Trees & Wellbeing During the COVID-19 Pandemic

NATURAL ENGLAND

UNIVERSITY OF SURREY

Forest Research

UKRI Economic and Social Research Council

Summary

Research Summary

This report presents the results of analyses of data from three sources: an online, UK-representative survey (n = 850), in-depth interviews (n = 34), and 808 photographs of nature taken by the interview participants. Four research questions were addressed through the analyses:

1. What terms did people use to describe trees and treed places?
2. Were tree-focused places perceived as more natural? And did respondents feel more connected to nature in tree-focused places?
3. How important were trees and different treed settings in participants' nature engagement experiences?
4. Were trees and treed places associated with greater wellbeing?

Key Findings

1. General terms for tree (e.g. "tree") and treed environments (e.g. "woodland") are in much wider use than more specific terms (e.g. "grove", "orchard", "oak").
2. Tree-focused places (i.e. places where trees & woodland were mentioned) were perceived as more natural than places without a tree focus, with respondents perceiving more greenery, animals, birds and insects, natural sounds, and natural materials. Respondents also felt more connected to nature in tree-focused places.
3. Both the survey and photo analyses evidenced the key role of trees in participants' nature engagement experiences, with trees regularly featuring in photographs, and participants engaging with trees in a range of settings (in woodland, outside of woodland, in urban and rural locations).
4. Trees & treed places contribute to perceived wellbeing in a range of ways.

Key Recommendations

1. Researchers and practitioners need to take on board peoples' language preferences and design future studies and interventions according to their level of understanding/usage of various terms for "tree".
2. Researchers and practitioners could explore the potential value of 'the presence of trees' as a proxy for greater perceived diversity (of sounds, habitats, lifeforms) in an environment.
3. Research should examine the perceptions of trees in different settings (in/outside woodland, in urban/ rural locations), as well as capture a range of activities and motivations for engagement with trees. In particular, more research is needed on the perceptions and benefits of rural trees outside of woodland.
4. Researchers and practitioners should further explore, understand and promote the different wellbeing benefits of trees, as well as explore ways that promoting the public health benefits of trees could further support other areas of tree-related research, policy and practice, such as tree and land management.

Contents

Glossary of Terms

Working definitions of key terms used within the report

Affect or Emotion: Niven[1] asserts that "affect is the collective term for describing feeling states like emotions and moods". Russell's circumplex model of affect[2] identifies emotions such as sad, happy, tired, excited, depressed and relaxed.

Attention Restoration & Being Away: According to Kaplan's attention restoration theory[3], natural environments are particularly effective at restoring people from 'directed attention fatigue', which occurs as a result of prolonged mental effort. There are four components which contribute to making an environment restorative: 1) Fascination, with the soft fascination of gently engrossing objects and processes in nature being particularly restorative (e.g. sunsets, moving leaves); 2) Being Away, the ability to physically or conceptually get away from a task or everyday life; 3) Extent, with a place being "rich enough and coherent enough that it constitutes a whole other world"; and 4) Compatibility between the environment and the goals a person wishes to achieve there.

Basic Content Analysis: "Basic content analyses are those approaches using word counts and other quantitative analytic methods to analyze data. Basic content analysts code mainly manifest data using deductively or inductively generated code lists... They seek to be systematic, objective, and transparent" (Drisko & Maschi[4]).

Connection to Nature: How connected people feel to nature. One measure, Mayer & Frantz's[5] Connectedness to Nature Scale (CNS), examines "individuals' experiential sense of oneness with the natural world".

Eudaimonic Wellbeing: Niemiec[6] defines eudaimonic wellbeing as "the subjective experiences associated with eudaimonia or living a life of virtue in pursuit of human excellence. The phenomenological experiences derived from such living include self-actualization, personal expressiveness, and vitality". It "focuses on meaning and self-realization and defines well-being in terms of the degree to which a person is fully functioning"[7].

First COVID-19 Lockdown: The first UK-wide COVID-19 lockdown occurred between 26th March and 13th May 2020. During this period, "all 'non-essential' high street businesses were closed and people were ordered to stay at home, permitted to leave for essential purposes only, such as buying food or for medical reasons"[8]. Outdoor exercise or recreation was permitted once per day, either alone or with household members only, with the advice being to stay local[9].

Hedonic Wellbeing: The hedonic approach to wellbeing is described as focusing "on happiness and defines well-being in terms of pleasure attainment and pain avoidance"[7].

Perceived Naturalness: How natural a place is perceived to be, with indicators of naturalness including elements such as the presence of vegetation, water, animals and insects, natural materials (e.g. soil and rocks), and the absence of human influence[10].

Thematic Analysis with an Inductive Approach: Braun & Clarke[11] define thematic analysis as "a method for identifying, analysing, and reporting patterns (themes) within data. It minimally organises and describes your data set in (rich) detail". There are two approaches to identifying data in a thematic analysis, with one being an inductive (bottom-up and data-driven) approach. They state that "an inductive approach means the themes identified are strongly linked to the data themselves" and that it is "a process of coding the data without trying to fit it into a pre-existing coding frame, or the researcher's analytic preconceptions".

Treed Places: Places with trees present, including tree-dominated places such as woodland or forest.

Tree-focused Places: This term is used solely in relation to data collected in the survey. It refers to places in which respondents specifically identified the presence of trees, woods, forests or similar, and reflects the focus of respondents on the trees in those places.

WEIRD countries: Westernised, Educated, Industrialised, Rich and Democratic (WEIRD) countries, as described by Henrich, Heine and Norenzayan[12].

Background

This report presents findings from a survey and a series of photo-elicitation interviews exploring how people engaged with nature in the UK before, during and after the first COVID-19 pandemic lockdown in 2020. The report focusses on trees and treed places as a form of nature, and their role in wellbeing.

Trees & Wellbeing

There is growing evidence to show an association between trees and treed places, such as woodland and forest, and psychological wellbeing, mental health and restoration[13,14]. One paper found that all types of forest included in their review (such as temperate forest, planted conifer and natural broadleaved forest) improved mental health and wellbeing[15]. Another study demonstrated a decrease in antidepressant prescriptions as street tree density increased[16]. A recent report by Forest Research valued the mental health benefits of visiting UK woodlands at £185 million, due to the reduced costs of visits to GPs, amongst other factors, associated with a reduction in the incidence of depression and anxiety from regularly visiting woodlands[17].

But more research is needed to unpick the association between trees and wellbeing. One review study, for example, called for further research to examine the mechanisms and elements through which those benefits are achieved[15]. And Forest Research has identified the need to better research trees outside of woodland, such as small woods, groups of trees and lone trees[18]. It is also important to bring the research up to date, examining the benefits of trees at the present moment, as we examine the effects of, and recover from, the COVID-19 pandemic.
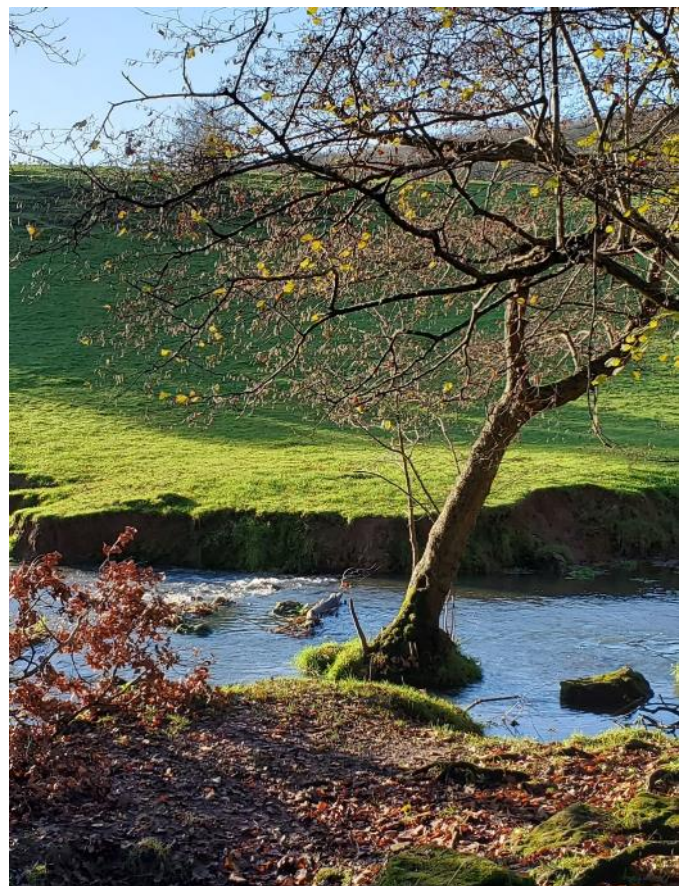
The COVID-19 Pandemic

On 11th March 2020, the World Health Organization declared the COVID-19 viral outbreak to be a pandemic[19]. The pandemic triggered lockdowns across the UK during 2020 and 2021, in which the movements of people in the UK were restricted to reduce the spread of the virus[8]. The first UK-wide lockdown began on 26th March, with restrictions eased on 13th May 2020.

The pandemic and lockdown restrictions had a serious impact on the mental health of those living in the UK during the first lockdown. Researchers found that depression, stress and anxiety were all elevated during this period[20]. Psychological distress significantly increased[21], and there was an increase in suicidal ideation from March to May 2020[22]. In June 2020, researchers called for more research on ways to mitigate the mental health consequences of the pandemic[23].

Trees & Wellbeing During the Pandemic

Several researchers investigated the benefits of trees during this time, with the hopes of identifying ways in which nature could improve wellbeing during a pandemic. One US-based study found that those who lived in more tree-rich greenspace had reduced levels of depression and improved mental health between April and October 2020[24]. There was a greater appreciation for trees (in those who were physically active) during 2020[25], and visits to treed environments inreased[26].

Research Questions

The Present Report

The present report aims to add to the body of evidence documenting the benefits of trees and treed places (such as forest and woodland, large and small) during the COVID-19 pandemic. It will look at the importance of trees and treed places to participants in the time before, during and after the first UK COVID-19 lockdown, as well as what activities participants did in such places, and how these interactions with trees were associated with wellbeing. To aid future research in unpicking the perceptions and benefits of various types of trees and treed environment, we will look at the terms participants used to describe trees and treed places.

The People and Nature in a Pandemic Project

The data on which the report is based were collected for a wider project looking at nature engagement during the first UK COVID-19 lockdown and the times before and after this period. This first phase of the project was a collaboration between The University of Surrey, The University of Plymouth, and Natural England, and funded by the Economic and Social Research Council (ESRC). As part of this project, a series of studies were conducted, including a UK representative, online survey, and in-depth, semi-structured interviews. To aid in their interview discussions, participants provided photographs of nature to the researchers (a photo-elicitation method), which they took in the times before, during and after the first lockdown. This provided three data sources for the present analysis: 1) the survey; 2) the interviews; and 3) the photographs. Due to the large amount of data collected as part of this project on nature engagement, it was possible to extract data relating to the perceptions and benefits of trees and treed places. Analyses of these data are presented in the present report.

