University of Exeter; The Green Exercise Research Team, University of Essex; and The Nature Connectedness Research Group, University of Derby) and strategic delivery sector partners (National Trust, RSPB, The Wildlife Trusts.)

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Key words – nature connection, nature connectedness, national, natural environment, wellbeing, pro-environmental attitudes, behaviours, health, adults, children, visits

Further information
This report can be downloaded from the Natural England Access to Evidence Catalogue: **http://publications.naturalengland.org.uk/** . For information on Natural England publications contact the Natural England Enquiry Service on 0300 060 3900 or e-mail **enquiries@naturalengland.org.uk** or **MENE@naturalengland.org.uk**

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1 Executive Summary

Context

The Monitor of Engagement with the Natural Environment Survey (MENE) was established in 2009 to provide a comprehensive dataset on people's relationship with the natural environment, capturing data from a representative sample of the English adult population on an annual basis, allowing trends to be monitored. MENE asks questions on people's attitudes to the natural environment and about their participation in environmental activities, including their visits to natural environments. More recently, questions about children's visits to the natural environment have also been included in the survey (Hunt et al. 2016.)

MENE data enables Natural England, its partners and data users to (taken from Natural England Joint Report, 2015):

- Understand how people use, enjoy and are motivated to protect the natural environment.
- Monitor changes in use of the natural environment over time, at a range of different spatial scales and for key groups within the population.
- Inform on-the-ground initiatives to help them link more closely to people's needs.
- Evaluate the impact and effectiveness of related policy and initiatives.
- Measure the impact of and inform policy relating to the natural environment.

The relatively new construct of nature connectedness or nature connection encompasses a person's subjective sense of their relationship with the natural world. A growing body of evidence suggests a positive association between nature connection (rather than exposure to or contact with nature) and outcomes such as wellbeing and pro-environmental behaviours. Recent summaries of this evidence can be found in an Evidence Briefing on Connection to Nature (Natural England, 2016), recent papers (e.g. Richardson et al., 2016), and a report of the Nature Connections 2016 Conference (Lumber et al, 2017).

Gaining a better understanding of the relationships between nature connection, wellbeing and pro-environmental attitudes and behaviours is very relevant to the development of policy and practice in this area.

The Strategic Research Groups with an interest in this area, and the recent Nature Connections Conference 2016 (Lumber et al., 2017) identified several research priorities, including the need to be able monitor and report on nature connection at a national level, to complement information already gathered on the scale and scope of people's attitudes and behaviours to the natural environment via the Monitor of Engagement with the Natural Environment Survey. Existing measurement scales for nature connection were reviewed, with the conclusion that none were suitable for use in a national survey context with both adults and children. The pilot project described in this report looked to address this by

developing and testing a new measure for nature connection, that could potentially be used to describe, monitor and report on levels of nature connection at a national scale, among the population of adults and children in England.

Purpose of the pilot

The pilot set out to:

- Develop a method for quantifying and reporting on the proportion of the English population at different levels of nature connection.
- Identify characteristics that were related to different levels of nature connection.
- Identify implications for future research and intervention.

It was important for data on nature connection to be collected in a way that enabled analysis against the measures of environmental attitude and behaviour captured by MENE.

Key findings

Development of a simple Nature Connection Index

- A review of existing nature connection scales and literature was used to develop a simple set of 6 statement questions for use with both adults and children.
- The question set was focused on measuring the affective and experiential aspects of nature connection (the affective aspects relate to people's emotional response to nature.) The scale did not set out to measure cognitive aspects of nature connection, as evidence suggests that it is the affective elements that are more likely to be important in relationships between nature connection and wellbeing.
- Responses to the question set were reported as a Nature Connection Index (NCI). A high correlation between the NCI and existing measures of nature connection was used to confirm that the NCI was measuring the construct of nature connection.
- The TNS omnibus survey was used as the vehicle to test the new statement question set. Sampling was carried out in four survey waves (quarterly across one survey year 2015-2016, and alongside MENE questions.) The sample size delivered nationally representative samples of adults and children (aged 7 to 15), and allowed analysis against demographics and environmental attitudes and behaviours.
- The NCI could differentiate levels of nature connection among the population. Results were expressed as a weighted points index (0-100), which allowed reporting on the proportion and characteristics of the population falling within different levels or bandings, and comparison of the characteristics of populations with highest and lowest levels of nature connection.
- The pilot focused on capturing general levels of nature connection in a national survey context. However, initial testing in other contexts by partners during the pilot suggested

that the NCI might also serve as a possible measure of nature connection in other applications, such as evaluating impact of interventions. (Use in other contexts would require an additional phase of piloting to fully test and inform use of the Index.)
- A working model, informed by evidence, was developed by the Project Group to guide its thinking. The model suggests how enabling nature connection may support the delivery of positive outcomes, such as wellbeing.

Wellbeing

- **There was a moderate positive correlation between nature connection and an individual's general wellbeing** (correlation of 26%) (Using ONS' subjective wellbeing measure of an individual's feeling that the things they do in life are worthwhile.)

Attitudes and participation in activities

- **There was a moderate to good positive correlation between nature connection and all four measures relating to attitudes to the natural environment** (correlation range of 33-43%). (This was much stronger than the correlation found with any demographics measured.) People in the highest 20% of the Nature Connection Index distribution were more likely to agree strongly with statements on the importance of spending time out of doors, the importance of local green spaces, and personal concern over damage to the natural environment. This contrasts with other MENE studies that report only relatively weak positive correlation between visit frequency and these measures (Bradshaw et al 2017; White et al, in preparation).
- **There was a moderate positive correlation between nature connection and taking part in nature based activities** (correlation range 18-30%). For example, people in the highest 20% of the NCI distribution were more likely to take part in activities such as watching wildlife, looking at books about the natural world and looking at scenery. In contrast, people within the lowest 20% of the NCI distribution were less likely to do any of the activities listed.
- **There was a weak to moderate positive correlation between nature connection and taking part in pro-environmental activities** (correlation range 10-30%). For example, people within the upper 20% of the NCI distribution were more likely to report being actively involved, for example by making regular donations of time or money to environmental causes (through volunteering, donations and membership) and by encouraging other people to protect the environment.

Demographics

- **There was a weak positive relationship between nature connection and most of the demographics tested**, including ethnicity (correlation 3%) and socio-economic

group (correlation 10%). **The results do not suggest that demographics are irrelevant, rather that other factors are more relevant**. Further detailed analyses on a larger data set, including visit specific data, will be needed to better understand the relationships between nature connection and different demographic and cultural factors.
- **Nature connection did show a moderate positive correlation with age** (correlation 21%). Nature connection was lowest among 16-24 year olds and highest among 55-64 year olds. Notably, there was a strong relationship between levels of nature connection among children and adults in same household. This suggests the need to better understand, for example, the potential role that adults play in influencing nature connection in children, the role of childhood experiences in developing nature connection and on nature connection in later life, and whether the age-related differences seen are simply a result of normal childhood development or whether they indicate any underlying trends.

Visits to natural environments

- **There was a weak positive correlation between nature connection and visit frequency** (correlation 15%). As this study found moderate/good correlations between nature connection and pro- environmental attitude and behaviour measures, this result suggests the need to better understand the relationships between nature connection, contact with nature (as measured by visit frequency) and pro-environmental attitudes and behaviours. Understanding the relative importance and any differences between contact with nature and nature connection could be important to policy and practice in this area.
- **An initial analysis of patterns of visits over the last 7 days suggested there may be important differences related to the types of natural environment visited and types of visits.** These results highlight the importance of avoiding generalisations across different types of natural environments and visits in relation to nature connection.

Conclusions

The pilot has delivered, for the first time, a method for measuring and reporting on nature connection at a national level, in this case among both children and adults in England. Analysis in this pilot revealed that levels of nature connection among the adult population were positively correlated to people's environmental attitudes and behaviours, and to their general wellbeing. Furthermore, that the strength of these relationships appears to be stronger than those reported between visit frequency and some of these outcomes (Bradshaw et al., 2017; White et al., in preparation).

This suggests the need for further work to better understand the relationships between nature connection, visit frequency, wellbeing and pro-environmental attitudes and

behaviours; so that this information can be used to inform policy and practice to support outcomes for both people and the natural environment.
Further work is also needed to understand and guide how the index might be used and interpreted: for example, to inform how information on different levels of nature connection might be used to target and shape interventions, and to guide comparisons between different types and sets of data.

Meanwhile, the results of this pilot support a rationale for policy and practice to consider not only how often people visit the natural environment, but the emotional and experiential aspects of those experiences.

2 Background and approach: developing a method to measure nature connection in a national survey context

Context

'Reconnecting' people with the natural environment is at the heart of several policy areas to support delivery of outcomes for people and the environment, including Conservation 21 - Natural England's Conservation Strategy for the 21st Century.

The Monitor of Engagement with the Natural Environment Survey (MENE) was established in 2009 to provide a comprehensive dataset on people's relationship with the natural environment, capturing data from a representative sample of the English adult population on an annual basis, allowing trends to be monitored. MENE asks questions on people's attitudes to the natural environment and about their participation in environmental activities, including their visits to natural environments. More recently, questions about children's visits to the natural environment have also been included in the survey (Hunt et al. 2016.)

MENE data enables Natural England, its partners and data users to (taken from Natural England Joint Report, 2015):

- Understand how people use, enjoy and are motivated to protect the natural environment.
- Monitor changes in use of the natural environment over time, at a range of different spatial scales and for key groups within the population.
- Inform on-the-ground initiatives to help them link more closely to people's needs.
- Evaluate the impact and effectiveness of related policy and initiatives.
- Measure the impact of and inform policy relating to the natural environment.

The relatively new construct of nature connectedness or nature connection encompasses a person's subjective sense of their relationship with the natural world. A growing body of evidence suggests a positive association between nature connection (rather than exposure to or contact with nature) and outcomes such as wellbeing and pro-environmental behaviours, with some studies suggesting a moderating or mediating role. Useful summaries of this evidence can be found in an Evidence Briefing on Connection to Nature (Natural England, 2016), in recent papers (e.g. Richardson et al., 2016), and the report of the Nature Connections 2016 Conference (Lumber et al, 2017).

Gaining a better understanding of the relationships between nature connection, wellbeing and pro-environmental attitudes and behaviours is very relevant to the development of policy and practice in this area.

The Strategic Research Groups with an interest in this area, and the recent Nature Connections Conference 2016 (Lumber et al., 2017) identified several research priorities, including the need to be able to monitor and report on nature connection at a national level, to complement information already gathered on the scale and scope of people's attitudes and behaviours to the natural environment via the Monitor of Engagement with the Natural Environment Survey. Existing measurement scales for nature connection were reviewed, with the conclusion that none were suitable for use in a national survey context with both adults and children. The pilot project described in this report looked to address this by developing and testing a new measure for nature connection, that could potentially be used to describe, monitor and report on levels of nature connection at a national scale, among the population of adults and children in England.

Overview of pilot project

This pilot was delivered over an 18-month period (during 2014 – 2016) to respond to the research need identified by the Strategic Research Groups for Learning in the Natural Environment and Outdoors for All. The pilot was supported and delivered by a Project Group of partners drawn from research and delivery organisations with expertise in this area.

The Project Group included:

- Natural England (project lead)
- Historic England
- Members of the Strategic Research Groups for Learning in Natural Environments and Outdoors for All:
    - The Department of Psychology, Canterbury Christ Church University.
    - The European Centre for Environment and Human Health, University of Exeter
    - The Green Exercise Research Team, University of Essex
    - The Nature Connectedness Research Group, University of Derby,
- Members of the associated groups of strategic delivery sector partners:
    - National Trust
    - RSPB
    - The Wildlife Trusts
- TNS (responsible for delivery of the data collection and analysis)

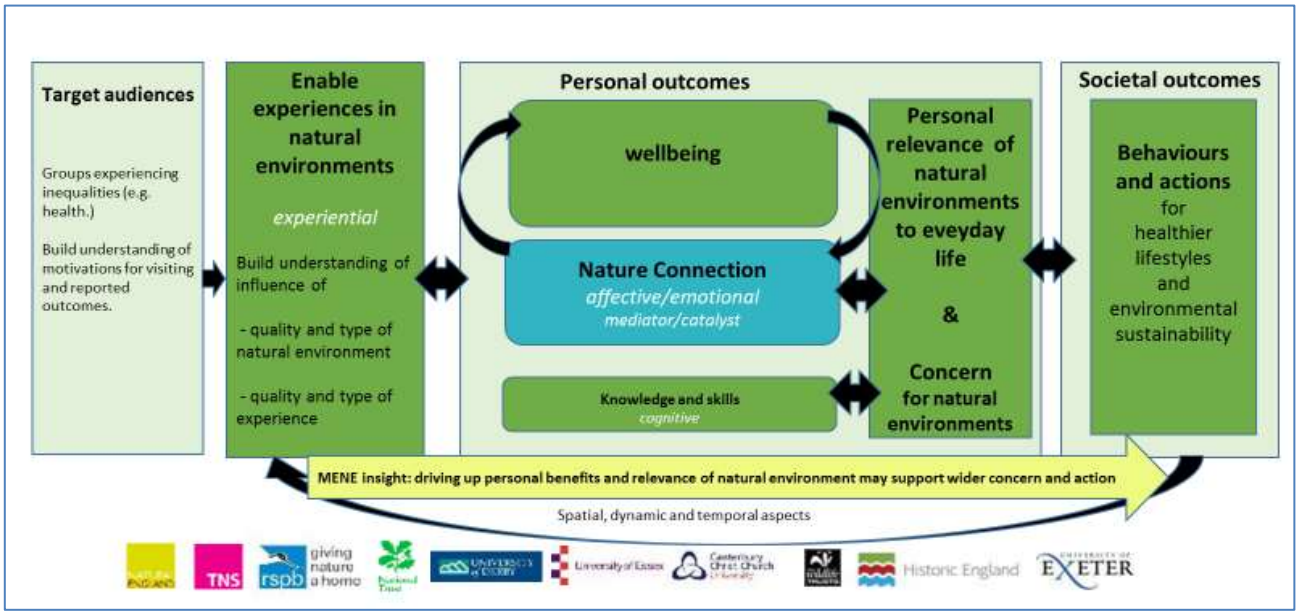
The objectives of the pilot were to:

- Develop a method for quantifying and reporting on the proportion of the English population at different levels of nature connection.
- Identify characteristics that were related to different levels of nature connection.
- Identify implications for future research and intervention.

Scoping phase:

- The Project Group used their understanding of the literature, including evidence from MENE, to develop a simple working model to guide their thinking (see diagram 1.) The model reflects evidence that outcomes for health and environment can be delivered through both contact with nature and nature connection, but that nature connection may play an important role in mediating or moderating outcome delivery. The model also drew on evidence that the affective aspects of nature connection are the most likely to be involved in mediation or moderation of outcomes.
- The Project Group brought extensive experience of using existing nature connection scales and methods for measuring nature connection. Their review of these confirmed that none were suitable for use in a national survey context with adults and children, as they were either too long, too complex or did not put enough focus on the affective elements of nature connection. The conclusion was that a new measurement scale or question set was needed to allow data to be captured and to assess whether this information would be useful in informing policy and practice for reconnecting people with the natural environment.
- It was important for the data on nature connection to be collected in a way that enabled analysis against the measures of environmental attitude and behaviour. The review identified that the TNS omnibus survey would be the most appropriate platform for the pilot as this is also the vehicle for the MENE survey. Inclusion of the new nature connection question set in this would allow analysis of the nature connection questions with other relevant questions and measures in the MENE question set and wider TNS omnibus survey.
- The project proposal and purpose was tested and confirmed with delegates at the Nature Connections Conference 2015, who came from a wide range of research and practice interests.
- A set of 6 new statement questions were developed and tested for use with both adults and children - see following sections for more detail.

Diagram 1: a working model, informed by evidence, to guide the pilot project approach



Data collection phase:

The MENE survey has run continuously since March 2009, providing statistically robust data on adult visits to the natural environment - including the frequency of visits taken, details of these visits, motivations and barriers for visits, and other related environmental behaviour and attitude measures. For further information please see MENE purpose and results. Similar information on visits to the natural environment by children was collected by MENE over the pilot period (Hunt et al., 2016.)

The MENE survey involves weekly waves of interviewing on an in-home Omnibus Survey with respondents asked about their general frequency of visits to natural environments over the last year and those taken in the seven days preceding the interview. In each wave, interviews are undertaken with a representative sample of the English adult population (aged 16 and over) with a sample of at least 800 achieved per wave. Interviews are undertaken in the homes of respondents.

Given the scale and coverage of MENE, the survey provided an ideal vehicle to pilot the new nature connection question set. This provided a proven, robust data collection approach and the opportunity to compare the results of the new question set against responses to other data collected in MENE, including visits to the natural environment, and other environmental behaviour and attitude measures.

As described in more detail below, the 6 nature connection questions were included in MENE interviews on a quarterly basis, in 4 survey waves during May 2015, August 2015, November 2015 and February 2016, each over a 5-day period during the last week of the month. The question set was asked towards the end of the existing MENE questionnaire. Exeter University funded the addition of the ONS standardised subjective wellbeing questions.

The Project Group met regularly over the course of the pilot to review data from individual waves and to agree any revisions needed, including adjustments to question wording and response scales. The Group also agreed the approach to weighting and analysing the data. Further information on methodology and implications are provided below.

During the pilot, the opportunity was taken to test the nature connection question set in a small number of other contexts, to test whether the scale had potential to assess nature connection in other applications. These included testing use as a pre- and post-intervention measure in a nature-based intervention context, and in a ‘non-nature’ based national survey context. This highlighted that the NCI may have potential as a simple measure of nature connection for use in other contexts, for example as a pre- and post-intervention nature connection measure (Hinds, Roberts and Camic, in preparation). This provides a strong

rationale for proper testing to guide and ensure future use of the scale in this sort of application would be appropriate.

Surveying adults and children

The question set was used with a sample of adult respondents and a sample of the children within these household (where permission was given and the children were available). As shown in Table 1, a total of 3,498 interviews were undertaken with adults and 456 with children.

Adults who were asked the NCI questions were then asked if they had any children aged between 7 and 15 in their household, and whether it would be possible for the child/children to also take part in a short survey interview. Permission from the child was also sought before undertaking the interview. (Interviewing children under 7 was beyond the scope of this pilot.)

To generate a sufficient sample of responses from children, the nature connection question set was also included in the wider TNS omnibus survey, this includes children of adults who were not included in MENE survey (MENE questions are normally only asked of half of the weekly omnibus sample). The size and make-up of the children's sample therefore restricted what could be done in terms of analysis of children's data from the pilot.

Feedback from interviewers

It was important to ensure the new questions were easily understood by all respondents, particularly the children.

Interviewers were asked to complete feedback forms on how well respondents appeared to understand the questions and to raise any issues from administering the survey.

No issues were raised and both interviewers and respondents reported that they understood the questions and clarification was rarely required. The low numbers of 'Don't Know' responses (<1% of respondents) suggests that the questions were well understood.

Choice of nature connection statement questions

A review of existing measurement scales for nature connection confirmed that they involve an extensive list of questions and would not be suitable for use with both adults and children. The aim of the pilot was to identify a simple set of questions that could capture enough information to reliably report levels of nature connection among English population (adults and children) but to also be easy enough to understand and short enough to avoid greatly increasing interview length. The Project Group aimed to identify one set of questions

suitable for both adults and children. The decision was made to create a set of positive statement questions, rather than a set of negative ones or a mix of negative and positive, for simplicity in surveying and reporting. The small number of statements used meant that there was no need to include a mix of positive and negative statements to reduce the incidence of acquiescent bias (when survey respondents are faced with a long list of statements and tend to mark all statements in the same way).

Affective connection appears to play an important role in people's engagement with the natural environment (Hinds & Sparks, 2008) and the bodies' affect regulation systems link through to people's health and wellbeing (Richardson, M., McEwan, K., Maratos, F., & Sheffield, D., 2016). So, the Project Group based question selection on people's affective and experiential relationship with nature, rather than cognitive appraisals of nature. An initial framework to inform broad themes for the questions within this context was provided by the nine values of biophilia (Kellert & Wilson, 1993), five of which, operationalized as emotion, meaning, ethics, contact and beauty, have been found to predict connection to nature (Lumber, Richardson & Sheffield, under review.) Further guidance, was provided by reviews of existing measures of nature connection (e.g. Bragg, Wood, Barton & Pretty, 2013).

The 6 affective statements identified were as follows:

I find beauty in nature

People are known to have a preference for aesthetically pleasing nature (Kaplan, 1987), and aesthetics is one of the nine values of biophilia proposed by Kellert & Wilson (1993). More recently, engagement with nature's beauty has been shown to mediate the relationship between nature connectedness and wellbeing (Zhang, Howell & Iyer, 2014); with an increasing sense of connection to nature leading to a greater appreciation of nature's beauty (Richardson & Hallam, 2013) and pro-nature conservation behaviours (Richardson, Cormack, McRobert, & Underhill, 2016). Further, engagement with nature's beauty has been found to underlie the relationship of emotion, meaning, contact and ethics to connection to nature (Lumber, Richardson & Sheffield, under review). Finally, although not addressed directly, beauty is a theme in existing measures, such as Cheng & Monroe (2010).

It's important to me to treat nature with respect

A connection to nature has been linked to pro-environmental attitudes (Davis, Le & Coy, 2011; Mayer & Frantz, 2004), and pro-environmental behaviour (Zelenski & Nisbet, 2012); with an individual's increasing sense of connection to nature leading to a greater understanding of human impact (Richardson & Hallam, 2013). Conservation of nature is captured within the moralistic value of biophilia (Kahn, 1997; Kellert, 1993) and an enduring ethic has been suggested to be associated with interconnectedness of non-human life and human sensibility (Wilson, 1992); a position that provides the foundation for Compassion Focussed Therapy (Gilbert, 2014). This aspect of connection to nature is included in existing measures, e.g. Nature Relatedness Scale for adults (Nisbet, Zelenski & Murphy, 2009). In framing this aspect suitably for children, the decision was taken to use the term 'respect'.

Being in nature makes me happy

An emotional attachment to nature is essential to a connection with nature (Mayer & Frantz, 2004), and such an attachment is captured in the humanistic value of Biophilia. An emotional connection to nature is associated with an individual's joy and happiness when spending time outdoors (Richardson & Hallam, 2013), which can be seen within the context of human neurophysiology (Richardson, McEwan, Maratos & Sheffield, 2016). Happiness has an affective component and is an emotional experience with a connection to nature being identified as a path to happiness (Zelenski & Nisbet, 2014), which impacts on health in a relationship mediated by nature connection (Richardson, Cormack, McRobert, & Underhill, 2016). Existing measures of nature connection include happiness, e.g. 'Being outdoors makes me happy' (Cheng & Monroe, 2010).

Spending time in nature is important to me

Research into people's connection to nature has placed an emphasis on direct experiences with nature that lead to the formation of an affective relationship (Beery & Wolf-Watz, 2014; Hinds & Sparks, 2008). Such contact and experiences of nature require time in it, and it is known that people who are more connected to nature spend a greater amount of time in nature; and that time in nature can promote or even amount to increased levels of nature connectedness (Nisbet, Zelenski & Murphy, 2011; Nisbet & Zelenski, 2011; Bragg, Wood and Barton, 2013). A desire to spend time in nature indicates its significance and meaning in a person's life. It is an aspect included in other nature connection measures, and 'Spending time in nature is important to me' is included in the Environmental Identity Scale (Clayton, 2003.)

I find being in nature amazing

Nature is known to be associated with positive feelings, such as wonder and awe (Hinds, 2011; Hinds & Sparks, 2011) and wonder is often noted in observations of everyday nature (Richardson, Hallam & Lumber, 2015). These represent emotional responses that are associated with a connection to nature (Zhang, Howell & Iyer, 2014); and enhancing connection with nature (Richardson & Hallam, 2013; White, 2012).

I feel part of nature

Connectedness to nature encompasses both affective and experiential sense of belonging to the natural world (Mayer & Frantz, 2004) and relates to a person's understanding of their interconnectedness with nature or their sense of inclusion in nature. It captures a breadth of concepts including cognitive appraisals, inclusion of self in nature, appreciation of nature and emotional affiliations (e.g. Davis, Green and Reed, 2009). Feeling part of nature is an overarching question that taps directly into this concept of humans occupying a shared place in the natural world, although an affective connection can be a more effective predictor of engaging with the natural environment than concepts of environmental identity (Hinds & Sparks, 2008). It is a concept included in several other measures of nature connection, although less directly.

Deciding nature connection statement wording and rating scale

As shown in Figure 1, and as described in detail below, the statement wording and rating scale options used were adjusted over the 4 survey waves in response to interim findings to optimise the performance of the scale, by minimizing skew and widening the standard deviation (spread or distribution) of responses across the sample.

During the 2nd and 3rd survey waves (August and November 2015), the sample was split into two similar sized groups to allow testing of 2 alternative statement question set options. (A random approach was taken to achieve this split and ensure a similar profile of respondents in each group.)

Table 1: Sample sizes by wave and split

	Wave 1 May 2015	Wave 2a August 2015	Wave 2b August 2015	Wave 3a November 2015	Wave 3b November 2015	Wave 4 February 2016	Total
Adults	884	442 (old)	459 (new)	409 (5pt)	443 (7pt)	861	3498
Children	134	70	67	62	52	71	456
- Core	78	45	40	36	36	55	290
- Boost	56	25	27	26	16	16	166

Figure 1: Questionnaire wording in the various waves

Statement wording used in Waves 1 and 2a:

A I find beauty in nature

B I treat nature with respect

C Being in nature makes me happy

D Spending time in nature is important to me

E I find being in nature amazing

F I feel part of nature

STATEMENT F ROTATED AS EITHER FIRST TO BE SHOWN OR LAST. ORDER OF OTHERS RANDOMISED

Statement wording revised for Waves 2b, 3 and 4:

A I always find beauty in nature

B I always treat nature with respect

C Being in nature makes me very happy

D Spending time in nature is very important to me

E I find being in nature really amazing

F I feel part of nature

Rating scale used in waves 1, 2a, 2b and 3a)

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

Rating scale used in waves 3b and 4)

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

The first wave of surveying returned responses to all six of the statements that were strongly skewed towards the 'agree' and 'strongly agree' options. Few respondents selected the 'neither agree nor disagree', 'disagree' or 'strongly disagree' answer options (see Wave 1 responses in Tables 2 and 3 below). The widest spread of answers was obtained for the statement 'I feel part of nature'. This was seen in both the adult and child sample.

Following a review of the data, it was agreed that to minimise skew and to optimise the standard deviation (spread or distribution) of responses, **the following changes should be made to the wording of the statements:**

- *'I find beauty in nature'* changed to *'I always find beauty in nature'*
- *'I treat nature with respect'* changed to *'I always treat nature with respect'*
- *'Being in nature makes me happy'* changed to '*Being in nature makes me very happy'*
- *'Spending time in nature is important to me'* changed *to 'Spending time in nature is very important to me'*
- *'I find being in nature is amazing'* changed to *'I find being in nature is really amazing'*
- *'I feel part of nature'* was not changed as it already delivered a relatively wide spread of answers.

To test the impact of the wording changes, in the second survey, half of the sample were surveyed using the original wording (labelled Wave 2a) and half were surveyed using the revised wording (labelled Wave 2b).

The responses obtained are shown in Tables 2 and 3. The change in wording appeared to have little or no impact on the standard deviation of the responses, especially amongst the adults.

Table 2: Responses to alternate statement wording Waves 1, 2a and 2b – Adults

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Wave 1 - I find beauty in nature	35%	59%	5%	1%	0%
Wave 2a - I find beauty in nature	36%	56%	8%	1%	0%
Wave 2b - I always find beauty in nature	37%	54%	6%	2%	0%
Wave 1 - I treat nature with respect	41%	55%	2%	0%	0%
Wave 2a - I treat nature with respect	43%	52%	4%	0%	0%
Wave 2b - I always treat nature with respect	44%	53%	2%	1%	0%
Wave 1 - Being in nature makes me happy	29%	60%	9%	1%	0%
Wave 2a - Being in nature makes me happy	31%	58%	10%	1%	0%
Wave 2b - Being in nature makes me very happy	36%	53%	9%	3%	0%
Wave 1 - Spending time in nature is important to me	30%	55%	11%	4%	0%
Wave 2a- Spending time in nature is important to me	29%	56%	12%	2%	0%
Wave 2b - Spending time in nature is very important to me	32%	53%	9%	6%	0%
Wave 1 - I find being in nature amazing	25%	56%	16%	3%	0%
Wave 2a - I find being in nature amazing	27%	53%	16%	4%	0%
Wave 2b -I find being in nature really amazing	30%	52%	13%	5%	0%
Wave 1 - I feel part of nature	17%	51%	23%	9%	0%
Wave 2a and 2b - I feel part of nature	19%	50%	19%	10%	0%

Table 3: Responses to alternate statement wording Waves 1, 2a and 2b – Children

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Wave 1 - I find beauty in nature	23%	60%	11%	5%	0%
Wave 2a - I find beauty in nature	25%	64%	6%	4%	1%
Wave 2b - I always find beauty in nature	20%	58%	12%	8%	2%
Wave 1 - I treat nature with respect	41%	56%	1%	1%	0%
Wave 2a - I treat nature with respect	38%	55%	4%	1%	1%
Wave 2b - I always treat nature with respect	38%	57%	5%	0%	0%
Wave 1 - Being in nature makes me happy	29%	60%	9%	2%	0%
Wave 2a - Being in nature makes me happy	26%	64%	9%	1%	0%
Wave2b -Being in nature makes me very happy	20%	69%	6%	5%	0%
Wave 1 - Spending time in nature is important to me	22%	60%	13%	4%	0%
Wave 2a - Spending time in nature is important to me	19%	64%	12%	4%	0%
Wave 2b - Spending time in nature is very important to me	17%	54%	20%	9%	0%
Wave 1 - I find being in nature amazing	21%	57%	13%	7%	0%
Wave 2a - I find being in nature amazing	29%	48%	16%	3%	1%
Wave 2b -I find being in nature really amazing	15%	63%	15%	6%	0%
Wave 2a and 2b - I feel part of nature	16%	54%	19%	11%	0%
Wave 2a and 2b - I feel part of nature	10%	60%	11%	13%	0%

As shown in Table 4, statistical analysis, comparing the responses obtained using the original and revised statement wording, also showed very little difference between the wording options in terms of the means, standard deviations and skewness of the measures.

Table 4: Statistical analysis/ comparison of original and revised statement wording

	Mean		Std. Error of Mean		Standard Deviation		Skewness	
	Wave 2a Original wording	Wave 2a Revised wording	Wave 2a Original wording	Wave 2a Revised wording	Wave 2a Original wording	Wave 2a Revised wording	Wave 2a Original wording	Wave 2a Revised wording
I find beauty in nature	4.27	4.28	0.017	0.031	0.616	0.664	-0.54	-0.79
I treat nature with respect	4.38	4.42	0.016	0.027	0.578	0.565	-0.60	-0.53
Being in nature makes me happy	4.18	4.22	0.018	0.033	0.648	0.712	-0.60	-0.79
Spending time in nature is important to me	4.12	4.11	0.020	0.038	0.738	0.806	-0.82	-0.92
I find being in nature amazing	4.03	4.07	0.021	0.038	0.753	0.814	-0.62	-0.87
I feel part of nature	3.77	3.76	0.023	0.044	0.848	0.927	-0.55	-0.57

Adjusting the rating scale

Results of the second survey wave highlighted that the impact of strengthening the statement wording was limited, so it was agreed an additional approach was also needed to obtain the desired differentiation and spread of responses.