Research Questions

Through these analyses, we sought to answer four main research questions relating to the perceptions and benefits of trees and treed places, with the aim of adding to the body of research in this area:

1. What terms did participants use to describe trees and treed places?
2. Were tree-focused places perceived as more natural? And did respondents feel more connected to nature in tree-focused places?
3. How important were trees and different treed settings in participants' nature engagement experiences?
4. Were trees and treed places associated with greater wellbeing?

These questions will be addressed over four sections in the present report. Data analyses from the three data sources (surveys, interviews and photographs) will be used to answer the questions, with the following icons used to indicate which data are being discussed:

| Surveys | Interviews | Photographs |

The methods of data collection and analysis will be further detailed throughout the report. Photographs of trees will be also presented throughout the report. Please note that participant photographs always receive attribution; those without captions were taken by the researchers and used for illustrative purposes. All participant names are pseudonyms.

Participant Photo. Taken by Jeff: White, male, age 64

Background to the Survey

An online survey was conducted to examine how people engaged with nature before, during and after the first lockdown in 2020, and whether nature engagement was associated with wellbeing. Recruitment for the survey did not explicitly state that the survey examined nature engagement and initial questions looked more generally at where respondents went to get away during lockdown, enabling researchers to examine the role of nature amongst the overall experiences of respondents. Analyses for the present report will focus on respondents' visits to, and perceptions of, places with trees during the first lockdown.
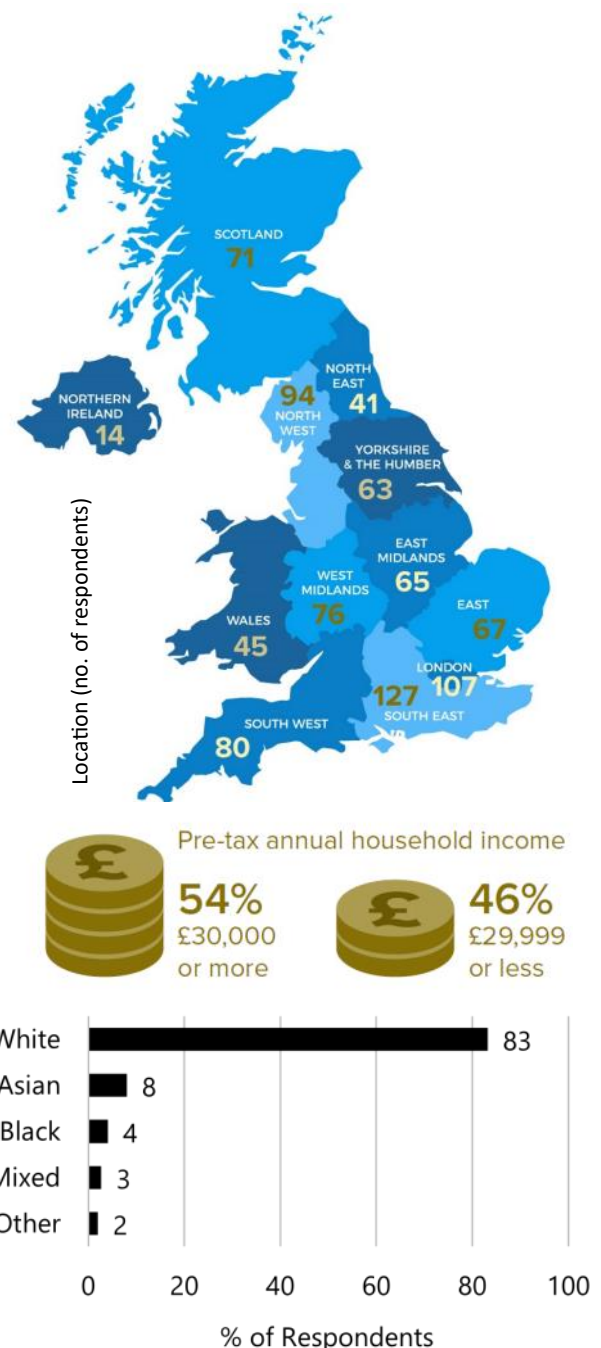
Methods

The online survey used a mixture of closed and open ended questions, to elicit quantitative and qualitative data, such as the frequency of visits to treed environments and what activities people did in these places. Of particular relevance to this report were two sections in the survey. The first section asked respondents to think of one place they went during lockdown to get away. This could be anywhere, indoors or outdoors. Respondents were asked to briefly describe the place they went to get away, in their own words, to say what they did there (e.g. walking, climbing a tree, reading a book) and to rate their wellbeing (hedonic and eudaimonic) and perceived restoration when they were in this place. The second section asked respondents to identify their favourite outdoor natural place during lockdown. Respondents were again asked to describe this place briefly, and rate their wellbeing (hedonic & eudaimonic), perceived restoration, the level of perceived naturalness of the place, and connection to nature whilst there. The full survey is available on the Open Science Framework.

Period of Data Collection

The surveys were completed in October 2020. Respondents were asked to think back to which environments they used to get away and which were their favourite natural environments in the period between 26th March and 13th May 2020, when UK-wide COVID-19 restrictions were enforced.

Respondents

Respondents were recruited through the online research platform, Prolific, and received monetary reimbursement for their time. A sample of 850 respondents representative of the UK population in terms of age, sex (stratified into male & female by Prolific) and ethnicity (using 5 aggregated ethnic groups; see chart below) completed the survey. Respondents were selected from across the UK. There was a relatively even split between males (49%) and females (51%), and respondents in low and high income groups (see graphic). Respondents ranged in age between 19 and 83 years, with a mean age of 46.

Location (no. of respondents)

SCOTLAND 71
NORTHERN IRELAND 14
NORTH EAST 41
NORTH WEST 94
YORKSHIRE & THE HUMBER 63
EAST MIDLANDS 65
WEST MIDLANDS 76
EAST 67
WALES 45
LONDON 127
SOUTH EAST 107
SOUTH WEST 80

Pre-tax annual household income

54% £30,000 or more

46% £29,999 or less

Ethnic Group
White — 83
Asian — 8
Black — 4
Mixed — 3
Other — 2

% of Respondents

Methods: The Interviews

Background to the Interviews

In-depth, semi-structured interviews carried out remotely via telephone or video call, looked at how people's experiences of engaging with nature were affected by the COVID-19 lockdowns and travel restrictions, and whether nature engagement supported (or not) people's wellbeing during the lockdowns. The present report will focus on participant engagement with trees, to enable an in-depth examination of engagement with this particular form of nature.

In this report, we will present the results of analyses which addressed two main questions:

- How did participants describe treed environments (what terms did they use)?

- What perceived wellbeing benefits did participants attribute to visiting trees or treed environments?

Methods

In depth-interviews were conducted with 34 participants either over the telephone or via the video meeting system, Zoom. The full interview schedule is available on the Open Science Framework. The interviews were transcribed and imported into NVivo 12 for analysis.
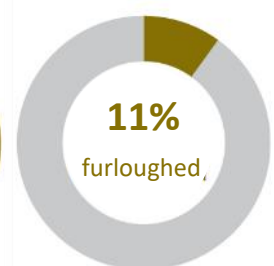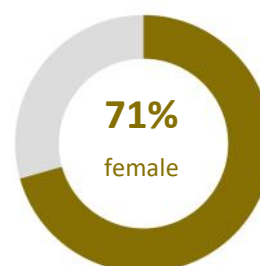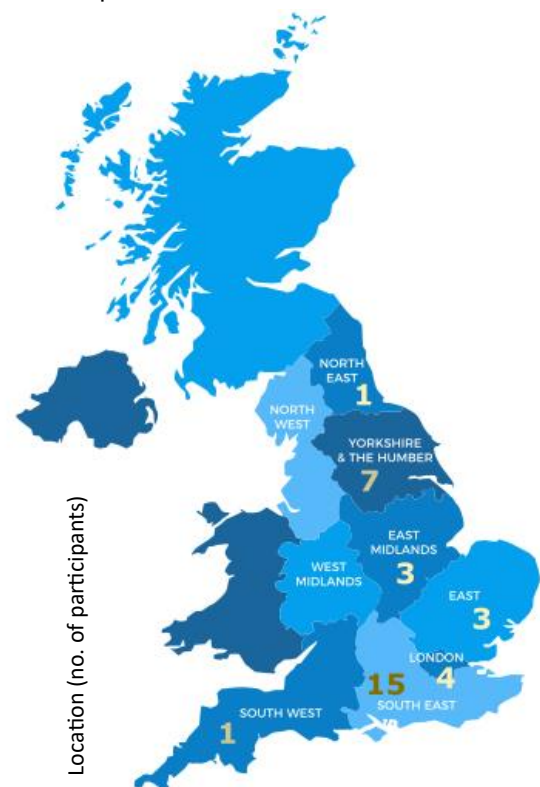
To aid in their interviews, participants provided photographs which were taken before, during and after the COVID-19 lockdowns, as illustrative of their experiences of nature engagement during these times. Across the sample, participants provided 831 photographs, although 23 were removed, leaving 808 photographs. These photographs were analysed in their own right, and will be further discussed on the next page.

Period of Data Collection

The interviews were carried out between October 2020 and May 2021 and examined the period before, during and after the first COVID-19 lockdown periods in the UK.

Participants

There was purposive sampling of participants from across different regions of England, living environments, and levels of deprivation, to ensure that diverse voices and experiences were represented in the interviews. Participants were aged between 18 and 73, with a mean age of 45.74 years. There were 24 women and 10 men, 31 White participants and 3 Asian participants. The majority of participants had a garden in the property in which they lived, with 22 having a private garden, 5 having a shared garden, and 7 having no garden. Four participants lived by the coast and 30 lived inland. Participants were anonymised and given pseudonyms, which will be used in this report.

71% female

11% furloughed,

Average age = 46 years

Methods: The Photographs

The Photographs

To aid in their discussion, interview participants provided the interviewer with photographs illustrative of their nature engagement experiences before, during and after the first lockdown (a photo-elicitation method). All 34 participants provided photographs. The number of photographs provided by each participant ranged from 6 to 120 ($M = 24$). In total, there were 831 photographs, although 23 were removed as they were collages or screenshots displaying no original photograph, leaving 808 photographs.

Aims of the Photographic Analyses

The photographs were analysed to better understand the importance of the role that trees played in the nature experiences of interview participants before, during and after the first lockdown. We were also interested in understanding the context of those trees, specifically where they were located, whether they were within woodland, and what time of day and season they were photographed in. With the analysis, we therefore sought to:

1. Identify the number of photographs containing trees.
2. Determine whether photographed trees were most likely to be in a rural location, or an urban location.
3. Determine whether photographed trees were situated within woodland or outside of woodland.
4. Identify the likely time of day in which the tree was photographed.

Illustrative Photographs in this Report

Of the 34 interview participants, 22 gave consent for their photographs to be published in research outputs. The present report will therefore include images illustrative of the themes and contents of the photo-elicitated participant interviews provided by these 22 participants.