For the third survey wave a **wider rating scale was tested**, with half of respondents asked to respond to the statements using the original five-point scale (labelled wave 3a) and the other half were asked to use an alternative seven-point version (labelled wave 3b).

The revised 'stronger' statement wording introduced in wave 2 was retained as it was felt likely that this wording, together with the wider rating scale, would be more likely to achieve the desired differentiation in responses:

5-point rating scale

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

7-point rating scale

1 2 3 4 5 6 7

Strongly Disagree ... Strongly Agree

The results obtained using the alternative scales are shown in Tables 5 and 6 below. Using the revised scale provided the desired greater spread of responses between answer options.

Table 5: Responses using original 5-point scale Wave 3a – Adults

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I always find beauty in nature	37%	52%	9%	1%	0%
I always treat nature with respect	45%	49%	5%	0%	0%
Being in nature makes me very happy	31%	55%	11%	3%	0%
Spending time in nature is very important to me	30%	50%	13%	6%	1%
I find being in nature really amazing	30%	49%	16%	5%	0%
I feel part of nature	20%	45%	23%	10%	1%

Table 6: Responses using revised 7-point scale Wave 3a – Adults

	Strongly agree - 7	6	5	4	3	2	Strongly disagree - 1
I always find beauty in nature	42%	26%	15%	10%	3%	2%	1%
I always treat nature with respect	53%	24%	15%	4%	2%	1%	1%
Being in nature makes me very happy	39%	27%	18%	9%	3%	2%	1%
Spending time in nature is very important to me	35%	23%	19%	10%	7%	3%	2%
I find being in nature really amazing	35%	26%	18%	14%	3%	3%	1%
I feel part of nature	22%	22%	21%	18%	9%	5%	3%

Statistical analysis confirmed that the 7-point rating scale provided a much higher level of variation than the original 5-point scale, after controlling for the wider range of scores (see Co-efficient of Variation metric in Table 7).

The statement “I feel part of nature” produced the lowest mean score and the widest spread of answers.

Table 7: Statistical analysis/ comparison of 7-point and 5-point scale responses

	7-point scale				5-point scale
	Mean	**Standard Deviation**	**Skewness**	**Co-efficient of Variation**	**Co-efficient of Variation (5 pt. scale)**
I always find beauty in nature	5.84	1.35	-1.25	23%	16%
I always treat nature with respect	6.20	1.12	-1.69	18%	13%
Being in nature makes me very happy	5.77	1.35	-1.14	23%	17%
Spending time in nature is very important to me	5.55	1.52	-1.00	27%	20%
I find being in nature really amazing	5.62	1.41	-0.93	25%	20%
I feel part of nature	5.07	1.62	-0.61	32%	25%
Average:	*5.68*	*1.39*		*25%*	*18%*

Recommendation from adjusting statement wording and rating scale

It was agreed that using the revised statement wording and 7-point scale answer options should be adopted as these provided the least skew and the best standard deviation (spread or distribution) of responses. This approach was used for the final fourth wave of sampling.

Testing statistical relationships between the six statement questions

A number of statistical analyses were used to understand relationships between the 6 statements, the relative importance of each statement and whether all of the statements were required in the final question set.

Internal consistency was measured using Cronbach's alpha, a statistic calculated from pairwise correlations between items.

This test showed that the 6 statements had very high internal consistency, suggesting that formed a coherent construct:

Cronbach's Alpha (Adult data)	Cronbach's Alpha (Children data)
0.918	0.899

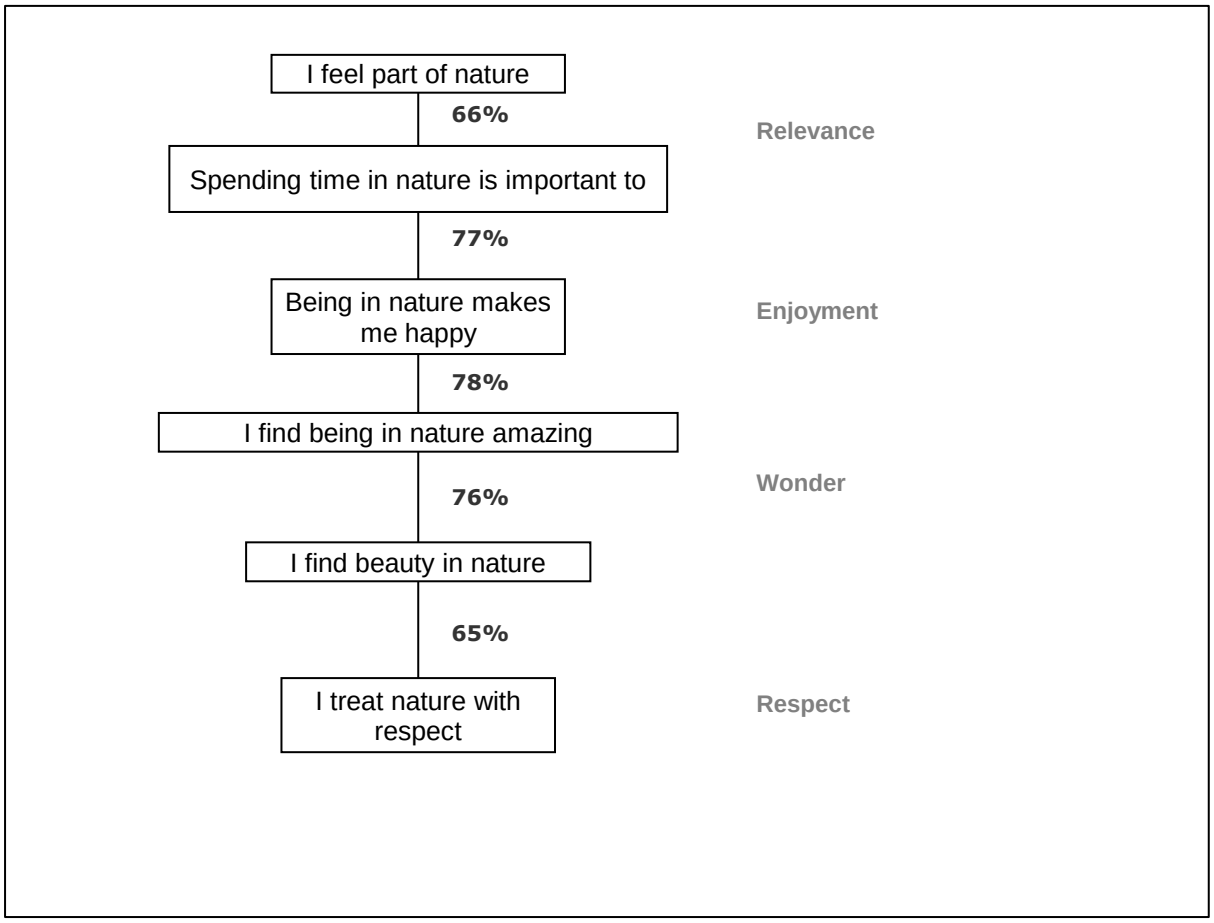
As shown in Table 8 an analysis of Inter-Item Correlation suggested that whilst internal consistency was high, the statement *"I feel a part of nature"* was the most divergent from the overall construct:

Table 8: Inter Item Correlation

Inter-Item Correlation Matrix	I find beauty in nature	I treat nature with respect	Being in nature makes me happy	Spending time in nature is important to me	I find being in nature amazing	I feel part of nature
I always find beauty in nature	100%	65%	77%	67%	76%	55%
I always treat nature with respect	65%	100%	66%	58%	61%	44%
Being in nature makes me very happy	77%	66%	100%	77%	78%	62%
Spending time in nature is very important to me	67%	58%	77%	100%	73%	66%
I find being in nature really amazing	76%	61%	78%	73%	100%	60%
I feel part of nature	55%	44%	62%	66%	60%	100%

Figure 2 displays the associations from the correlation matrix from this analysis. Items joined together have the strongest association with each other (with the pairwise correlation figure shown on the line) whereas items further apart had lower associations with each other. One interpretation of these results is that there are subtle differences in what each statement is measuring. (These appear to range from a fundamental sense of relationship with the natural world to more experiential and behavioural measures.)

Figure 2 - Associative Network Map: Inter-Item Correlation Matrix



Recommendations from looking at statistical relationships between the 6 statements

Based on the above analyses, it was agreed that all 6 of the statements should be retained within the scale. The statement *"I feel close to nature"* was found to be the most sensitive of the 6 statements, however it was agreed that a composite of the 6 statements would provide greater insight than using this statement alone. The 6 statements together appear to provide the required depth and detail required, whilst also being short and simple enough to add to surveys.

Confirming the statements are measuring nature connection

To confirm that the 6 new statement questions were measuring the recognised construct of nature connection, the questions were tested alongside existing nature connection measures in a number of contexts.

Of the existing measures, the Connection with Nature Scale (CNS) and Nature Relatedness Scale (NR) are the most frequently used, and so are often used to evaluate the reliability of newly created measures, such as the Love and Care for Nature Scale (Perkins, 2010). The

NR scale was thought to be particularly relevant to test against, as NR aims to measure an individual's general or 'trait' connection to nature, and the new scale aimed to capture levels of nature connection among the population.

All tests reported a good correlation between the new and existing measures, confirming that the new scale is a valid measure of the construct of nature connection. A lack of complete correlation is thought to reflect the fact that the new measure is focused on the affective elements of nature connection, and that it therefore does not duplicate any existing nature connection measurement scale.

As an example of the studies completed to enable comparison, c250 participants in research being conducted by the University of Derby were asked to complete the new 6 statement question set, plus CNS and NR6 measures (a subset of the NR scale). Results showed that the nature connection statement questions had a strong positive correlation with both the CNS (0.69) and NR6 (0.76) measures. The data was collected through two independent research studies. The first was obtained as part of a wider online survey administered through Qualtrics (an online survey software used by the University of Derby to securely collect survey data), which sampled 118 participants (age range 18-78) with a mean age of 38.76 (standard deviation = 15.32). The second study was also administered via Qualtrics, with participants recruited via social media including Facebook and Twitter. The study contributed 132 participants to the dataset (age range 18 to 65). Results showed that the nature connection statement questions had a strong positive correlation with both the CNS and NR6 measures, indicating that the new set is valid measure of nature connection. The reliability of the new set was also tested and found to be higher than that of both the CNS and NR6 measures.

NCI reliability could not be improved through the removal of any of the 6 questions. In addition, the 6 statement questions were tested to ensure there was not a full correlation with any existing MENE variables and to confirm that they were not simply duplicating any existing information gathered by MENE questions. The MENE question with the strongest correlation to the new question set was 'I feel close to nature' with a correlation of 31%.

Recommendation

The results suggest that the new 6 statement question set is both a valid and reliable measure of nature connection.

Presenting the results as an index

Once the 6 questions and the 7-point response rating scale had been agreed, focus turned to how best to treat and present the survey scores to provide data that would be of most use in meeting the objectives.

A number of possible options were considered by the Project Group, ranging from simply presenting the responses as mean scores out of 7, to more complex indexing approaches. Whilst simple averaging over 1-7 would be easy to apply and has some coherence with existing reporting approaches, an indexing approach was considered to have a number of advantages in this context as it would:

- allow for weighting of statements to reflect their relative importance
- be more likely to allow differentiation between different population groups, especially in the middle range
- be more likely to be in line with approach and expectations for a national measure
- be able to be applied in other contexts if supported by simple tools and user guides to help convert survey responses into the weighted index.

Construction of index

The following possible indexing options were tested before a final index approach was selected.

I – Unweighted Index

II – Weighted Index

III – Points Index

Unweighted Index

This was computed by applying the scores given in Table 9 to the responses to the 6 questions. (In cases where one or more of the 6 questions had not been answered, all question responses were excluded from the data.) Once the individual question scores had been calculated, a single index for all 6 statements was calculated by averaging the scores given to each question.

Table 9: Application of unweighted index to 7-point scale responses

Response		Index
1		0
2		16.7
3		33.3
4		50
5		66.7
6		83.3
7		100

Weighted Index

The second approach took the initial unweighted index method and developed it by assigning greater weight to different statement questions. This was to ensure appropriate representation of all 6 statement questions in the index calculation and to improve the sensitivity of the scale in discerning levels of connection

As shown in Table 10, the weighting was created to deliver lower mean scores and wider variation among the answers.

Table 10: Allocation of weights to statements based on mean scores and variance

	Inverse of 1-7 mean score	Variance	Sum of inverse of mean score and variance	Weight* (%)
I always find beauty in nature	1.16	1.81	2.97	15.0%
I always treat nature with respect	0.80	1.26	2.06	10.4%
Being in nature makes me very happy	1.23	1.83	3.06	15.5%
Spending time in nature is very important to me	1.45	2.30	3.75	19.0%
I find being in nature really amazing	1.38	1.98	3.36	17.0%
I feel part of nature	1.93	2.61	4.54	23.0%

*Weight reflects distribution of sum of inverse of mean score and variance e.g. 'I always find beauty in nature' = 2.97/(2.97+2.06+3.06+3.75+3.36+4.54)

Points Index

As above, the aim was to give the questions with more inherent variability in answer distribution more weight, and to stretch out the range of scores to reduce skew and low variance. So, a third option was tested, using a points system. This was scaled using the same relative weight of questions as above, but gave greater emphasis towards higher levels of agreement. This had the effect of weighting both across statements and within a statement:

Table 11: Application of points index to responses

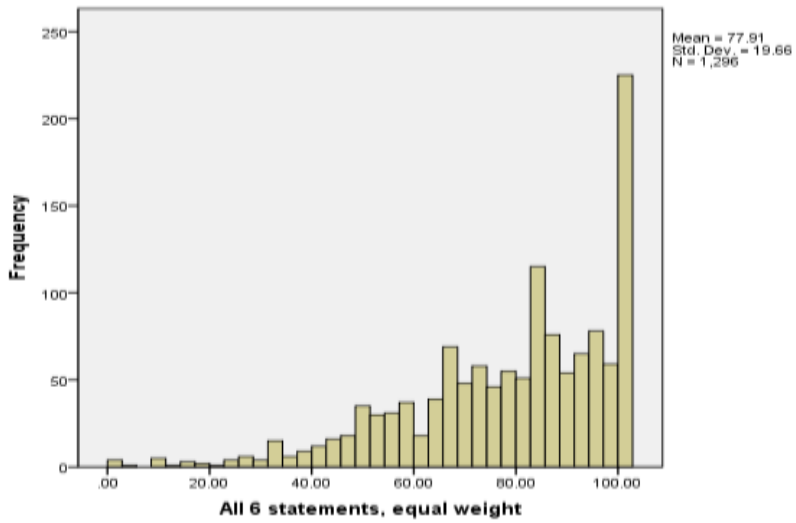
	Rating						
Statement	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I always find beauty in nature	0	1	2	3	5	9	15
I always treat nature with respect	0	0	1	2	4	6	10
Being in nature makes me very happy	0	1	2	3	6	10	16
Spending time in nature is very important to me	0	1	2	3	6	11	19
I find being in nature really amazing	0	1	2	3	6	10	17
I feel part of nature	0	1	2	4	7	13	23
Index	0						100

Comparison of distribution of results when applying each index solution

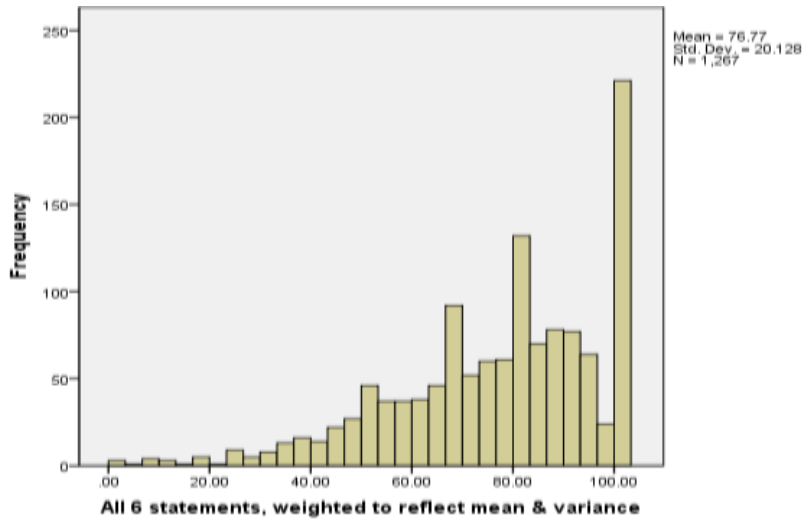
Comparing the results obtained across the three index options (Figure 3), the points index version produced the most evenly distributed Index. (The spike at the end in all graphs reflecting the 17% of people who selected the top rating for all 6 statements.)

Figure 3: Comparison of potential index solutions

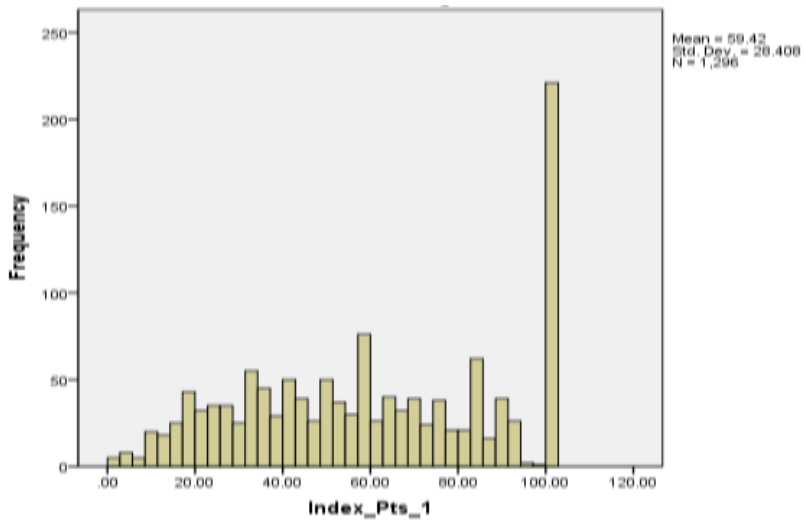
Unweighted index



Weighted index



Points index



A limitation of this approach is that Parametric descriptive statistics were used which assume a Normal Distribution. Whilst the underlying distribution does not quite conform to these assumptions, the Project Group felt this should not fundamentally affect the findings or conclusions of the descriptive statistics.

Recommendations

Although application of a points index approach is marginally more complicated that other options, it provided the best distribution of responses. So, the Points Index approach was used for all subsequent analysis.

The name proposed for the new points index measure is the Nature Connection Index (NCI).

3 Analysis of Nature connection Index against other variables

Having developed and agreed an approach to collecting and presenting the data as a points index, an analysis was undertaken to understand the relationships between the Nature Connection Index (NCI) and other variables captured by the TNS omnibus survey and MENE.

Key results are presented below and are based on the 1,304 interviews conducted with adults and 123 interviews conducted with children during waves 3b and 4 of the pilot (i.e. when the 7-point scale and revised statement question wording were both in place).

Relationships between NCI and other measures

Statistical analyses were undertaken to measure the correlation between the NCI and several behavioural or attitudinal variables captured by MENE. This included questions on the following themes, several of which represent multiple questions asked in the survey:

- Concern with diversity loss (MENE Question 2)
- Frequency of visiting green spaces (MENE Q17)
- Frequency undertake exercise (MENE Q21)
- ONS Wellbeing measures (4 attributes, MENE Q23 to Q26)
- Positive outcomes of visits to natural environment (6 attributes, MENE QE1)
- Importance of nature/green spaces (4 attributes, MENE QE2)
- Participation in other nature related activities (MENE QE3)
- Participation in pro-environmental actions / activities (MENE QE4)
- Demographics – (TNS omnibus Qs on Gender, Age, Social Grade, Working Status, Ethnicity, Region of residence)

Overview of relationships:

For the purposes of this report, the Group considered existing literature to suggest that a correlation of 40% or above was used as the benchmark for a good correlation, 20%-39% for a moderate correlation and less than 20% as a weak correlation.

The 10 individual variables most closely correlated to NCI are shown in Table 12 below. **NCI was found to be most strongly associated with measures of environmental attitudes - including the importance of spending time out of doors, concern about damage to the natural environment and the importance of having local green space close to where you live.**

NCI was also found to have a positive association with the ONS subjective general wellbeing measure (an individual's feeling that the things they do in life are worthwhile.)

The correlation between NCI and other variables was weaker. This included a weak correlation between NCI and frequency of visits to the natural environment during last 12 months (15%) and between NCI and most of demographics tested (ranging from 21% for age, 10% for both socio-economic group and presence of children in the home, and less than 10% for gender, ethnicity, working status and measures related to general health and disability).

Table 12: Correlation between NCI and other key MENE measures – top 10 strongest correlations (and against frequency of visits in last 12 months for comparison)

	Correlation with NCI
Spending time out of doors (including my own garden) is an important part of my life	43%`
I am concerned about damage to the natural environment	40%
Having open green spaces close to where I live is important	38%
There are many natural places I may never visit but I am glad they exist	33%
I felt close to nature (during recent visit)	31%
Take part in watching wildlife (including bird watching)	30%
Encourage other people to protect the environment	30%
Took time to appreciate my surroundings (during recent visit)	28%
Choose to walk through local parks or green spaces on my way to other places	27%
Extent feel that the things you do in your life are worthwhile	26%
Frequency of visits to natural environment in last 12 months	**15%**

In the tables and figures that follow, the correlation % between the variable (whether demographic, behavioural or attitudinal measure) and the NCI are stated in the heading.

Please note that the base sizes for some groups are very small, so these results should be treated as indicative only. Particularly small sample sizes are flagged *where under 50, and ** where under 25.

Variations by demographic

Age

There was a moderate positive correlation between NCI and age (21%)

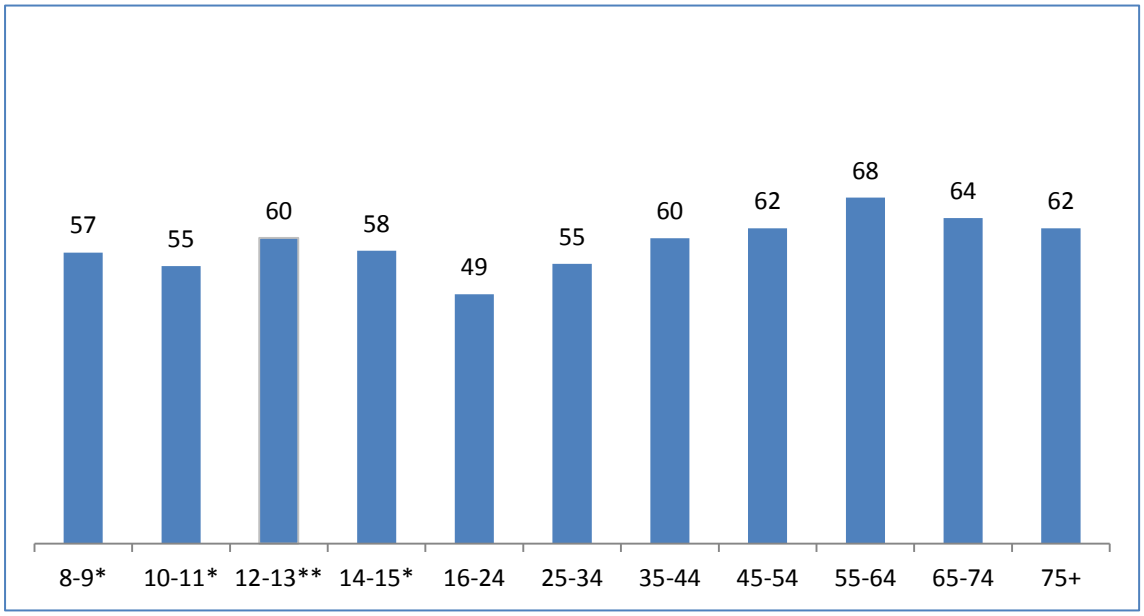
As shown in Figure 4, NCI appeared to be being lowest among the 16 to 24 age group and highest amongst the 55 to 64 age group.

Average NCI amongst adults (aged 16+) was 59

Average NCI amongst children (aged 8 to 15) was 57.

Figure 4: NCI by age (Adults & Children)

Correlation with NCI: 21%



* Sample under 50 **Sample under 25

Base sizes: 8-9 (26), 10-11 (28), 12-13 (15), 14-15 (23), 16-24 (217), 25-34 (223), 35-44 (197), 45-54 (164), 55-64 (161), 65-74 (179) 75+ (152)

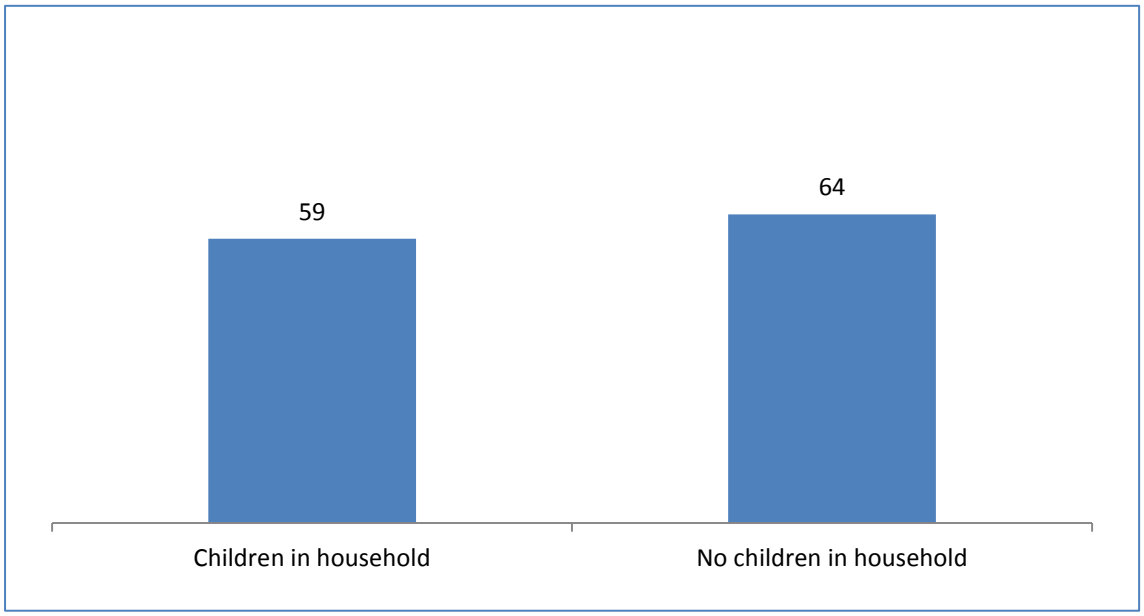
Going forward it will be important to do further work, for example, to understand the role of childhood experiences in developing nature connection, the role that this might play in supporting engagement with nature in later life, and whether the age-related differences seen result from normal childhood development stages or reflect any underlying trends of disconnection.

Presence of children in the household

There was only a very weak correlation between NCI and presence or absence of children in the household (4%), although NCI did appear slightly higher amongst adults with no children living in their household (this may also reflect differences related to age, as seen in Fig 4).

Figure 5: NCI by presence of children in household (Adults)

Correlation with NCI: 4%



Base sizes: Children in household (380), No children in household (914)

Comparison of NCI among children and adults within households

Table 13 shows that there was a moderate to good correlation between NCI responses provided by adults and children within the same household. This was particularly strong (56%) in relation to the statement ‘I feel part of nature’.

This suggests that relationships between adult and child responses should be considered and controlled for in future analyses.

On average, the adults provided significantly higher responses to the statement relating to treating nature with respect, which may reflect elements of social desirability or the complexity of this concept for children.

Children typically reported a higher sense of "wonder “.

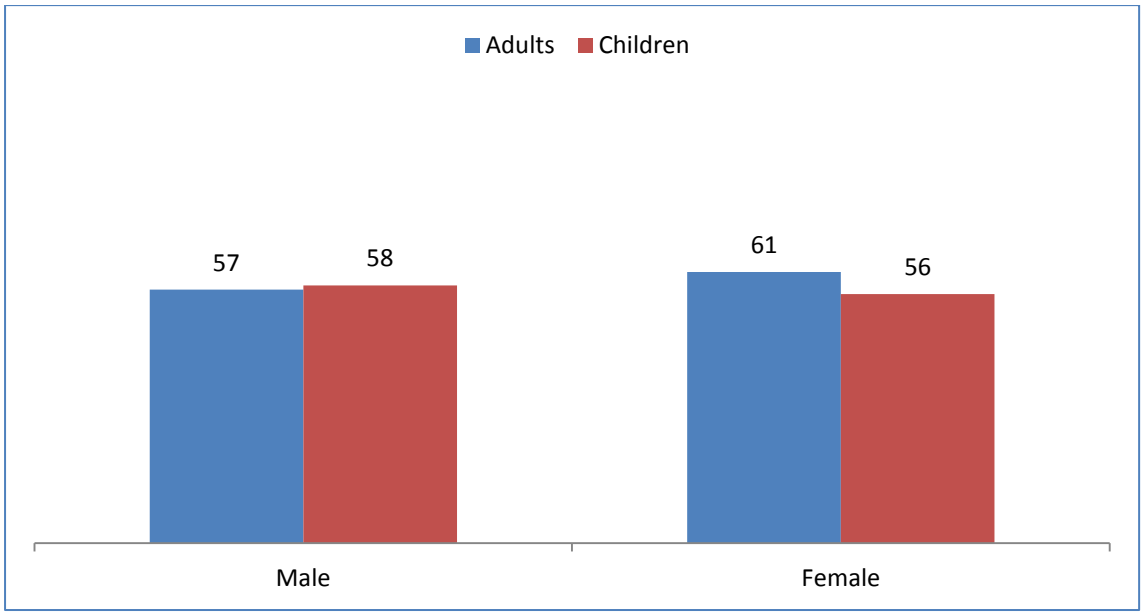
Table 13: Comparisons and correlations between adults and children in same household

	Adults	Children	Difference	Sig. (2-tailed)	Correlation between adults & children in same household
I always find beauty in nature	6.11	5.92	0.19	0.32	36%
I always treat nature with respect	6.30	5.97	0.33	0.05	37%
Being in nature makes me very happy	5.92	6.08	-0.16	0.42	27%
Spending time in nature is very important to me	5.59	5.50	0.09	0.68	33%
I find being in nature really amazing	5.79	6.11	-0.32	0.10	37%
I feel part of nature	5.18	5.43	-0.25	0.22	56%

Gender

As shown in Figure 6, there was only a weak correlation between NCI and gender (8%), and no significant difference in average NCI between males and females (within both the adult and child sample.)