Basic demographic information will be displayed with each photograph (pseudonym, ethnicity, gender and age). Photographs will also be used alongside the interview data, to show which photograph prompted the participant's discussion. Please note, however, that quotes can not be linked with certainty to a particular photograph, given that they were used as prompts in discussion and not explicitly identified in the transcripts. While it was often possible to associate a quote with a photo, these associations should be taken with caution, and quotes should be seen more as providing context for the photographs.

Also note that given the large number of photographs, it is not possible to include all participant photographs. No photographs containing people, houses or identifiable locations or information are presented in this report. Where photographs have been cropped for the purposes of anonymity in this report (e.g. to remove identifiable features), this will be stated.

Participant Photo
Taken by Judith: White, female, age 50 years

Methods: Limitations

Limitations

It is important to contextualise the findings of the report within the limitations associated with the methods employed for the studies and the time period in which the data was collected. Limitations include:

- **Time period (COVID-19):** The data were collected in 2020 and 2021, during the COVID-19 pandemic and associated lockdowns. Perceptions and behaviours will have been affected by these restrictions, potentially limiting generalisations to other time periods.

- **Time period (spring):** Survey respondents were asked to recall their experiences during the lockdown period of Spring 2020 (26th March to 13th May). That spring was named "the sunniest spring on record" across the UK by the Met Office[28], and this good weather is likely to have affected the usage and perceptions of the outdoors.

- **Generalisability (sample):** A large sample representative of the UK population (by age, sex and ethnicity) completed the survey. This permits some cautious generalisation to the UK population, given considerations of the time and season in which the data were collected, as well as consideration for the method of recruitment (via the online recruitment platform, Prolific). But the sample for the interviews was much smaller (_n_ = 34) and was not representative (representation and generalisability are not goals of qualitative research), and while participants were recruited from areas across England, there was some overrepresentation of the southern counties of England and no data was collected from the other UK countries. We also recognise that nature-related experiences during COVID-19 in WEIRD countries (see Glossary of Terms), such as the UK, will likely have been different to experiences in non-WEIRD countries.

- **Photographic Contents:** Assessments of whether the scenes presented in the photographs were rural or urban, with woodland or without, and the likely time of day, were indicative only. It is not possible to know the surroundings from such a small vignette, and therefore be certain of the categorisation. But the researcher assessing the scenes was an experienced gardener and garden designer, and therefore able to identify vegetation as belonging to tree or shrub and apply the definition of woodland to the scenes with relative confidence.

- **Time of Day:** A large number of photographs were taken in the evening/morning or night-time. It is possible that this is due in part to participants spending more time in the outdoors during the quieter times of day during the COVID-19 lockdown, to avoid other people. Indeed, this was a reason given by participants in some of their interviews. It may therefore be that daytime visits are more likely in periods outside of COVID-19 lockdowns.

Part 1: Terms Used to Describe Trees

What terms did participants use to describe trees & treed places?

Data sources: surveys & interviews

Terms Used to Describe Trees

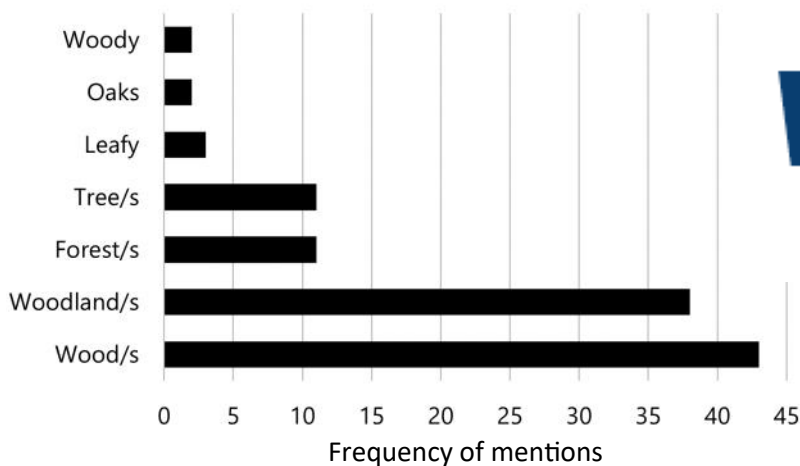How did survey respondents describe trees and treed places?

Survey Data: Word Frequency Analyses

Word frequency analyses were run in NVivo 12 to identify all words of three characters and longer used by respondents in their open-ended responses to each of the two questions examining: 1) where they went to get away (termed "being away"); and 2) their favourite places during lockdown. The responses to these two questions will be referred to throughout this report.

The lists generated by these word frequency analyses were then reviewed to identify and count all words related to trees, bushes and treed places in the open-ended responses. Quotes provide examples of some of the tree-related responses given by respondents. The terms identified in responses to each question are displayed in the two charts below. A word cloud was created using a combination of data from both questions.

The charts show that across the two questions, the top four terms for treed places were: "wood/s", "woodland/s", "tree/s" and "forest/s". The terms "bushes" and "shrubs" were used as generic descriptions for shrubs, and "woody" and "leafy" were used to describe specific attributes of trees. Only two terms were used to describe specific species of tree or shrub: "oaks" and "gorse". This suggests that most people chose to use more generic terms. This could be the result of the way the question was asked, which requested that respondents write down brief descriptions of the places, rather than describing the contents of the environments in more detail. But it could also be representative of a lack of language to describe trees. For example, Robert McFarlane in his book, *Landmarks*[27], laments the loss of words relating to nature in everyday language in the UK.

Being Away Places: Frequency of Terms

Natural Places: Frequency of Terms
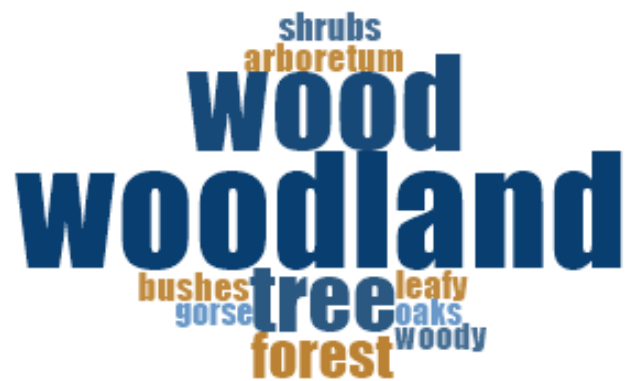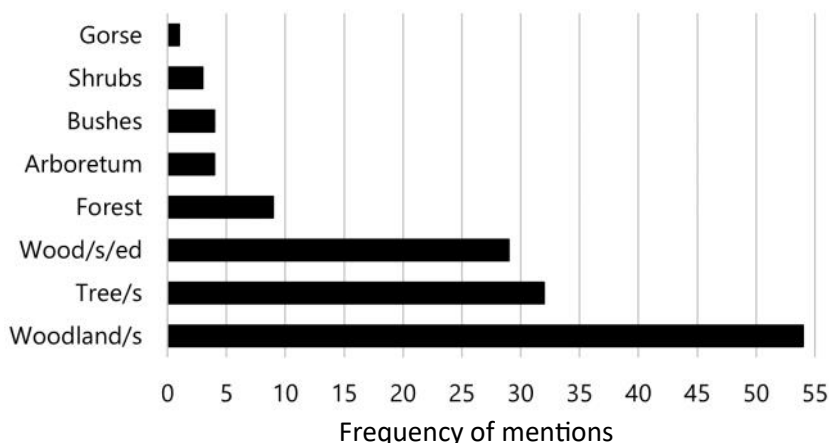
> 66 *A track along the path of an abandoned railway line, with banks of <u>trees</u> on both sides*

> 66 *A small patch of <u>wood</u> near our village*

> 66 *A public park with beautiful <u>trees</u> and open space*

Terms Used to Describe Trees

How did interview participants describe trees and treed places?

Interview Data: Word Frequency Analyses

Word frequency analyses were run in NVivo 12 to identify all words of three characters and longer which were used by participants in their interviews. A total of 6608 different words were identified by NVivo across the interviews (stemmed words, such as "wood", "woods", "wooded", were grouped together and counted as one word).

> **[In the _arboretum_] you go through the _cherry blossom_ areas, and you get the _monkey puzzle trees_**

Words related to trees, bushes and treed environments were then identified within this list of all words used in the interviews. To do this, the primary researcher first familiarised themselves with common terminology identified by Forest Research (personal communication, May 05, 2023) as relating to trees and hedges, including:

> tree*, hedge*, bush, ghyll, copse, thicket, grove, shrub, avenue, green lane, parkland (as opposed to parks), shelterbelt, orchard*, scrub, holloway* or hollow way*, topiary

The researcher then read through the word list to identify and count any words relating to trees, such as those above. This method was chosen over the use of direct word searches, as it would result in a more comprehensive list of tree words. Any tree-related terms which could have multiple meanings were manually checked for context within the interview text, and the list refined to exclude any words not related to trees. For example, "Bushy" was removed where it referred to the place, "Bushy Hill".

Note that because interviews assessed the time periods of before, during and after lockdown, participants referred to some locations or environments outside of the UK, and therefore referred to trees such as lemons and pomegranate that are more likely to grow abroad (unlike in the survey data, which referred only to the UK).
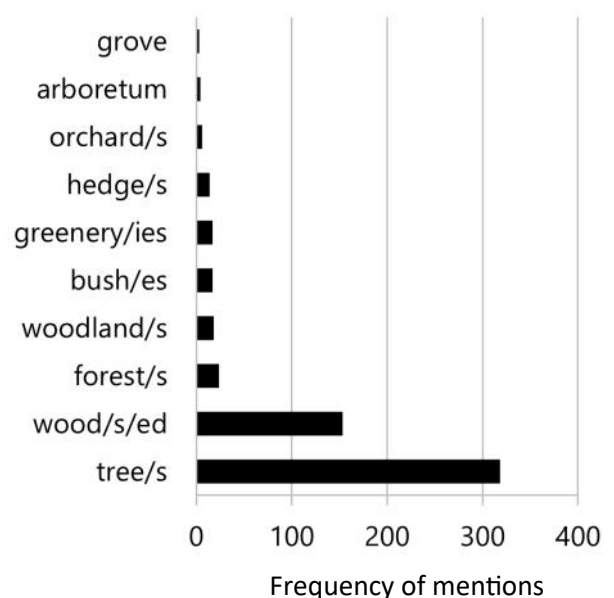
Frequency of Words Related to Trees

The tables on the following page display the frequency of words related to trees. The words have been grouped into three tables, representing: 1) words related to trees and treed places; 2) words related to the attributes of trees; and 3) words related to the species or species-specific attributes of the trees.

Two sets of data are presented: 1) the overall count or frequency of mentions of a word in the text (participants often mentioned a word more than once in their interview; each was counted here), and 2) the number of participants who mentioned a word (a figure which is unaffected by the number of times a participant mentioned a word).

The frequencies in the first table show that, in line with the findings from the survey analyses, interview participants chose to use general terms such as "tree" and "wood" to describe trees and treed places, compared with more specialised or specific terms, such as "orchard" and "grove". This is illustrated in the chart below. The same pattern was observed amongst terms to describe tree attributes, with "green" and "leaf" most popular. Very few terms were also employed to describe more specific tree species, such as "beech" and "cherry".