Figure 6: NCI by gender (Adults & Children)
Correlation with NCI: 8%

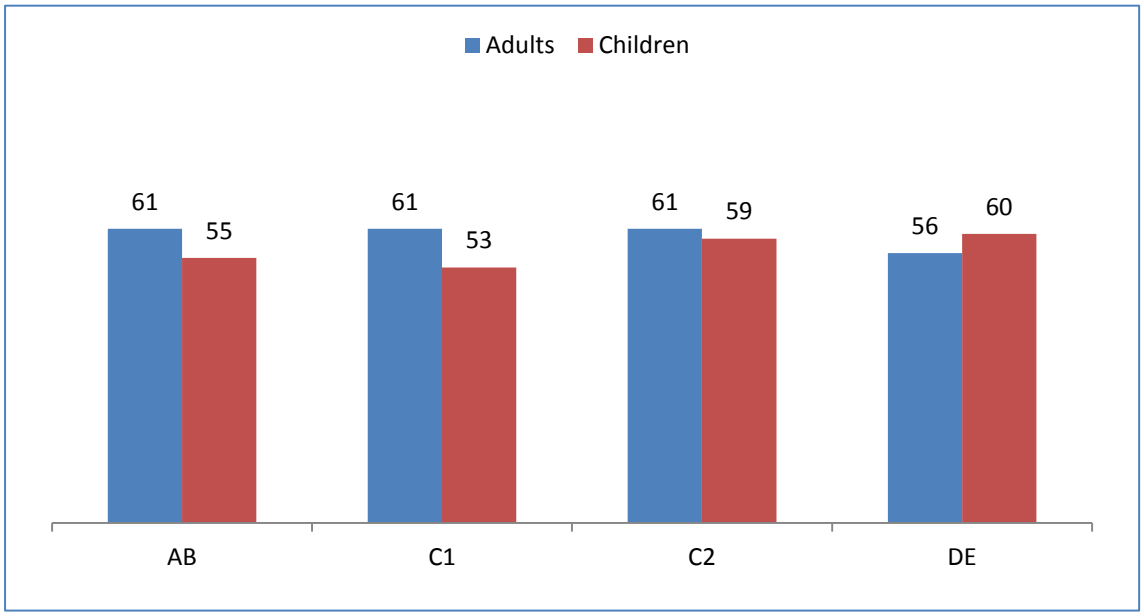


Base sizes: Adults: Male (619), Female (674)/ Children: Male (50), Female (60)

Social economic group and working status

There was little variation in NCI by socio-economic group 10% (among adults or children). In the adult group, NCI was marginally lower (statistically significant) among the socio-economic group DE, but this pattern was not seen for children.

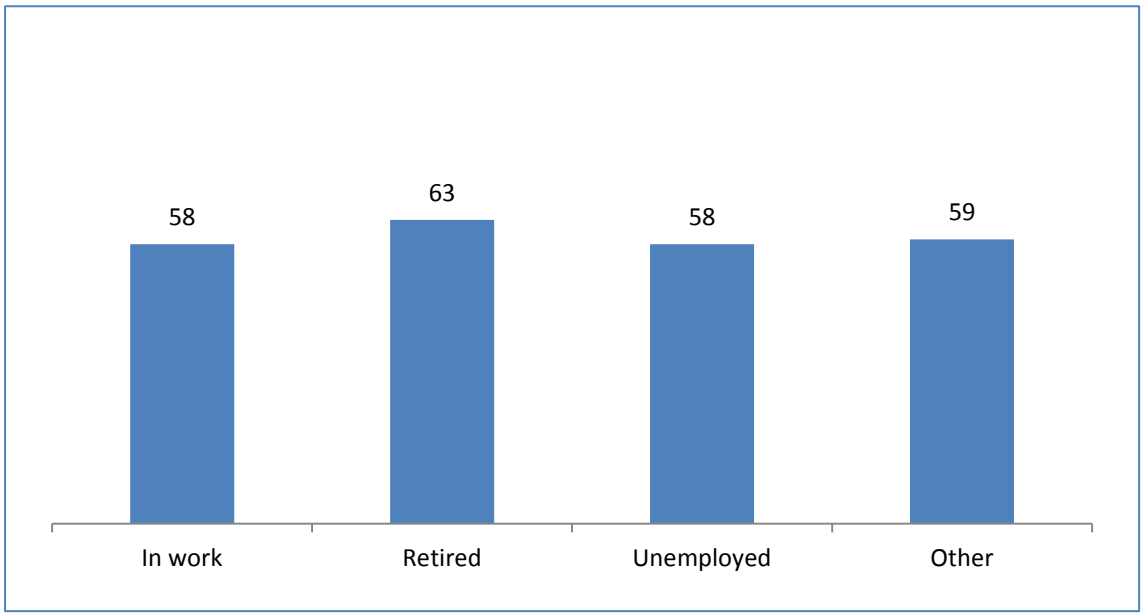
Figure 7: NCI by socio-economic group (Adults & Children)
Correlation with NCI: 10%



* Sample under 50 **Sample under 25
Base sizes: Adults: AB (241), C1 (351), C2 (254), DE (447) / Children: AB (29), C1 (21), C2 (30), DE (30)

Similarly, there was only a weak correlation (7%) between NCI and the working status of adult respondents. The slightly higher NCI among retired people may reflect the higher NCI seen among the older age groups (see Figure 4).

Figure 8: NCI by working status (Adults)
Correlation with NCI: 7%

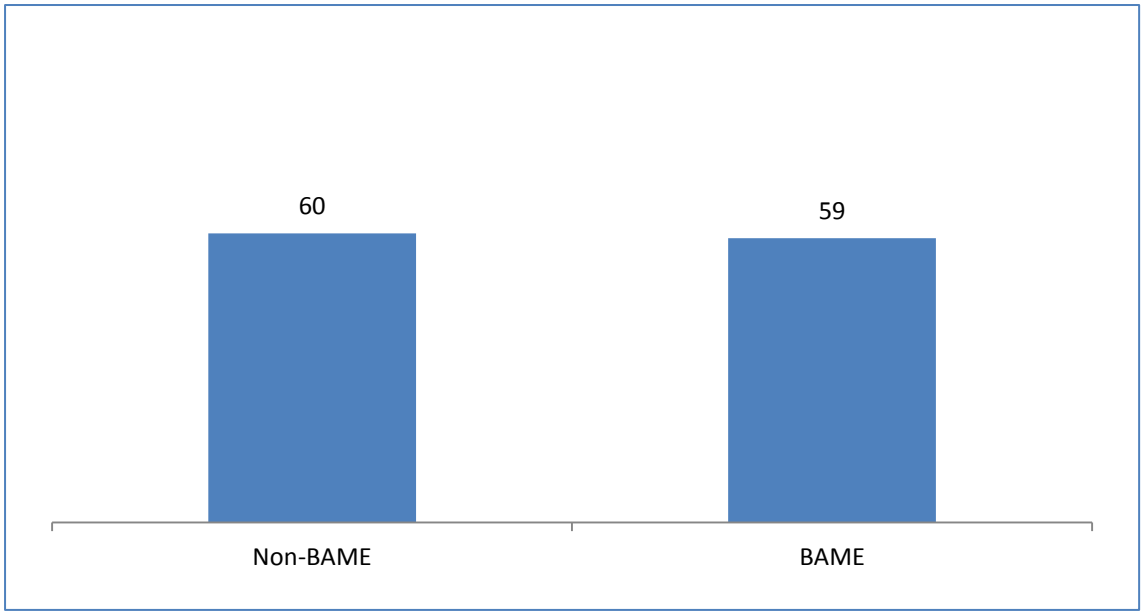


Base sizes: In work (569), Retired (367), Unemployed (79), Other (278)

Ethnicity

There was no significant difference between average NCI related to ethnicity (BAME compared to Non-BAME). The correlation between NCI and ethnicity was the weakest of all the variables tested (3%), suggesting very little or no relationship between a person's ethnicity and their nature connection among the population in England.

Figure 9: NCI by ethnicity (Adults)
Correlation with NCI: 3%



Base sizes: Non-BAME (1,077), BAME (204)

The results shown in Figures 8 and 9 do not suggest that ethnicity or SEG are irrelevant, rather that other factors (when taken in isolation) were more strongly related to nature connection than ethnicity and SEG among a representative sample of the English population.

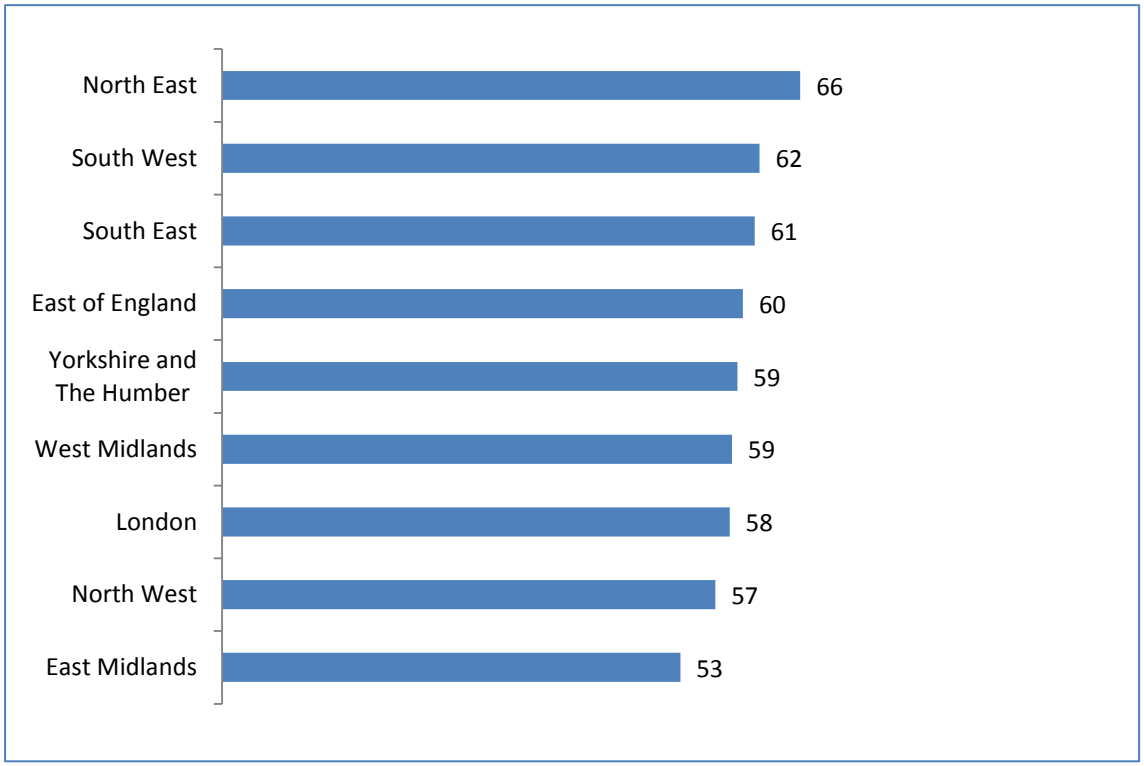
MENE consistently reports a strong relationship between visit frequency and ethnicity and with socio-economic group, so it was expected to see lower NCI among these groups. However, this was not the case. Rather, this study found only weak correlations between ethnicity and NCI, between socio-economic group and NCI, and between NCI and visit frequency. The findings support the need to better understand the differences between nature connection and visit frequency and thee relative strength of their relationships with demographics, and the implications this might have for intervention planning with different communities. This requires more detailed multifactor analysis on a larger data set to account for confounding factors and to better understand any differences that may exist between the different cultural groups within the very broad definition of BAME and non-BAME populations used by MENE.

Variations by region and place of residence

In general, Figure 10 shows there was a weak correlation between NCI and region of residence (4%).

Figure 10: Connection to nature index by region of residence (Adults)

Correlation with NCI: 4%



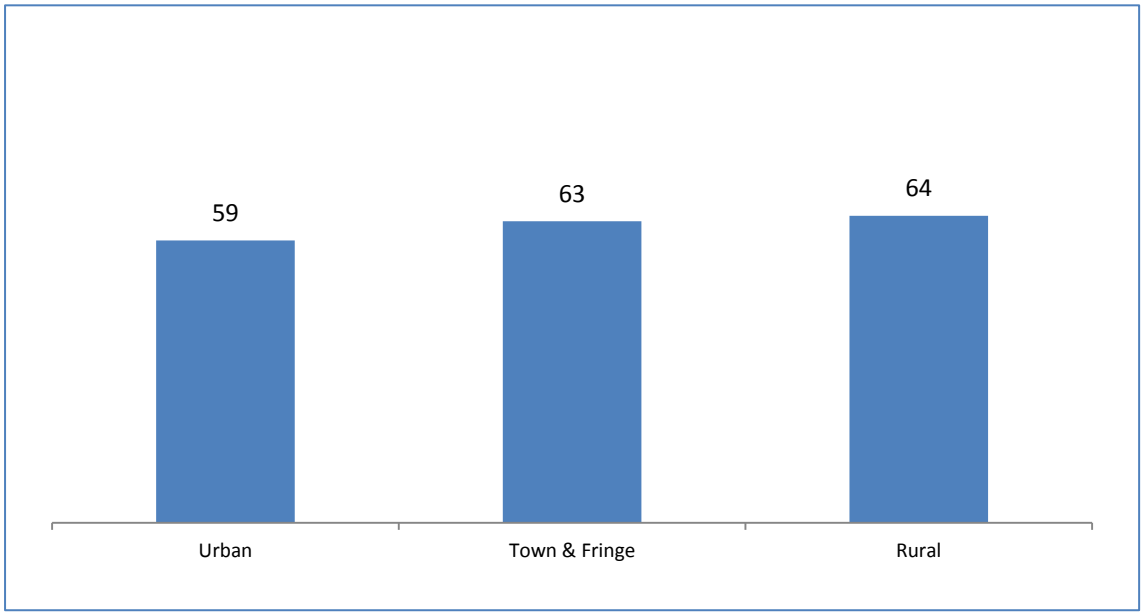
Base sizes: East Midlands (100), North West (170), London (203), West Midlands (146), Yorkshire & the Humber (105), East of England (135), South East (235), South West (128), North East (54)

Variations by urban-rural residence

When place of residence was profiled using the ONS rural-urban classification, NCI was slightly higher amongst residents of rural and fringe areas than amongst those living in areas classed as urban, however due to the sample sizes this should be treated with caution (Figure 11.) Going forward it would be useful to explore this in more detail, with consideration to the scale and scope of environments close to where people live, accounting for other potential confounding factors.

Figure 11: NCI by place of residence classified using ONS rural-urban classification (Adults)

Correlation with NCI: 6%



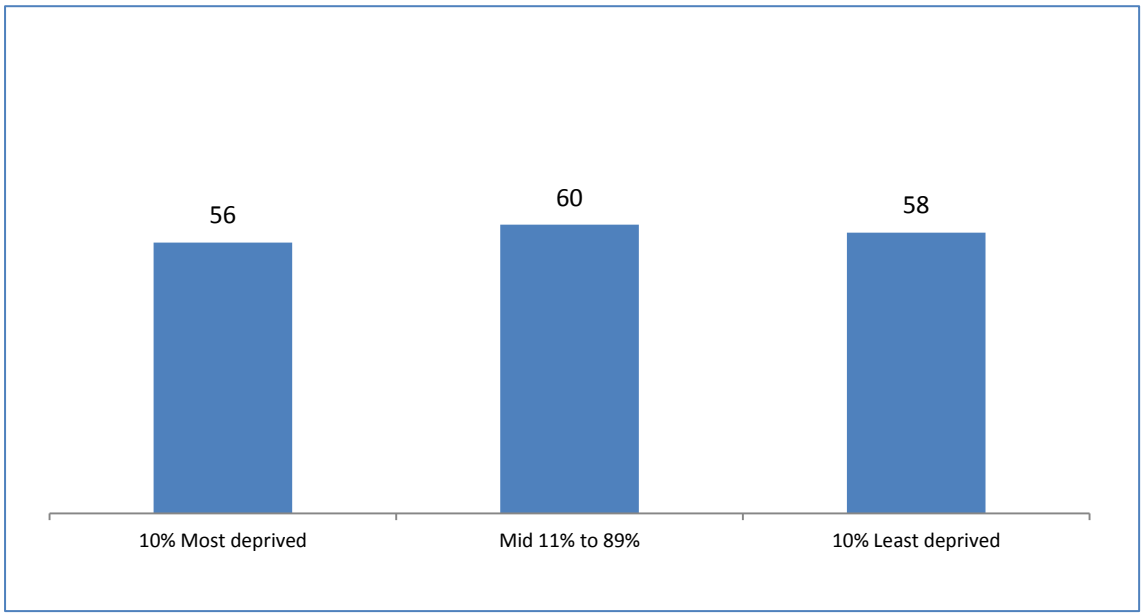
Base sizes: Urban (1,093), Town & Fringe (117), Rural (75)

Variations by Index of Multiple Deprivation

When place of residence was classified using the Index of Multiple Deprivation, there was no significant difference in NCI between those living in the most and least deprived areas. This finding reflects those relating to socio-economic group and working status.