Top 10 Tree Words

(Horizontal bar chart, Frequency of mentions on x-axis from 0 to 400)

- grove
- arboretum
- orchard/s
- hedge/s
- greenery/ies
- bush/es
- woodland/s
- forest/s
- wood/s/ed (~150)
- tree/s (~320)

Frequency of mentions

Terms Used to Describe Trees

How did interview participants describe trees and treed places?

Tree Words	Frequency	No. Participants
tree/s	318	34
wood/s/ed	153	28
forest/s	24	13
woodland/s	18	11
bush/es	17	11
greenery/ies	17	10
hedge/s	14	7
orchard/s	6	2
arboretum	4	2
hedgerows	3	3
grove	2	2
copse/s	2	2
rainforest	2	2
shrubbery	2	1
shrubs	1	1
parkland	1	1

Attribute Words	Frequency	No. Participants
green/green space	117	21
leaf/ves	45	13
blossom/s/ed	11	6
branch/es	9	7
fruit/s/ful	5	4
cone/s	5	2
twigs	4	4
berries	4	3
coppice/ing	2	2
woody	2	1
catkin/s	2	1
bark	1	1
canopy	1	1

Species-Specific Words	Frequency	No. Participants
beech	10	1
cherry	9	2
olive/s	8	2
sloe, sloeberry/ies	7	1
apple/s	6	5
hawthorn	5	3
elder/elderflower	5	2
crab apple	5	1
magnolia	4	2
pear/s	4	2
plums/s	3	2
rhododendron/s	3	2
bay	3	1
yew	3	1
pine	2	2
redwood/s	2	2
willow	2	2
oak	2	2
conifers	2	1
gooseberry	2	1
privet	2	1
acorns	1	1
ash	1	1
azaleas	1	1
cobnuts	1	1
fir/s	1	1
gorse	1	1
holly	1	1
lemons	1	1
lilac	1	1
oranges	1	1
pomegranates	1	1
almond	1	1
monkey puzzle	1	1
sycamore	1	1
conker	1	1

Part 2: Trees & Nature

Were tree-focused places perceived as more natural?
And did respondents feel more connected to nature in tree-focused places?

Data source: surveys
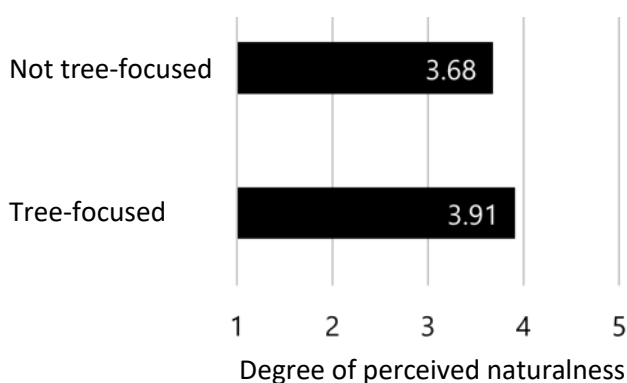
Perceived Naturalness

Were tree-focused places perceived as being more natural?

The Level of Naturalness in Tree-focused Places

The level of naturalness which respondents perceived in the places they chose as their favourite natural place was assessed using 8 items. These items examined, for instance, the amount of greenery, the amount of water, and the amount of animals, birds and insects present in that place (on a 5-point Likert-type scale from "none" to "a lot"). Note that this measure was not used for the being away question (mentioned earlier), since respondents could choose an indoor, non-natural place to get away in, and it was therefore not possible to answer in this context.
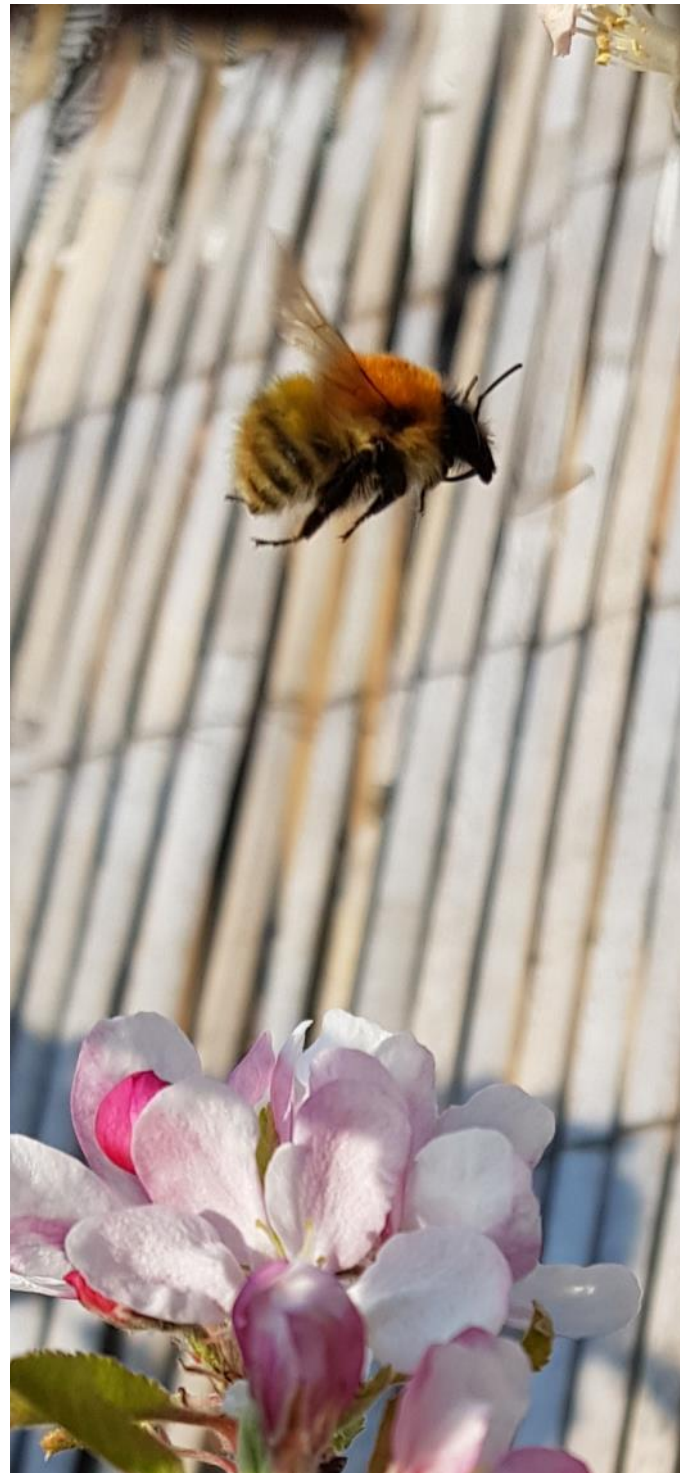
Mann-Whitney U analyses were used to compare the perceived level of naturalness in tree-focused places (places in which respondents specifically identified the presence of trees, woods, forests or similar) compared with other natural places identified by respondents. Non-parametric tests were chosen due to the lack of normality in the data.

Tree-focused places were perceived as significantly more natural than other, not tree-focused, natural places ($z = 3.51$, $p <.001$). The chart shows that the mean level of naturalness in tree-focused places was close to a score of 4, which equated to "quite a lot" of naturalness on the 5-point scale.

Not tree-focused: 3.68
Tree-focused: 3.91

Degree of perceived naturalness

The level of naturalness can be further unpicked into its constituent components, to help understand this finding. Further analyses showed that in treed environments, there was perceived to be significantly more greenery, including trees ($z = 4.88$, $p = <.001$),

which is to be expected. But there were also perceived to be more animals, birds and insects ($z = 2.76$, $p = .006$), natural sounds ($z = 3.67$, $p = <.001$), and natural materials, such as rocks and mud ($z = 3.26$, $p = <.001$).

Connection to Nature

Did respondents feel more connected to nature in tree-focused places?

Connection to Nature in Tree-focused Places

Mann-Whitney U analyses were used to compare the connection to nature experienced by those who chose a tree-focused place versus those who chose another natural place that was not tree-focused, for the two main survey questions. These questions looked at which places respondents: 1) went to get away from everyday stressors during lockdown (being away); and 2) chose as their favourite natural place to visit during lockdown. Connection to nature was measured using a modified and shortened version of Mayer & Frantz's Connectedness to Nature Scale[5].

Being Away Places

Connection to nature was first compared for those who chose a tree-focused place to get away versus those who chose another outdoor place to get away. Those who chose an indoor environment to get away during lockdown, such as their bedroom or living room, were removed from this analysis, with 643 respondents remaining.

A significant difference was found between those who chose a tree-focused place to get away versus those who chose another outdoor natural place to get away, with those choosing a tree-focused place feeling significantly more connected to nature (z = 5.60, p = <.001; mean rank for tree-focused places = 429.87; mean rank for other places = 307.11). The mean connectedness to nature scores for both groups are shown in the chart below.
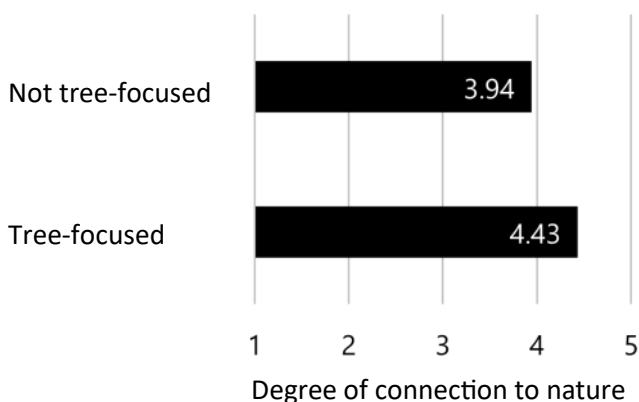
Favourite Natural Places

For the favourite natural places chosen by respondents, no significant difference was identified in the level of connection to nature between those who visited tree-focused places and those who visited other natural places; it was generally high for both groups, with a slightly higher mean connectedness for the tree-focused group (M = 4.17, compared with M = 4.03).

Not tree-focused	3.94
Tree-focused	4.43

Degree of connection to nature

Part 3: Importance of Trees

How important were trees and different treed settings in participants' nature engagement experiences?

Data sources: surveys & photographs

Visits to Tree-focused Places

How often did people visit tree-focused places during the first lockdown?

Natural Environments Visited During Lockdown

Responses to the open-ended survey question examining which favourite natural place respondents visited during lockdown were analysed in NVivo 12, using basic content analysis with an inductive approach[4]. Responses were grouped into twenty main environment types, including tree-focused places (places in which respondents specifically mentioned trees, wood, forests and similar), gardens, parks, and coastal environments. It should be noted that it is likely that both gardens and parks contained trees, without these being explicitly mentioned by respondents. The categories were also not exclusive, with some mentioning more than one environment. For example, one respondent described visiting "a local park that has a wooded area and more open spaces".

Frequency of Visits to Tree-focused Places

Of the 850 survey respondents, 100 reported visiting a tree-focused place during lockdown (12%). Gardens were the most commonly visited place, followed by parks, but tree-focused places were the third most frequently visited natural place, highlighting their importance to survey respondents. The chart below presents the top 10 most mentioned natural places.

% of Respondents (*n*=850)
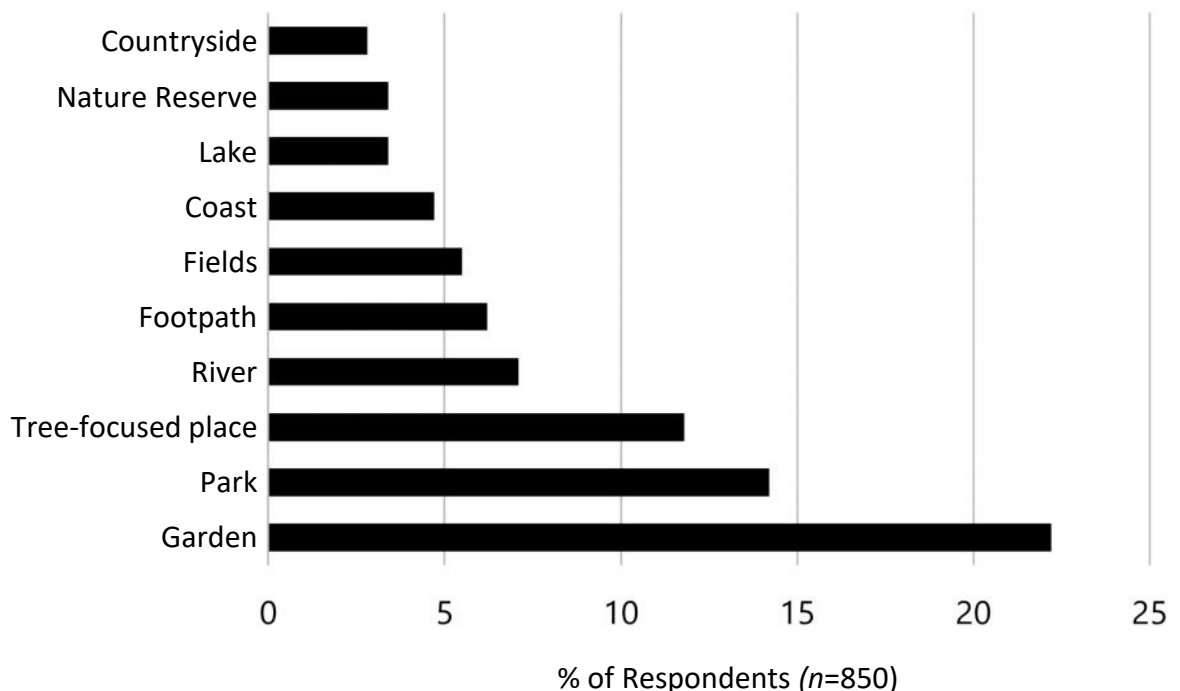
Activities in Tree-focused Places

What did people do in tree-focused places?

Getting Away in Tree-focused Places

We asked survey respondents where they went to get away from stresses and demands during the lockdown. 78 respondents (9% of the sample) said they went to a tree-focused place to get away (they mentioned a place with trees, a wood, or forest). Respondents wrote briefly about what they did in these places, with many doing multiple activities. It is worth noting that the lockdown period occurred during Spring 2020, and the weather had been considered particularly favourable during this time[28]; something which may have affected the activities carried out by respondents. The word cloud diagram represents the most frequently used words in responses to this question (words with 3 characters or more, with common words such as "there" removed).

Walking

Walking, strolling and stretching the legs was by far the most common activity carried out in tree-focused places. Over two thirds of respondents (68%; 53 of 78 respondents) said that they did this.

> ❝ *Walked, listened to bird song and enjoyed the sight of trees in their new spring leaves*

Being with Pets

One-fifth of respondents (19%; 15 of 78 respondents) wrote that they spent time with pets in tree-focused places; walking, cuddling and playing with them.

Engaging with Nature

A similar number (18%; 14 of 78 respondents) wrote that they spent time looking at nature, flora and fauna, observing and contemplating, or actively engaging with nature.

Socialising

14% (11 of 78 respondents) said that they spent time socialising in tree-focused places during lockdown. Respondents wrote of spending time with family: husbands, wives, partners, children and parents.

Listening to Music

14% (11 of 78 respondents) also listened to music, podcasts and radio in tree-focused places.

> ❝ *I climbed into the lower branches of the big oak tree in the centre and listened to an audiobook for a couple of hours*

Listening to Birds

13% (10 of 78 respondents) wrote of listening to birds, nature and trees, as well as water sounds.

> ❝ *I would stand and admire the beauty of nature and enjoy the birdsong*

Photographs of Trees & Treed Places

How prevalent were trees & different treed settings in participants' photographs?
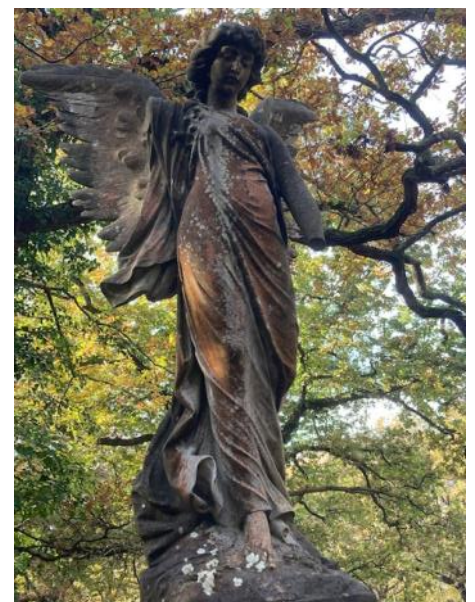
Analysis of the Photographs

A basic content analysis[4] was performed to identify and quantify the presence of trees and different treed settings in the photographs supplied by interview participants (see method section for more details). The categories identified through analysis included information such as: whether there were trees present in the photograph (trees/no trees); whether the photograph showed woodland or no woodland (woodland/no woodland), with photographs without woodland taken to represent trees outside of woodland; whether the scene was rural or urban (rural/urban); and the time of day at which the photograph was taken (e.g., daytime or evening/night-time/early morning).

Note that due to the limitations inherent in analysing the scenes presented by a photograph (i.e., it was not possible to determine the exact surroundings of the trees in the photographs), these categories are indicative only. It should also be noted that whilst most photographs were taken near to where participants lived, some were also taken whilst on holiday, and therefore show trees abroad (such as palm trees and olive groves).

An example of the range of photographs taken by participants is provided below, with a selection of photographs taken by Sally, who was white, female, and aged 56 years.

Sample of Photographs Taken by Sally:
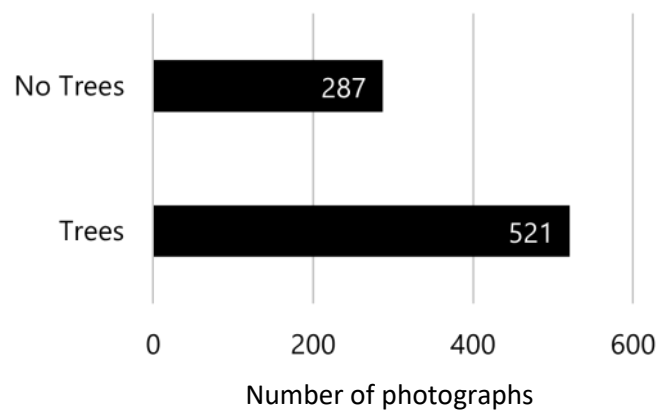
Photographs Containing Trees

How many of the photographs contained trees?

Number of Photographs Containing Trees

To examine the importance of trees and treed places to interview participants, we began by looking at how many of their photographs contained trees, using basic content analysis[4]. Of the 808 photographs, approximately two thirds (n = 521; 65%) contained identifiable trees, including trees in the distance or on the horizon, and aspects of trees such as roots, leaves or branches. All 34 participants provided at least three photographs with a tree in.

This illustrates the importance of trees in the nature experiences of the participants. Photographs without trees included scenes such as beaches, close-ups of animals, plants or people and natural objects, amongst other things.

Number of photographs

Examples of Photographs Containing Trees

Jeff: White, male, age 64 years

Gemma: White, female, age 52 years

Gillian: White, female, age 59 years

Penny: White, female, age 54 years

Photographs Containing Trees

Examples of Photographs Containing Trees

Karthik: Asian, male, age 37 years

Gemma: White, female, age 52 years

Colin: White, male, age 67 years

Gemma: White, female, age 52 years

Dawn: White, female, age 59 years

Stephanie: White, female, age 31 years [cropped]

Location of Trees

Were the trees in a rural or an urban setting?

Location of Trees

Analyses looked at whether a scene was predominantly rural or urban in character. The categorisation was based on DEFRA's Rural Urban Classification[29] and guided by the presence, number and character of buildings, paving materials, signposts, street lighting, etc.. Where necessary, other photographs taken in the same area by a participant were consulted to indicate location. In the absence of urban indicators (e.g. a solitary tree with no indicators of urbanness), this was classified as rural. Of the 521 photographs with trees, 345 (66%) appeared to show a rural scene and 176 (34%) showed an urban scene. This indicates the importance of trees in both settings, but particularly rural.

Number of photographs
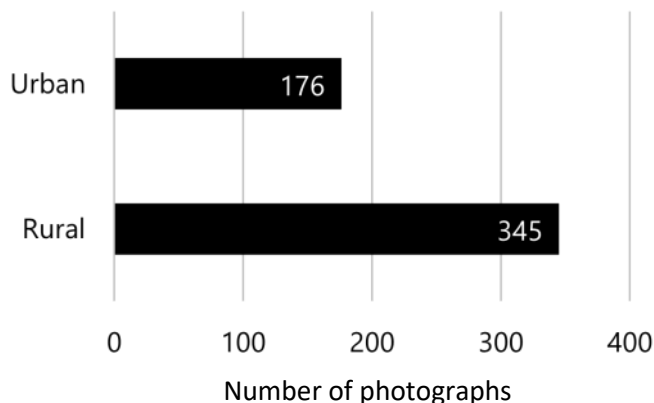
Rural Settings

Sally: White, female, age 56 years

Amy: White, female, age 50 years

Amy: White, female, age 50 years

Mike: White, male, age 63 years

Location of Trees

Are the trees in a rural or an urban setting?
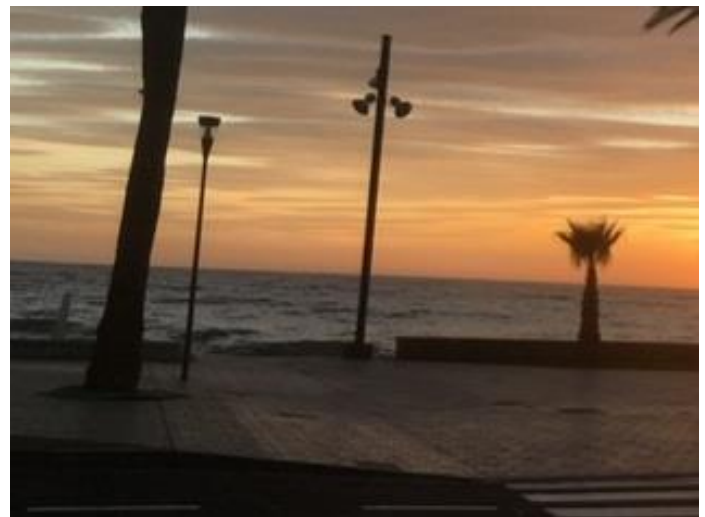
Urban Settings