Figure 12: NCI by place of residence classified using IMD (Adults)

Correlation with NCI: 7%



Base sizes: 10% Most Deprived (177), Mid 11% to 89%(1,016), 10% Least Deprived (92)

Conclusions on variations by demographics:

These findings suggest that other factors are more strongly linked to nature connection than demographic factors; however, they suggest the need for further detailed analysis on a larger data set to account for confounding factors and to properly understand the relationships between nature connection and demographics, including age, region of residence, socio-economic group, cultural grouping and the types of environment around where people live.

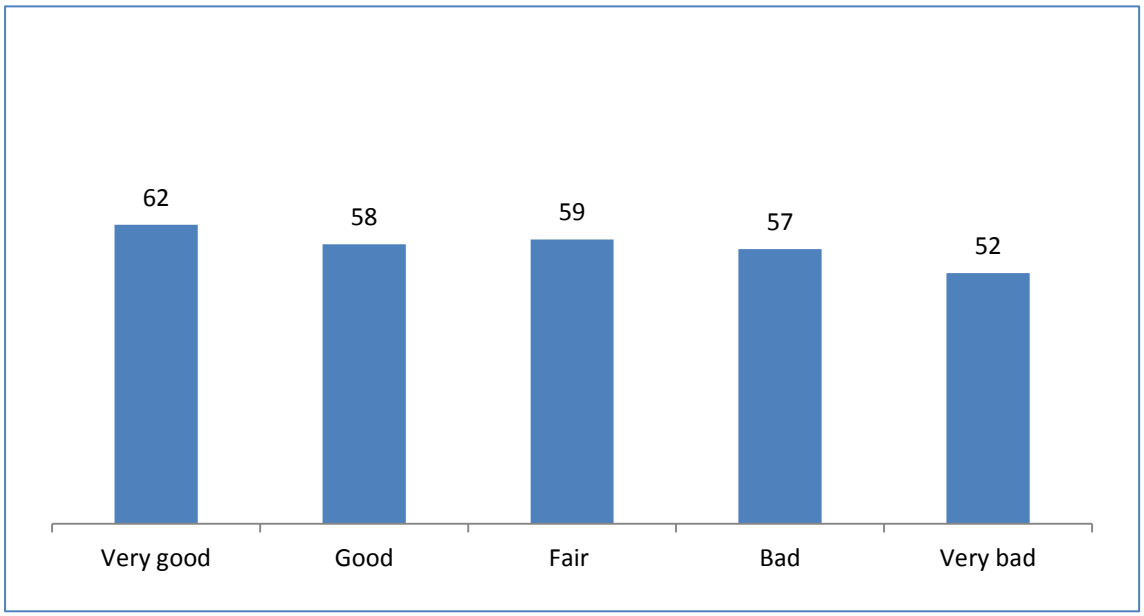
Variations by health and wellbeing

Variation by general health

Analysis was undertaken to compare average NCI in relation to how survey participants stated that they felt about their health is in general (Figure 13) and whether they had any long-term illnesses or disabilities (Figure 14).

As illustrated below, there was a very weak correlation to general health (4%). NCI did appear to be higher amongst those reporting good health than bad health, although the differences are relatively small. This may be worth revisiting on a larger data set (not least as the 'very bad health' sample was very small in this case.)

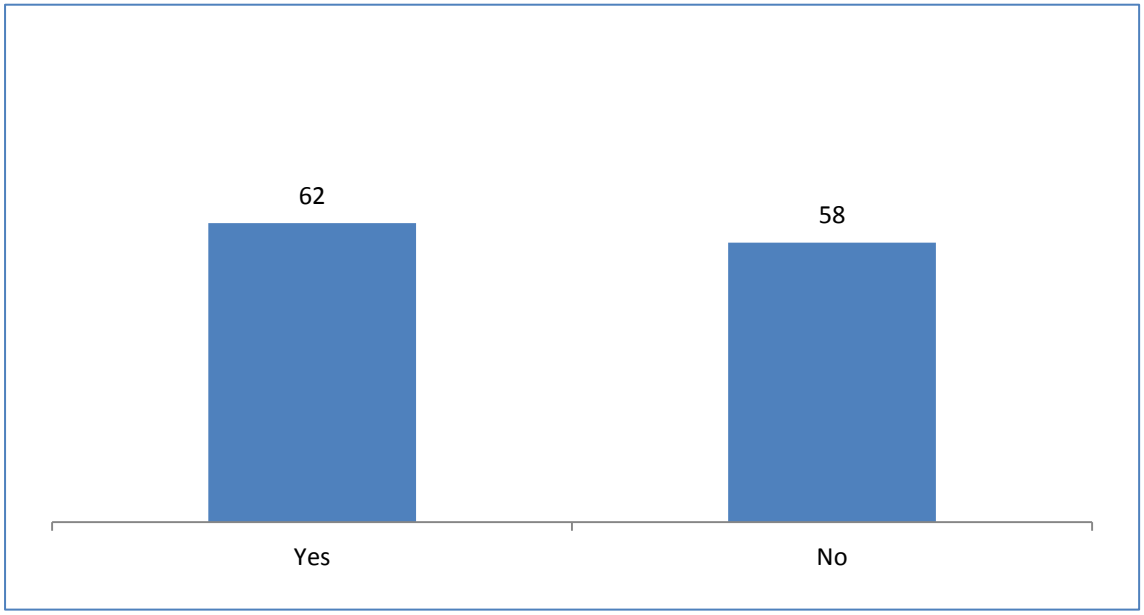
Figure 13: Connection to nature index by general health (Adults)
Correlation with NCI: 4%



* Sample under 50 **Sample under 25
Base sizes: Very good (372), Good (566), Fair (264), Bad (77), Very bad (13)

There was also no significant difference in NCI amongst those who report living with or without a long-term illness or disability.

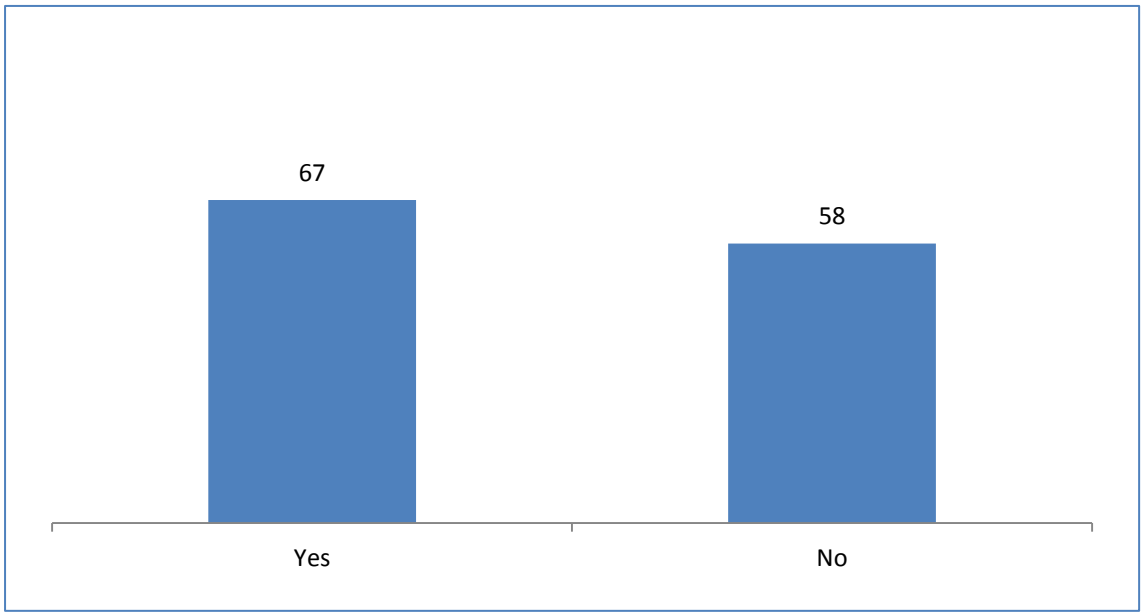
Figure 14: Connection to nature index by long term illness or disability (Adults)
Correlation with NCI: 6%



Base sizes: Long term illness or disability (309), No long-term illness or disability (984)

As shown in Figure 15 below, there was a weak relationship between NCI and whether visits had been taken a visit to the natural environment for health or exercise reasons (the measure used in the Public Health Outcomes Framework Indicator 1.16). However, NCI was higher in the group who answered yes to this question, so this may warrant further investigation.

Figure 15: Connection to nature index Public Health Outcomes Framework (PHOF) Indicator 1.16 "I visited nature for health and exercise reasons." (Adults)
Correlation with NCI: 11%



Base sizes: Yes (visited nature for health and exercise reasons) (202), No (did not visit nature for health and exercise reasons) (1,092)

Variation by wellbeing

The team at the University of Exeter supported the inclusion of the 4 ONS standardised wellbeing questions in MENE, and for providing access to this data for the purposes of this pilot. There were positive correlations between NCI and participant's responses to 3 of the 4 the ONS wellbeing questions. The strongest of these (26%) was seen between NCI and the trait based 'eudaimonic' wellbeing question "*do you feel that the things you do in your life are worthwhile?"* Whilst it is not possible to draw detailed conclusions on the relationships between wellbeing and nature connection from this analysis, the findings are in line with other evidence that suggests that nature connection has a relationship with wellbeing and may play a role in mediating or moderating wellbeing outcomes.

(Colleagues on the Project Group at the University of Exeter are continuing to investigate the extent to which general levels or 'trait' nature connection moderates the effects of nature visits on visitor wellbeing; and the extent to which current 'state' nature connection mediates the relationship between nature visits and visitor well-being, across a range of visit setting and circumstances. Further detailed analysis will be published.)

Table 14: NCI by wellbeing (Adults)

	3	4	5	6	7	8	9	10	Correlation to NCI
Overall how satisfied are you with life nowadays?	53**	50*	54	57	58	58	64	67	16%
Base:	14	31	131	128	224	346	160	228	
Overall, how happy did you feel yesterday?	51*	51	57	53	58	56	64	70	17%
Base:	28	55	133	97	170	298	191	258	
Overall to what extent do you feel that the things you do in your life are worthwhile?	41**	42*	51	53	56	59	63	71	26%
Base:	20	26	117	106	238	315	177	273	
	10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	
On a scale where nought is not at all anxious and 10 is completely anxious, overall how anxious did you feel yesterday?	64*	54**	64*	63	57*	57	51	49	-5%
Base:	26	22	43	58	40	114	59	75	

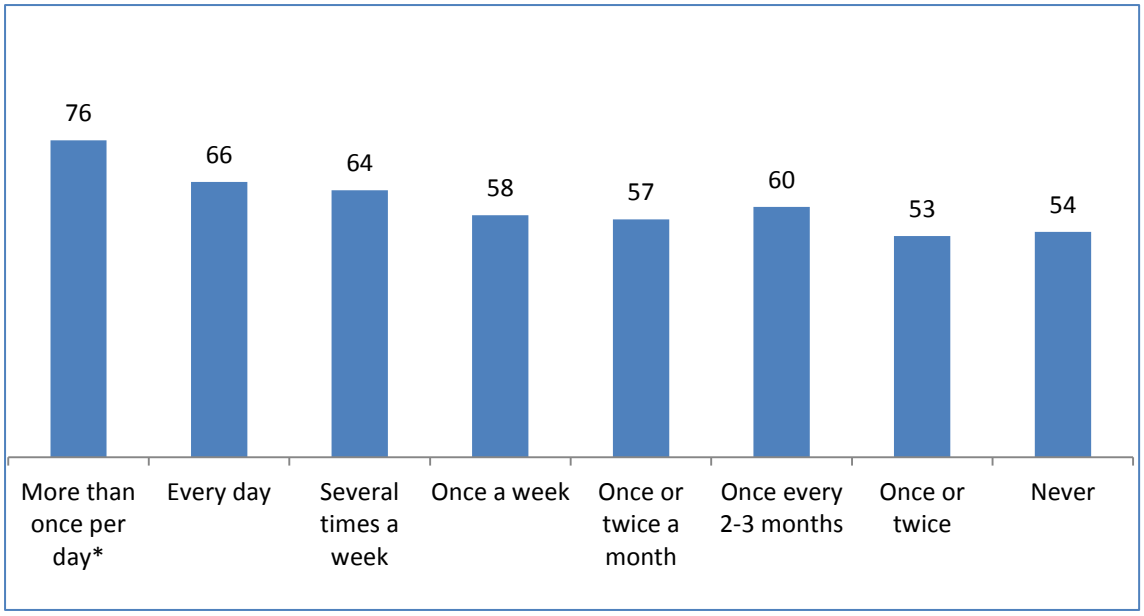
* Sample under 50 **Sample under 25, the most negative responses were not included in table due to small sample sizes.

Variations by frequency of visits to the natural environment in the last 12 months

Figure 16 illustrates the average NCI in relation to general frequency of taking visits to the natural environment over the last 12 months.

As mentioned previously, the correlation between these two measures is relatively weak (15%). NCI was notably higher amongst those who visited most frequently (more than once a day) however the sample size for this group was small.

Figure 16: NCI by frequency of visits to the natural environment in last 12 months (Adults)
Correlation with NCI: 15%



* Sample under 50
Base sizes: More than once per day (38), Every day (114), Several times a week (274), Once a week (285), Once or twice a month (273), Once every 2-3 months (77), Once or twice (90), Never (142)

This contrasts to the stronger relationships seen between NCI and environmental attitude and behaviour measures (discussed below.)
A comparison of NCI and visit frequency, in terms of their relative strengths of relationship with other measures was beyond the scope of this pilot project. However, an initial exploratory analysis was carried out and is mentioned in more detail at the end of section 3 and in Appendix 3. The results of this suggested the need for further analysis.

Variation by places visited and outcomes

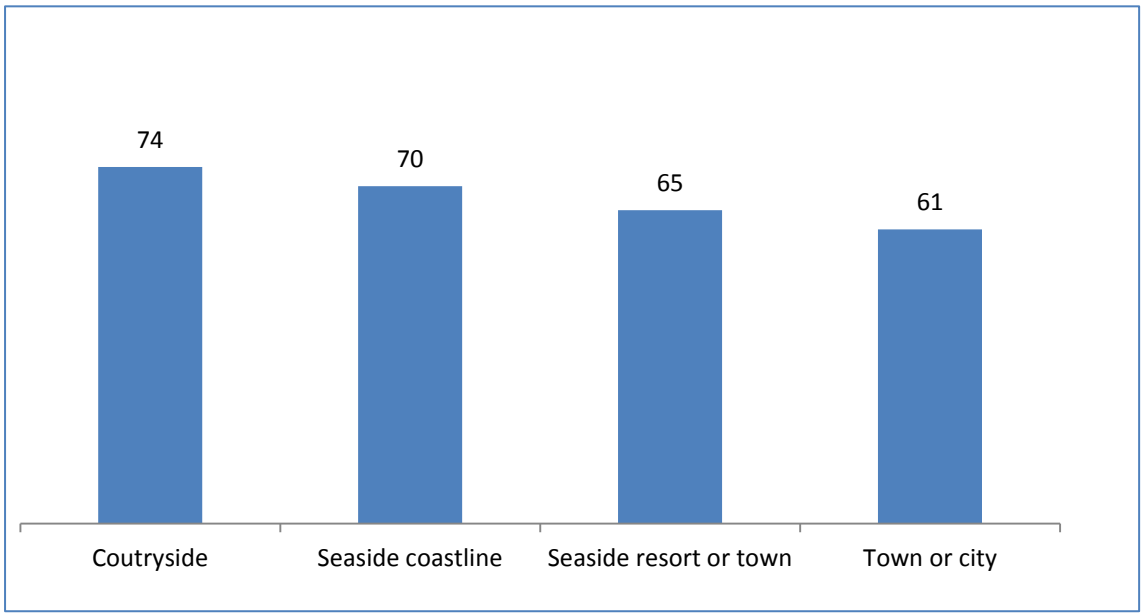
Exploring the data collected on specific visits taken during the last 7 days was beyond the scope of this pilot.