Note that most of these photographs have been cropped for reasons of anonymity, losing some of the urban indicators that aided in their classification.
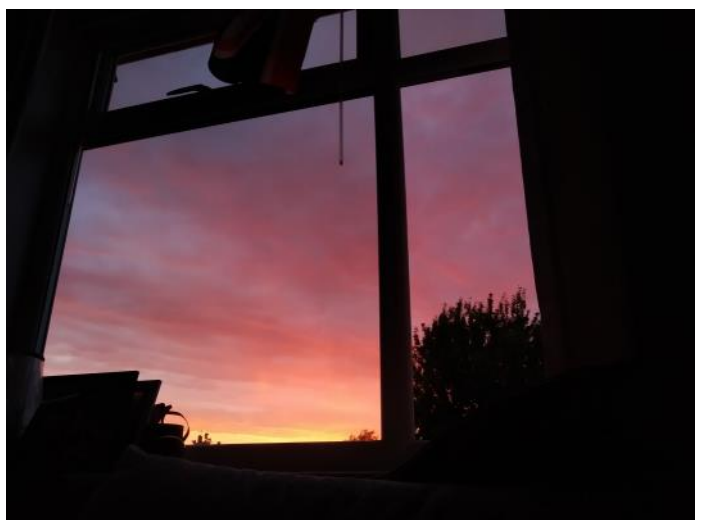

Kirsty: White, female, age 27 years [cropped]

Sally: White, female, age 56 years [cropped]

Amy: White, female, age 50 years [cropped]

Nishanth: Asian, male, age 28 years

Trees Inside/Outside Woodland

Of the treed photographs, how many showed woodland?

Photographs with and without Woodland

Photographs containing trees were then classified according to whether or not woodland appeared to be present in the scene, as an indicator of whether trees were within or outside of woodland. The Forest Research definition of woodland was employed to guide this classification[30]. Please note that the classification did not include any distinction as to whether woodland was the focus of the scene or in the background, simply whether it was present. The classification meant that for photographs containing woodland, there could be both woodland and lone or small groups of trees present. The photographs with no woodland present, however, are a more accurate assessment for trees outside of woodland.

Of the 521 photographs containing trees, 221 (42%) of the photographs appeared to show woodland, and 300 (58%) of the photographs did not appear to have woodland present. More than half of the treed photographs could therefore be considered as representing trees outside of woodland, indicating their importance to participants.

Number of photographs
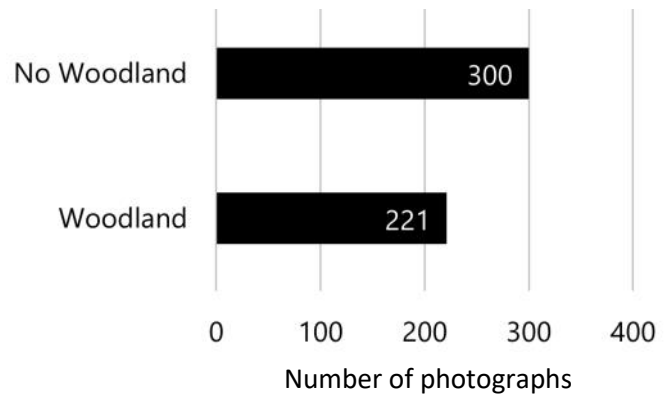
Photographs of Trees Outside of Woodland

Nishanth: Asian, male, age 28 years

Photograph of Woodland

Gemma: White, female, age 52 years [cropped]

Josh: White, male, age 44 years [cropped]

Rural/Urban Trees Outside Woodland

Of the trees outside of woodland, how many were in rural and urban settings?

Rural and Urban Trees Outside Woodland

Further analyses were carried out to determine how many of the 300 photographs of trees outside of woodland were in urban areas, and how many were in rural areas. Results showed a similar number of trees outside of woodland in both settings, with slightly more urban trees (55% in urban areas). This demonstrates that trees outside of woodland are important to participants in rural and urban areas alike.

Number of photographs
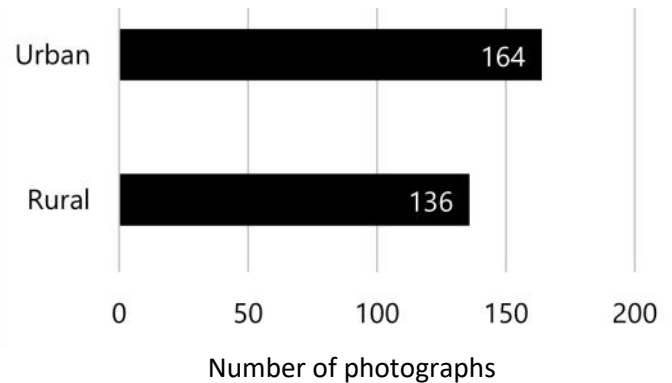
Trees Outside Woodland in Urban Areas
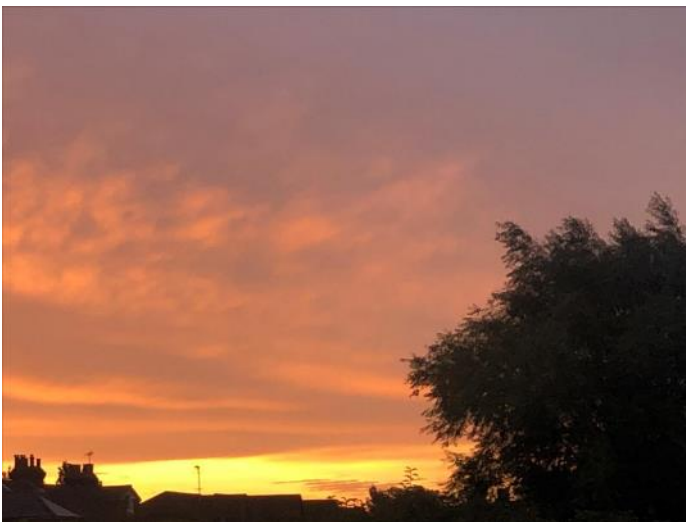
Gemma: White, female, age 52 years [cropped]

Trees Outside Woodland in Rural Areas

Gemma: White, female, age 52 years

Colin: White, male, age 67 years [cropped]

Amy: White, female, age 50 years

Trees at Different Times of Day

In Part 4 of this report, we will see that some participants highlighted the interplay between sunset/sunrise and trees. Yet many studies tend to focus on the daytime period when examining the perceptions and benefits of nature. It was therefore of interest to look at when participants were observing trees: either daytime or evening/nighttime/ early morning (including sunset and sunrise).

To classify photographs, indictors of time of day included lighting (with more orange lighting indicating evening and whiter lighting indicating daytime), the brightness of the scene, and the position of the sun on the horizon (with consideration of season), amongst other factors.

Of the photographs containing trees, 392 (75%) were taken during the day and 129 (25%) were taken during the evening, morning or nighttime. This shows that while most trees were photographed during the day, a quarter were photographed at other times. This indicates that experiencing trees and treed places as dusk, dawn or during the night was an important aspect of participants' nature engagement experiences.

Number of photographs

Examples of Photographs Taken During Evening, Night or Early Morning

Gemma: White, female, age 52 years

Example of Photograph Taken During the Daytime

Gemma: White, female, age 52 years [cropped]

Jeff: White, male, age 64 years

Part 4: Trees & Wellbeing

Were trees & treed places associated with greater wellbeing?

Data sources: surveys & interviews

Tree-focused Places & Wellbeing

Were visits to tree-focused places associated with wellbeing improvements?

How Survey Respondents Felt during Lockdown

As context for the following analyses looking at wellbeing for survey respondents who visited tree-focused places, we first examined overall wellbeing in the survey sample (n = 850). Overall hedonic wellbeing was assessed by asking respondents to rate how often they felt "happy & cheerful" and "anxious & depressed" during lockdown. Whilst around a third (36%) reported feeling happy & cheerful frequently during lockdown, 46% only felt happy & cheerful sometimes, and 19% rarely felt happy & cheerful. Almost a quarter (24%) frequently felt anxious & depressed and 31% felt anxious & depressed sometimes.

Measuring Wellbeing & Restoration

Wellbeing (hedonic and eudaimonic) and restoration was also measured for respondents when in: 1) the places they went to get away during lockdown; and 2) their favourite natural places during lockdown. For this question, hedonic wellbeing examined the affect or emotions experienced by people using 6 items, such as "relaxed", "happy" and "sad", based on Russell's circumplex model of affect[2]. Eudaimonic wellbeing looked at wellbeing through the lens of meaning in one's life, using 5 items from Waterman's Personally Expressive Activities Questionnaire (PEAQ) [31], with slightly modified wording. Items included, for example, "when I was there I felt more complete or fulfilled than I did when I was somewhere else".

Perceived restoration was measured using a modified version of Berto's perceived restorativeness scale[32], with items assessing the four components of attention restoration theory: Being Away; Fascination; Coherence; and Compatibility. All responses to these measures were given on a 5-point Likert-type scale.

> **❝ It was a avenue of ancient oaks. We enjoyed watching squirrels there, listening to birds & looking at the wonderful old trees**

Tree-focused Places for Getting Away

Mann-Whitney U analyses were performed to compare hedonic wellbeing, eudaimonic wellbeing and perceived restoration in those who chose tree-focused places to get away versus those who chose another outdoor place to get away (one for which they did not explicitly mention the presence of trees). Respondents who chose an indoor environment to get away during lockdown (such as their bedroom or living room) were removed from this analysis, with 643 respondents remaining.

Findings showed that those who chose a tree-focused place to get away experienced significantly greater levels of hedonic wellbeing (z = 2.20, p = .028) compared with those who chose another outdoor place to get away. They also experienced significantly greater eudaimonic wellbeing (z = 2.57, p = .010) and restoration (z = 3.70, p = <.001).

Tree-focused Favourite Natural Places

Mann-Whitney U analyses were then used to compare those who chose a tree-focused place as their favourite place during lockdown, versus those who chose another natural place in which they did not specifically mention the presence of trees, woodland, forest, or similar (such as a river, coastline or park).

While there were no significant differences in wellbeing between those who visited tree-focused places versus those who visited other natural places, there was a significant difference in restoration (z = 2.93, p = .003), with those visiting tree-focused places experiencing greater restoration.

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

Thematic Analysis of Interviews

Inductive, thematic analysis[11] was used to examine the wellbeing benefits of trees to interview participants in the time periods of before, during and after the lockdowns of 2020/2021. The first step in analysis was to use the terms derived from the word frequency analyses of the interview data (described in Part 1), as search terms to identify any instances in the interviews in which participants discussed trees. All the tree-related words were included in a text search using NVivo 12, with the exception of the terms "green", "green space", "greenery" and those with other words stemmed from "green", given that these were more generic and could refer to other types of vegetation as well. The text search included stemmed words, so it was only necessary to include, for example, the word "wood" as a means to capture words such as "woodland" and "wooded".

A total of 1021 references to trees (using the words on this list) were identified during the text search, although some of these references were made by the interviewer. References made by the interviewer were still used to guide analysis, as it provided context as to the subject the interviewer and interviewee were discussing (namely, trees). All 34 participants mentioned trees in some form, so all were included at this stage of analysis.

References to trees and the text around them was next read to identify any discussion of the benefits of trees, and thematically analysed according to Braun and Clarke[11]. Note that some of the identified benefits may be unique to the lockdown periods, when participants experienced specific issues, such as an inability to travel and a physical inability to access some nature.

The Themes

Four overarching themes were identified, to summarise the various ways in which trees:

1.   Supported emotional wellbeing
2.   Supported physical wellbeing
3.   Supported social wellbeing
4.   Supported spiritual wellbeing

Within these overarching themes, were several subthemes, which are presented in the theme map on the following page. We will also summarise and explore each of the subthemes, using quotes to illustrate them. Key words will be underlined in the quotes, to highlight aspects particularly relevant to a subtheme. Words relating to trees will also be underlined, to emphasise the role trees played in participant wellbeing.

Details of the participants are displayed below each quote or photograph taken by a participant (photographs taken by the researchers for illustrative purposes in this report will not be captioned).

Theme Map

Trees & treed Places

Emotional wellbeing
- Positive perceptions & emotions
- Freedom, escape & simplicity
- Immersed, fascinated & focused on trees
- Interest & learning in treed places
- Adventure & exploration

Physical wellbeing
- Exercise & physical activity
- Breathing clean air
- Appreciating shade
- Foraging food & tending to fruit trees

Social wellbeing
- Connecting with friends & family
- Being with pets
- Fostering community

Spiritual wellbeing
- Meaning & memories
- Connecting with nature
- Other worldly, magical experiences
- Variety, change & transitions
- Feeling guided, comforted & nourished
- Experiencing transcendence
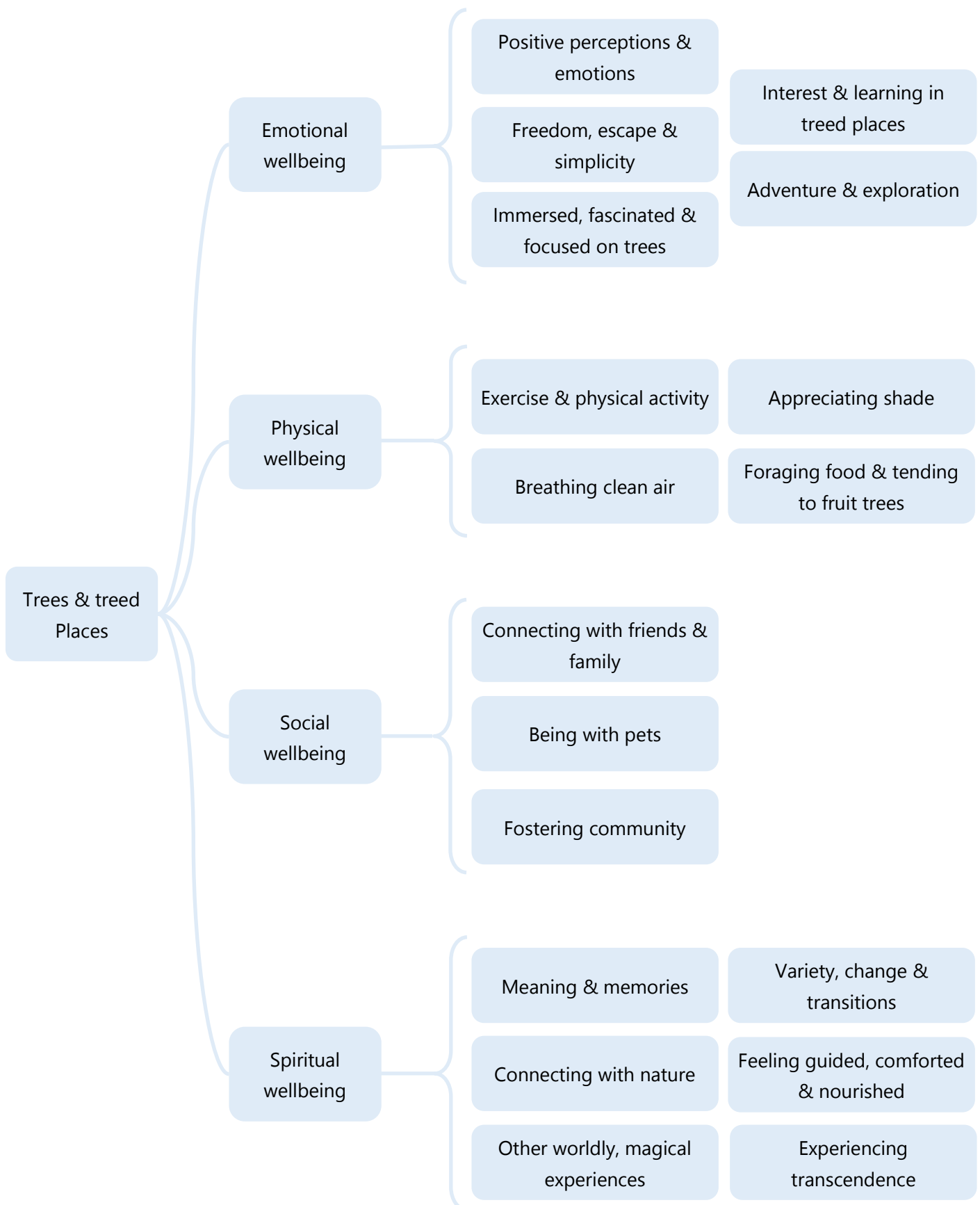
Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

Theme 1: Emotional Wellbeing

This first theme encompasses 5 sub-themes that examine how trees and treed places offer people a range of fulfilling experiences, which participants felt supported their emotional wellbeing. Participants expressed a range of positive perceptions and emotions in response to trees and treed places (e.g., calm, awe, enjoyment of beauty), as well as feelings of freedom and escape, of adventure and exploration, and of being immersed and fascinated. Participants also felt interest and pride at learning about trees.

1.1 Positive Perceptions & Emotions

Participants experienced a range of positive perceptions and emotions in response to visiting trees and treed environments, including pleasure, awe, amazement and joy, an appreciation of the beauty of trees, and a sense of relaxation and calm. For instance, Marie spoke of the blossom on the cherry trees, expressing a range of emotions:

> "It's the colour, and when they start to shed the petals, it's like a carpet on the ground of pink petals and it just looks absolutely beautiful and glorious. And I just love the pink against the blue sky, and I sit down under the cherry tree

Marie: White, female, aged 62 years [cropped]

and look up and see the blue sky through the cherry blossom, it's absolutely amazing."

Charlotte also described positive perceptions and emotions, in response to the everyday trees outside the window of her home:

> "During the summer there are like flowers out of our window and there are big beautiful trees. Our cat just loves it, it's amazing and it's so peaceful out there."
>
> Charlotte: White, female, age 18 years

1.2 Freedom, Escape & Simplicity

For several participants, treed places offered a space to be alone, to escape from the everyday and experience freedom and a simpler way of being, and they spoke of how this contributed to their sense of wellbeing. Scott, for example, spoke of how his days at home during lockdown in the city in which he lived were claustrophobic, and so he would spend as long as possible in a local park, only leaving once it was dark. He felt the park allowed him to escape this claustrophobic feeling for a more expansive place, and feel freer. He recounted one particular moment, which he captured in a photograph:

> "The trees are changing. You can see some leaves on them... they're starting to come through, and the sun was out. And I think I'm showing, look at all this space I've got, I've got all this sky, all this ground and I think that felt really, really restorative."
>
> Scott: White, male, aged 29 years

For other participants, the sense of freedom and escape came from the privacy offered by trees, shrubs and hedges. For example, Debbie spoke of the privacy offered by her tall privet hedge and what this meant to her:

> "I've got a fence one side and on the other side, another really tall privet, so it's a nice private space where you can just relax and have a cat on your lap... sometimes it's just nice to go outside and have five minutes, have time for yourself."
>
> Debbie: White, female, aged 49 years

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

1.3 Immersed, Fascinated, & Focused on Trees

Participants also spoke of being fascinated by trees or particular elements of trees, of feeling immersed in treed places, or of focussing on tasks related to trees. For example, Gillian spoke of sitting on a chair in her front garden and looking up at a tall Christmas tree that she had planted 13 or 14 years previously from a small pot:

> "I noticed it had a cone on it, just one solitary cone. And I thought, oh, my God, you know, why has it only got one, why is it all the way up there and why have I noticed this before? So the cone became quite a feature of the lockdown; I kept watching it and you know, wondering when it was going to fall."

Gillian: White, female, age 59 years

Whereas Gillian was fascinated by and focussed on the cone, actively watching and thinking about it, Judith's fascination with trees was gentler and helped her relax:

> "I have a great memory of... lying on a stone in the middle of the beck, I think everybody else had gone for a walk and it was warm... [the] trees were in bud but they weren't in full leaf, so I just lay there looking at the branches against the blue sky, it was the nicest 40 minutes I've had for a long time. It was just perfect. I just was completely lost in it, it was lovely."

Judith: White, female, age 50 years

1.4 Interest & Learning in Treed Places

Some participants spoke of their own (or that of others) interest in trees, and of their experiences of learning and teaching about trees. Participants were engaged in identifying trees and the animals that live around them, learning species names and interesting facts, and increasing their understanding of habitats. For instance, Scott said:

> "I got a book about the park where I was learning about the different species of trees and stuff, to help me in trying to see owls... I was wanting to be there as often as I could in order to become as familiar as I could with it."
> Scott: White, male, aged 29 years

It was clear that this knowledge, and being able to impart it to others, generated a sense of pride. Will, for example, talked about visiting a small arboretum with his children during lockdown, before they began their home schooling. He said that they "were specifically looking for nature with the kids", and he appreciated the ability to find things to pique and hold their interest there, as well as teach his children about nature and trees:

> "They've learnt a lot from it, through all the different birds, and trying to count how many squirrels we'd see, just ways to keep them entertained and doing stuff... it's really nice because the arboretum takes you through four different regions of the world... so you get to see... little names on the trees... so you go through the cherry blossom areas, and you get the monkey puzzle trees."

At the weekends, Will would walk further with his children, through commons and woods, and he spoke of his pride when his son spotted and identified a slow worm moving over a tree root near their home:

> "One of my sons, I'm so proud of him, he went, "Isn't that a slow worm?" And I was like, "I'm so proud of you, you're eight years old."