However, an initial analysis did indicate a moderate positive correlation between NCI and the types of place visited over the last 7 days (21%) and the reported outcomes of these visits (range 16-31%).

Figure 17 shows that, on average, people who had visited a coastline or countryside location in the last 7 days recorded a higher NCI than those who had visited a green space in a town or city or a seaside resort or town. This should be treated with caution as it could simply be reflecting the profile of people making these visits and their reasons for making visits.

However, this result is in line with other emerging evidence, so warrants further research on the impact of different types of natural environment on nature connection and conversely on the levels of nature connection in determining choice of visit location.

Figure 17: NCI by type of place visited on most recent visit to natural environment (adults, visited in last 7 days)
Correlation with NCI: 21%



A stronger variation was apparent when NCI was analysed against the reported outcomes of visits.

Correlation was strongest amongst those who reported taking time to appreciate their surroundings during a visit and amongst those who reported feeling close to nature. Again, this suggests the need for further research to understand the relationships between NCI and the type of visit experience, including motivations for the visit and reported outcomes of visits.

Table 18: NCI by potential positive outcomes of visits to natural environment (adults, visited in last 7 days)

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Correlation with NCI
I took time to appreciate my surroundings	n/a	50	52	63	77	28%
Base:	5	36*	42*	255	104	
I enjoyed it	n/a	n/a	n/a	60	70	16%
Base:	1	4	9	236	192	
I felt close to nature	n/a	57	49	66	78	31%
Base:	8	61	64	209	100	
It made me feel calm and relaxed	n/a	54	53	63	73	22%
Base:	1	24*	35*	258	124	

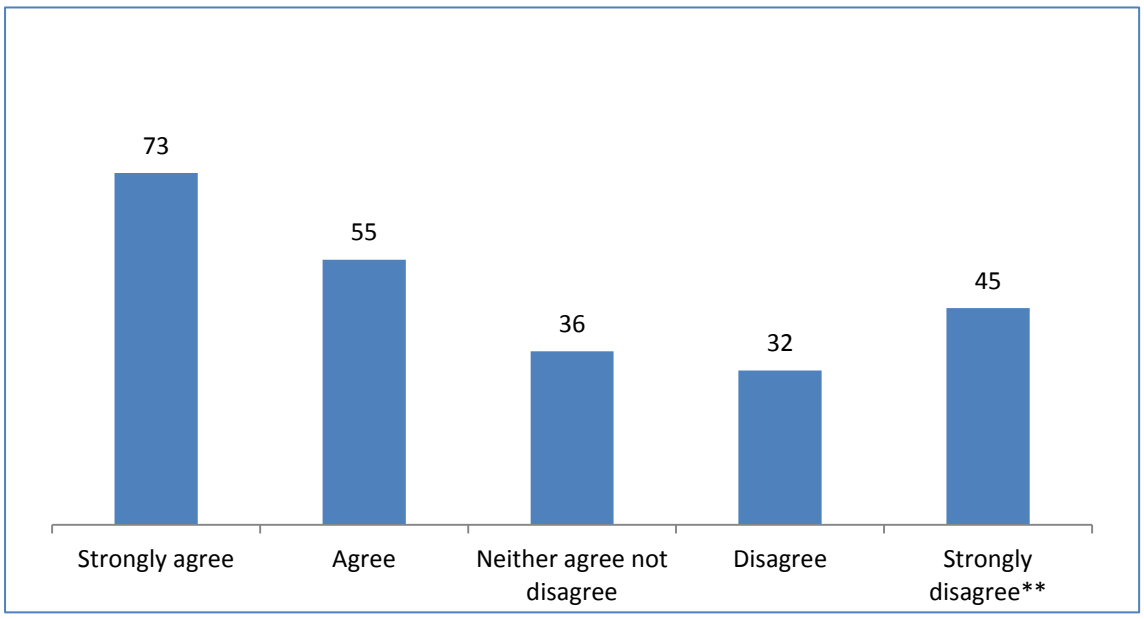
* Sample under 50

Variations by attitudes to the natural environment

The correlation between NCI and measures of attitude to the natural environment was much stronger (range 33-43%) than the correlation between NCI and demographic measures. For example, figures 18 to 21 illustrate that those people with a higher NCI were also more likely to agree strongly with statements regarding the importance of spending time out of doors, the importance of local green spaces, and personal concern over damage to the natural environment.

Figure 18: NCI by agreement with "*Spending time out of doors (including my own garden) is an important part of my life" (Adults)*

Correlation with NCI: 43%

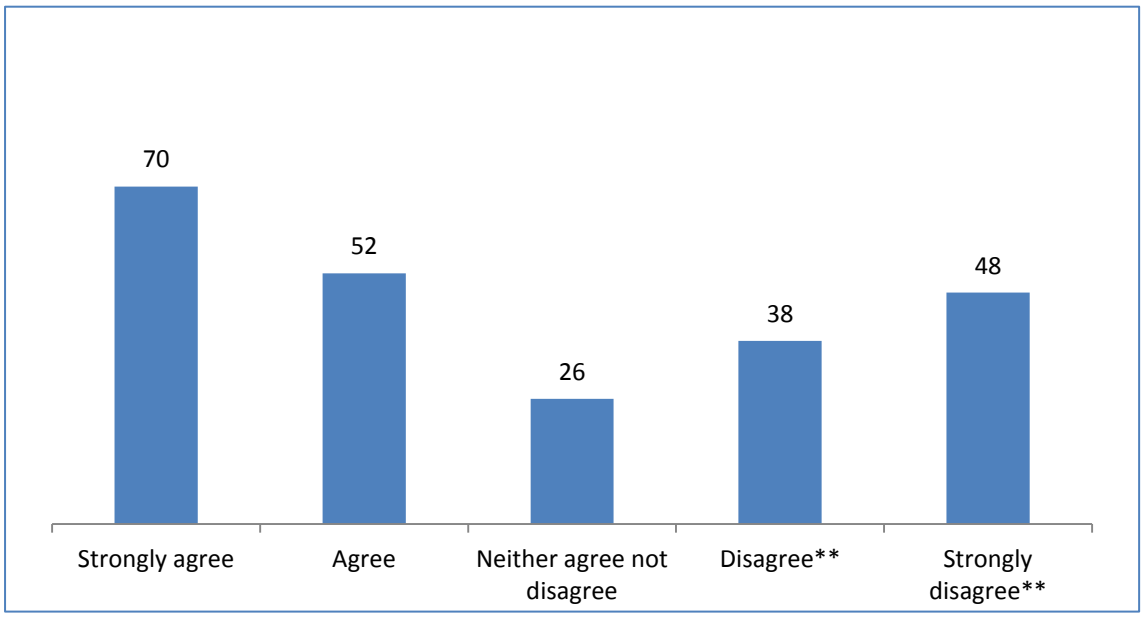


* Sample under 50 **Sample under 25

Base sizes: Strongly agree (501), Agree (607), Neither agree nor disagree (114), Disagree (57), Strongly disagree (14)

Figure 19: NCI by agreement with statement "*Having open green spaces close to where I live is important" (Adults)*

Correlation with NCI: 38%

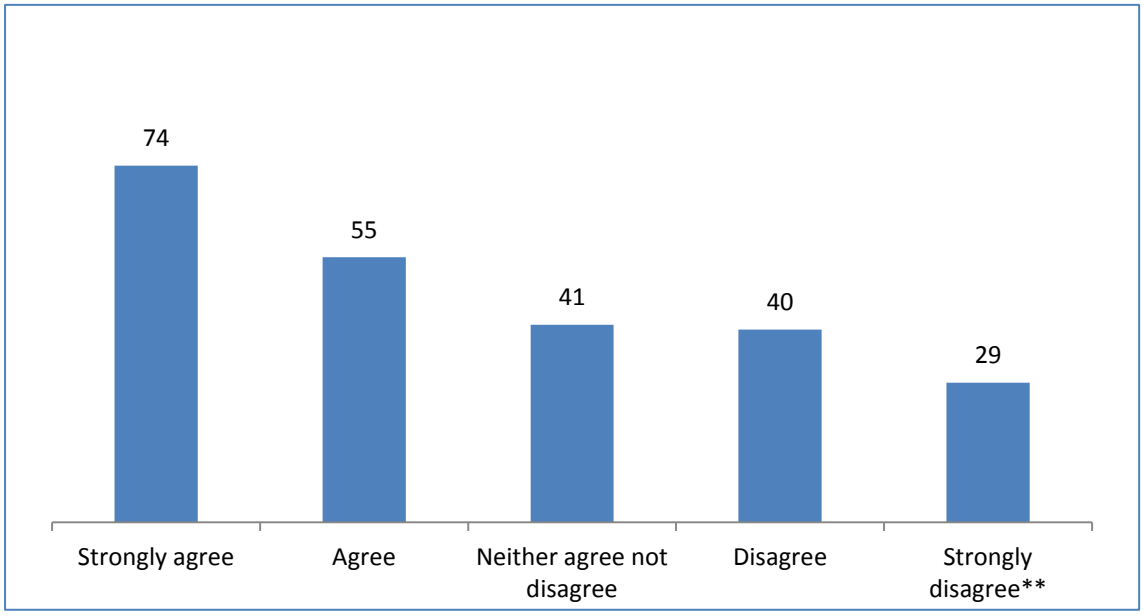


Sample under 50 **Sample under 25

Base sizes: Strongly agree (615), Agree (593), Neither agree nor disagree (59), Disagree (20), Strongly disagree (6)

Figure 20: NCI by agreement with statement "*I am concerned about damage to the natural environment" (Adults)*

Correlation with NCI: 40%

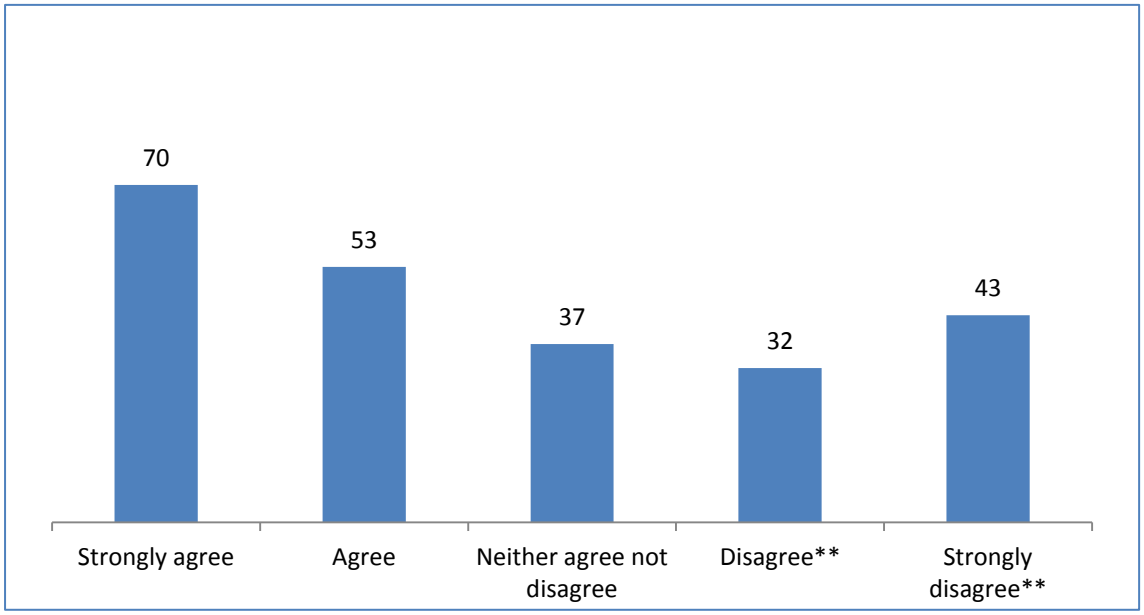


* Sample under 50 **Sample under 25

Base sizes: Strongly agree (435), Agree (682), Neither agree nor disagree (113), Disagree (52), Strongly disagree (11)

Figure 21: NCI by agreement with statement "*There are many natural places I may never visit but I am glad they exist" (Adults)*

Correlation with NCI: 33%



* Sample under 50 **Sample under 25

Base sizes: Strongly agree (547), Agree (677), Neither agree nor disagree (53), Disagree (10), Strongly disagree (7)

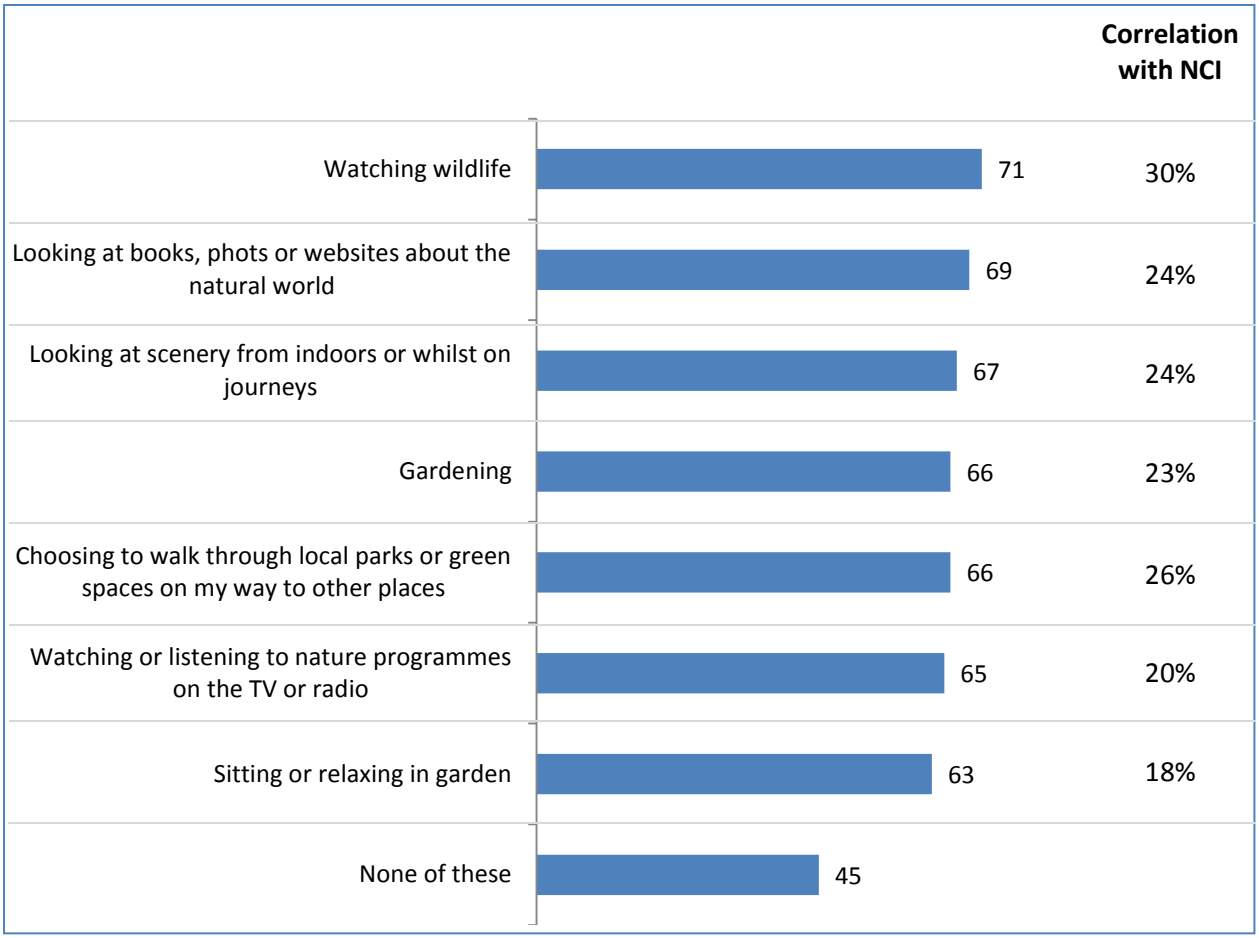
Variations by environmental activities and behaviours

In addition to visiting natural environments, MENE records participation in several activities or behaviours related to engaging with and/or protecting the natural environment.

Nature based activities

As shown in Figure 22, there was a moderate positive correlation between NCI and taking part in nature-based activities (range 18-30%). NCI was highest amongst those who reported that they normally took part in activities that involved looking at or being in nature – with watching wildlife having the highest correlation at 30% and 'sitting in the garden' being lowest at 18%. These are all activities that appear to include nature or natural environment as an integral part of the activity, rather than it simply being the location for an activity. NCI was much lower amongst those who normally wouldn't do any of the activities listed.

Figure 22: NCI by other nature based activities normally undertaken



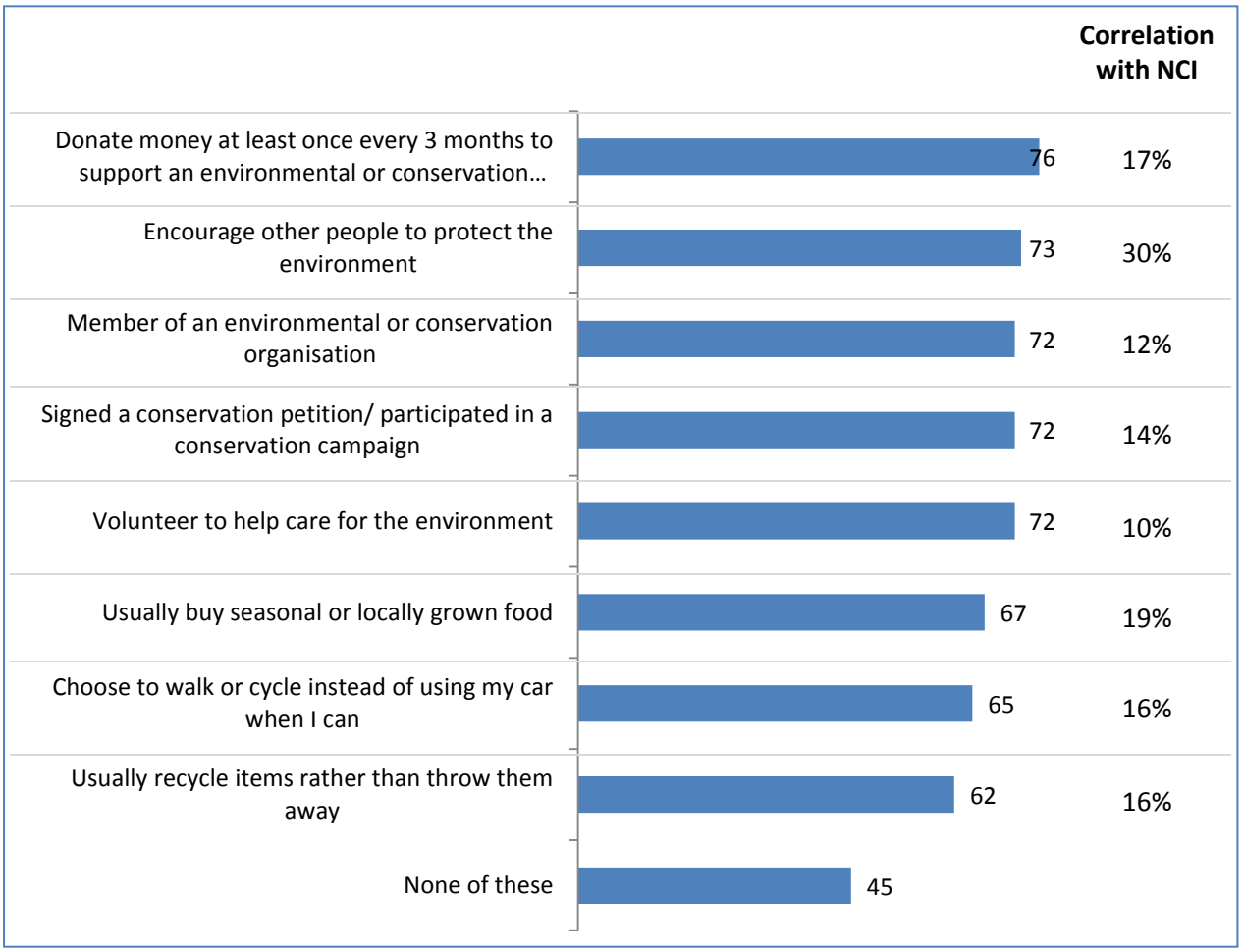
Base sizes: Watching wildlife (481). Looking at books, photos etc. (425), Looking at scenery from indoors or on journey (598), Gardening (627), Choosing to walk through local parks, etc. (723), Watching or listening to nature programmes (660), Sitting or relaxing in garden (787), None of these (110).

Pro-environmental activities

A similar pattern was seen for participation in pro-environmental activities (Figure 23). The highest average NCI was found amongst those who reported they were actively involved in

environmental protection (for example through encouraging other people to protect the environment, regular donations of money, buying seasonal or locally grown produce.)

Figure 23: NCI by pro-environmental activities normally undertaken



Base sizes: Donate money (107), Encourage other people (357), Member of organisation (82), Signed a petition (112), Volunteered (70), Usually buy season or locally grown food (468), Choose to walk or cycle (583), Usually recycle (956)

Distribution of NCI across the sample population

The mean score for NCI was 59 for adults and 57 for children.

The data was reviewed to identify an analytical method for identifying any obvious tipping points or thresholds in the data that would support assigning of bandings. This returned the recommendation to adopt low, medium and high bandings.

As mentioned earlier, the disadvantage of using specific percentage points as thresholds for these bandings is that it can introduce anomalies, for example a 1% change close to a threshold could result in a change in banding, whereas a 10% change in the middle of a band may not. So, Table 19 shows how the data could instead be reported in line with other

national indicators, by simply showing the proportion of the population who fall into different percentage bands (quintiles.)

Table 19: Allocating population into connection to nature bandings

Percent of sample in this band	Banding	NCI range
20%	Highest NCI	90-100
20%	Mid-High NCI	68 - 89
20%	Mid NCI	50 - 67
20%	Mid-Low NCI	33 – 49
20%	Lowest NCI	0 – 32

Characteristics associated with different NCI bands

Table 20 illustrates how the percentage band approach could be used to profile and compare the characteristics of the people in the various bands, as a way of illustrating the predominant demographic, behavioral and attitudinal traits among people in different parts of the distribution.

For example, people in the highest 20% of the NCI distribution were more likely than those in the lower 20% to take part in nature based and pro-environmental activities such as volunteering for, or membership of, a conservation or environmental organisation; they were also more likely to report higher levels of concern for the natural environment and place higher value on natural places.

There were less clear distinctions between the characteristics of people in the middle three NCI quintiles of the pilot sample, compared to those seen between in the highest and lowest quintiles.
Further detail on these results is given at Appendix 3.

Comparison of NCI versus visit frequency in differentiating population responses

Comparing the relative strength of the relationships between visit frequency and nature connection with other variables was beyond the scope of this project. However, an initial exploratory comparison revealed that the differences in characteristics of groups with high and low visit frequency were not as distinct as those found with high and low nature connection, especially in relation to measures regarding attitudes to the natural environment,

environmental protection and pro-environmental behaviours. This reflects the finding that NCI was more closely related to these factors than visit frequency.

This initial comparison also highlighted that NCI appeared to give better differentiation across the range of population responses to many other measures tested. This can be illustrated by looking at the percentage point differences seen when comparing the result for the top 20% against the result for the lower 20% bands. The percentage point differences between top and bottom were often considerably greater when using NCI rather than visit frequency. (Spreadsheets of the comparison analyses are given in appendix 3.)

Using 'spending time out of doors is important' as an example:

63% of people in the top 20% NCI group strongly agreed that 'spending time out of doors is important'; the figure was 11% among the bottom 20% NCI group. **This represents a 52% points difference between the top and bottom 20% NCI groups.**

By comparison:

53% of people in the top 20% visit frequency group strongly agreed that 'spending time out of doors is important'; the figure was 25% among the lower 20% visit frequency group. **This represents a 27% points difference between the top and bottom visit frequency groups.**

Further detail on these results is given at Appendix 3.

This initial analysis strongly suggests the need for more in-depth analyses to assess the relative strength of relationships between the nature connection index and visit frequency and other outcomes, and hence to assess the relative importance of visit frequency and nature connection as tools to inform strategies for targeting and delivering outcomes for people and the natural environment.

Table 20 – Comparing the characteristics of different NCI population groups (top and bottom quintiles)

	20% of population in <u>lowest</u> NCI were also more likely to:	**20% of population in <u>highest</u> NCI were also more likely to:**
Demographics	Be male, under 35, single, working full time, in DE socio-economic group, renting home (privately or local authority), no access to a car	Be aged 55+. retired, married, own home outright, with access to a car
Place of residence	Live in a place classified as urban and/or in the bottom 10% of Index of Multiple Deprivation	Live in the North East
Visits to the natural environment	Take an average 0.6 visits per week (typically visit less than weekly). Cite barriers to visiting including lack of interest and 'no particular reason' Take visits to urban greenspaces, paths & cycleways, playing fields. In general, have fewer strong motivations for taking visits (more functional?) Less likely to visit natural environments for health and exercise	Take an average 1.6 visits per week (typically several times per week/daily) Cite barriers to visiting more as poor weather and being too busy at work Take visits to countryside, villages, mountain and moorland. Take visits for a wide range of reasons esp. to watch wildlife, to visit favourite place, fresh air/weather. More likely to visit the natural environment for health and exercise. Report feeling calm & relaxed, learning something, feeling close to nature when they visit.
Other behaviours	Less likely to undertake any other engagement with nature or pro-environmental behaviours.	More likely to undertake any other engagement with nature or pro-environmental behaviours especially: - Wildlife watching - Choosing to walk through local parks while travelling to other places - Volunteering - Membership or donating to conservation/environmental organisation - Signing a petition for conservation cause
Attitudes	In general, have lower levels of concern for the natural environment and lower value attached to natural places.	In general, have much higher levels of concern for the natural environment and higher value attached to natural places: - Spending time out of doors is important - Local green spaces are important - Concerned about environment/ loss of biodiversity - Glad natural places exist, even if I won't visit them

4 Conclusion

The pilot has delivered, for the first time, a method for measuring and reporting on nature connection at a national level, in this case among both children and adults in England. The measure developed is a simple set of 6 statement questions, reported as a weighted points index (The Nature Connection Index, NCI). This could differentiate levels of nature connection among the population, and allowed comparison of the characteristics of populations with highest and lowest levels of nature connection.

Analysis of NCI against other variables captured by the TNS omnibus survey and MENE survey enabled analysis of the relationships between nature connection and demographics, and between nature connection and wellbeing and pro-environmental outcomes. This revealed that levels of nature connection among the adult population were positively correlated to people's environmental attitudes and behaviours, and to their general wellbeing. Furthermore, that the strength of these relationships appears to be stronger than those reported between visit frequency and some of these outcomes (Bradshaw et al., 2017; White et al., in preparation).

The findings support the need for further work to better understand the relationships between nature connection, visit frequency, wellbeing and pro-environmental attitudes and behaviours; so that this information can be used to inform policy and practice to support outcomes for both people and the natural environment.

Further work is also needed to understand and guide how the index might be used and interpreted: for example, to inform how information on different levels of nature connection might be used to target and shape interventions, and to guide comparisons between different types and sets of data.

Meanwhile, the results support a rationale for policy and practice to consider not only how often people visit the natural environment, but the emotional and experiential aspects of these experiences.

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Appendix 1: Definition of socio-economic groups

A

These are professional people, very senior managers in business or commerce, or are top-level civil servants.

Retired people, previously grade A, and their widows/ widowers.

B

Middle management executives in large organisations, with appropriate qualifications.

Principal Officers in local government and civil service.

Top managers or owners of small business concerns, educational and service establishments.

Retired people, previously grade B, and their widows/ widowers.

C1

Junior management, owners of small establishments, and all others in non-manual positions.

Jobs in this group have very varied responsibilities and educational requirements.

Retired people, previously grade C1 and their widows/ widowers.

C2

All skilled manual workers, and those manual workers with responsibility for other people.

Retired people previously grade C2, with a pension from their job.

Widows/widowers, if receiving pensions from their late spouse's job.

D

All semi-skilled and unskilled manual workers, and apprentices and trainees to skilled workers.

Retired people, previously grade D, with a pension from their job.

Widows/widowers, if receiving pensions from their late spouse's job.

E

All those entirely dependent on the state long term, through sickness, unemployment, old age or other reasons.

Those unemployed for a period exceeding 6 months (otherwise classified on previous occupation).

Casual workers and those without a regular income. Only households without a chief wage earner are coded in this group.

See http://www.nrs.co.uk/nrs-print/lifestyle-and-classification-data/social-grade/ for further details.

Appendix 2: Questionnaire

The following questions are about you and nature. By nature we mean all types of natural environment and all the plants and animals living in them. Nature can be close to where you live in towns; the countryside or wilderness areas further away.

CLARIFICATION TEXT IN INTERVIEWER INSTRUCTION USED IN RESPONDENT IS UNCLEAR:

By nature I mean all different types of natural environment and the things that live in them. It can be close to where you live or further away, and includes green spaces in towns and cities (such as your own and other people's gardens, parks, playing fields and allotments); the countryside (such as farmland, woodland, hills and mountains); and watery places (such as streams, canals, rivers, lakes, the coast and the sea.)

QX Using the words on the screen please tell me how much you agree or disagree with the following:

STATEMENT F ROTATED AS EITHER FIRST TO BE SHOWN OR LAST. ORDER OF OTHERS RANDOMISED

A I find beauty in nature

B I treat nature with respect

C Being in nature makes me happy

D Spending time in nature is important to me

E I find being in nature amazing

F I feel part of nature

From August alternative wording used:

A I always find beauty in nature

B I always treat nature with respect

C Being in nature makes me very happy

D Spending time in nature is very important to me

E I find being in nature really amazing

F I feel part of nature

5 point scale used in May, August and for half sample in November:

Strongly disagree Disagree Neither agree nor disagree Agree Strongly agree

7 point scale used in for half sample in November and all of February:

1 2 3 4 5 6 7

Strongly disagree Strongly agree

Q.A We are interested in asking young people a few questions about how they feel about nature. Is this child in the home at the moment?

Yes No

Q.B Can I ask for your permission to interview this child?

Parent\Guardian agreed Other adult agreed Refused

Q.C Can I ask for the child's permission to be interviewed?

Child Agreed Child Refused

The following questions are about you and nature. By nature, we mean all types of natural environment and all the plants and animals living in them. Nature can be close to where you live in towns; the countryside or wilderness areas further away.

QX Using the words on the screen please tell me how much you agree or disagree with the following:

SAME STATEMENTS, SCALE AND VARIATIONS AS ADULTS

Appendix 3: Data profiling the population by Nature Connection Index and visit frequency

See seperate Excel document containing the following additional results:

NCI pen portraits – indices are used to highlight particular traits of those in either the bottom or top 20% of the population when classified by the Nature Connection Index. The indices are based on a comparison of the profile of each group against the total population e.g. an index of 100 means the group's profile for a particular attribute matches the total population while an index of 200 means that members of the group are twice as likely to be in particular demographic group or exhibit a particular behaviour etc. Colours are used to highlight variations. Commentary on right hand side summarises key differences between the bottom and top groups.

NCI versus Visit Frequency – a cross tabulation of key MENE results regarding various measures including attitudes to the natural environment by NCI and Visit Frequency. This includes a comparison of the size of difference between the 'top' and 'bottom' groups when using NCI or visit frequency, and notes are included to highlight points of interest – where NCI showed a larger difference between the 'top' and 'bottom' groups than seen for Visit Frequency, the note on the right hand side is coloured in blue.