Will: White, male, age 38 years

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

Will: White, male, age 38 years

1.5 Adventure & Exploration

There was also a sense of adventure, exploration and discovery in treed places, be that discovering a clearing in the local woods with a picnic bench, or trekking through the rainforest. For example, Felicity spoke about a photograph of her son looking through a split tree and the place in which it was taken:

> "...that was a walk he did with my husband. And they went right into the landslip which is a sort of forgotten secret area along, a very hidden sheltered area. And I don't think anyone has probably been there for [laughing] years. And they discovered this tree and because the land is very unstable here it had split in two. So, he was quite fascinated by that."
> Felicity: White, female, aged 54 years

Marie talked about walking through some local woods during the COVID-19 lockdown and how she "saw different things" there. It seems to have inspired her to have adventures in woodland in the future, with her saying:

> "I'd quite like to go to Wales and stay in a treehouse and then I could do some wood exploration. I want to explore woods."
> Marie: White, female, aged 62 years

Theme 2: Physical Wellbeing

This second theme, which has 4 sub-themes, examines a range of physical wellbeing benefits which participants felt they derived from trees and treed places. Treed places offered a space to exercise in and be physically active. Trees were also perceived as cleaning the air and providing shade, and their fruits offered possibilities for foraging and gardening.

2.1 Exercise & Physical Activity

Treed places provided locations for 'formal' exercise, such as cycling, running and climbing, and for other types of physical activity, such as walking, strolling and dog walking. Sally, for example, would cycle through the woods regularly as a way to get fit during lockdown, in response to health fears associated with the possibility of catching COVID-19:

> "This hour's exercise that you could have, was quite good for me because... I was quite frightened of getting ill 'cause I'm overweight and I smoke... And so I started cycling in the evenings when there wasn't anyone about... I cycled a good sort of 10, 15 miles."

Sally: White, female, age 56 years

Gillian said that she would often walk in woodland, where she took the dogs she cared for as a volunteer dog walker. She also recalled a moment when she discovered a new walking route past some trees with mistletoe, as a result of dropping her car at the repair garage. She spoke of how physically invigorating it felt:

> "I'd never walked along that route before. I was having some repairs done to my car and so I left the car there and walked for miles and miles... So, you know, it was invigorating."
> Gillian: White, female, age 59 years

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

Gillian: White, female, age 59 years [cropped]

2.2 Breathing Clean Air

The ability of trees to photosynthesise was recognised by participants as being supportive of human health. Participants perceived treed places as having more fresh air and oxygen, and spoke of the role of trees in producing clean air. Fiona, for example, spoke of the importance of trees in improving air quality for human health:

> "Obviously, if there aren't places where we can have <u>trees</u> and things, that's really not <u>good for our health</u>... in terms of you know, how much <u>trees</u> keep us <u>healthy</u> and give us <u>clean air to breath</u>."

Fiona: White, female, aged 52 years

Amy also expressed a sense of the vital importance to physical wellbeing from the oxygen produced by trees:

> "If you go into the <u>wood</u>, you've got <u>more oxygen</u> because of the <u>trees</u>, and to <u>breathe all</u>

<u>that in</u> gives you a much sort of <u>better sense of wellbeing</u>."

Amy: White, female, age 50 years

2.3 Appreciating Shade

The shade provided by trees was valued by participants as providing refuge from heat and sunshine, and creating cooling, comfortable conditions. Dawn, for example, spoke of how different types of natural environments bring her "a sense of wellbeing", focussing on the physical wellbeing she experienced in shady woodlands:

> "A <u>woodland</u> walk, you know, may tend to be quite <u>shady</u>, it's <u>lovely and cool on a hot day</u>... in some lights you might think that a dark <u>wood</u> is quite sombre, but actually it's quite <u>refreshing</u>, it's <u>cooling</u> and <u>nice on a hot day</u>."

Dawn: White, female, aged 59 years

Shade (and light) also provided interest and intrigue in the experience of interacting with trees, as Judith highlights here in speaking about the light filtering through a tree canopy:

> "It <u>filters</u> through <u>rather than a bright sun</u>... like <u>dappling</u>, and that's <u>calming</u> I think. I think when it's <u>nature's shade</u>, it's quite pleasing to think there is all this <u>nature</u> that you <u>can hide under</u>."

Judith: White, female, age 50 years

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

Judith: White, female, age 50 years

Nishanth: Asian, male, age 28 years

2.4 Foraging Food & Tending to Fruit Trees

Some participants spoke of foraging from trees, bushes and hedges, others of gardening and tending to trees and bushes in gardens. Several participants experienced a sense of pride and resilience from learning about and cooking with this food. For example, Nishanth spoke of the fruits he picked from his garden, saying:

> "We had plums last year and… since we are engaged more with the garden, we saw a lot. And then me and my landlady picked some plums and we did some jam and all those things. Oh, wow, [the jam] was good! [laughs]."

Nishanth: Asian, male, age 28 years

Meanwhile, Karthik recounted how he would pick apples from a tree in the park and observe the berries growing in nature, as inspiration for his own garden. He said:

"I'm on a plant-based diet myself and so… I've been to Zoom chats on foraging, trying to learn about this and… growing your own… [In this interview] I talked about the blackberries, I talked about the sloe berries, I talked about how to grow your own… we're looking at nature as not only something to enjoy, we're looking at nature to actually keep us, to survive from a nutrition point of view also. So that's sort of been the interesting part of it."

Karthik: Asian, male, age 37 years

Theme 3: Social Wellbeing

This theme, which has 3 sub-themes, explores how participants described trees and treed places as supporting their social wellbeing. Trees and treed places provided focal points and places to be with other people and pets, offered opportunities for shared experiences around trees, and helped to foster a sense of community.

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

3.1 Connecting with Friends & Family

Treed places facilitated opportunities to spend time with loved ones. Several participants described socialising with friends and family in treed places, and some described the importance of experiencing trees and treed places together. Hayley, for example, described going to a treed park with her boyfriend, and meeting his parents there to talk and socialise during COVID-19, after the initial lockdown restrictions eased. It is a greenspace that she described as being "not particularly impressive", but one that they valued nevertheless:

> "The [photograph] with the <u>trees</u>... I went to stay with my boyfriend for a couple of weeks so that I could see his family, and also just go back to [the park, with him]... that is the space that we had never valued, particularly, never visited particularly, but it was the space where <u>we met his parents</u>, pretty much every weekend. And that was <u>really, really important</u>. He doesn't live with his parents, he was living in a flat... so <u>he hadn't seen them</u> for a little while and so it was <u>really important</u> to have <u>that space</u>, and it's not a very particularly impressive <u>green space</u> [laughs], it's not very big, but <u>it meant a lot to us</u> because <u>we could see his family</u>... <u>sit with his family and chat</u>."
>
> Hayley: White, female, age 27 years

Ashleigh recounted an experience in which she viewed the sunset over trees, something which she shared with her very good friend after the lockdown period, and which was clearly of profound importance to her:

> "It was just such a <u>lovely experience</u>, because she's again one of <u>my dear friends</u> who <u>I really miss</u> if I don't get to <u>see her</u>, and so we were <u>both</u> just transfixed, and there's something

Ashleigh: White, female, age 53 years [cropped]

about being <u>together</u> and <u>sharing</u> like <u>the same experience</u> of <u>nature</u>, and being like, this is just <u>incredible</u>."

3.2. Being with Pets

Relationships with pets, as well as other humans, were also clearly important to several participants. Treed places facilitated meaningful interactions with pets, primarily through activities such as dog walking and exploring in parks and woodland. However, trees in home gardens also provided a focal point around which some participants spent valued time with their pets; something which seemed to make both owner and pet happy. Ashleigh, for example, described how:

> "The <u>cat would love it</u> when we were out there because it's a communal garden and... two or three other cats that go through it, and this would stress her out a lot, and she was obviously <u>a lot more comfortable when we were there</u>, so she would come and like <u>hang out with us</u>... that <u>tree</u> that I'm crouched by is a <u>plum tree</u> and she would lie underneath it in the heat, and I'm just sort of <u>talking to her</u>... so it all became about this garden and just <u>sitting out there with the cat</u>, and that became <u>really, really enjoyable</u>."
>
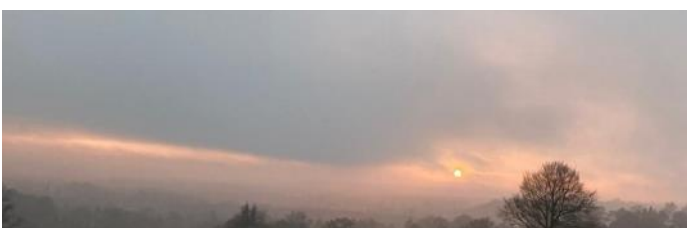> Ashleigh: White, female, age 53 years

Charlotte also described being in her garden with her cat, who seemed reassured by her owner's presence:

> "She's so much <u>happier</u> and <u>she loves it</u> when <u>we go out there</u>... And that <u>tree</u> that I'm sitting next to is right outside of our door. So yeah, that's about where I'm sitting and I'm probably listening to music. I'm probably not doing much. I like just sitting out there listening to music and not doing anything and she sort of <u>runs around or sits under me</u> in the shade."
>
> Charlotte: White, female, age 18 years

3.3. Fostering Community

Trees also seemed to be the focus for community activities and fostering a sense of social cohesion and community. Marie, for example, talked about how her community share tree produce, saying:

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

"In the village we have a very strong community and so during lockdown, people would put things on our [village] webpage saying, 'Oh, I'm just cutting back some bay trees, if anybody wants bay leaves, for cooking, come up and collect them, they'll be on the wall'... so we had all of this, really lovely village community."

Marie: White, female, age 62 years

Josh, who described himself as "very much a social being", shared a photograph depicting a group of six people smiling in a wood, gathered around a fallen tree, some leaning on it, another sitting on it. When talking about this photograph, he explained that he had created a community of people on Facebook, who would walk together in nature:

"I set-up a Facebook group for people, for friends and friends of friends and it's sort of grown and it's a funny mixture of people that didn't really know each other to start with... if you want to go for a walk, suggest it on here and, anyone else that wants to join you can join you, and... It's been going the best part of a decade now and it really, strength to strength, and it works nicely because it's kind of grass roots, it doesn't involve me or any central person like organising all the walks, it's like, if you want to go for a walk... It's a good model... I feel everyone should have this model in their life."

Josh: White, male, age 44 years

Independently from Josh's experience, Fiona also recounted setting up a very similar Facebook group, with woods again providing a setting in which to socialise:

"I set up a group called Social Walks, and people used to sort of go, "Hey, does anyone want to go for a walk this weekend?" and then people would agree to go somewhere like the woods or the seafront."

Fiona: White, female, age 52 years

Theme 4: Spiritual Wellbeing

This final theme, which has 6 sub-themes, presents ways that trees and treed places helped to support the spiritual wellbeing of participants, provided a source of comfort, and helped take them out of themselves. This theme encompasses different aspects of self-transcendence, which for some participants was an explicitly religious or faith-based experience, while for others it was not. Participants described how trees were associated with important memories, how trees helped them connect with nature, and how treed places could be imbued with other-worldly qualities. People valued the changes they observed in treed places and felt nourished by being in such environments. Trees also helped some people gain a sense of perspective in their lives, or a sense of their place in the universe and in time.

4.1 Meaning & Memories

Specific trees and treed places held special meaning for some participants, with often profound memories associated with them. One participant had lost a beloved cat, but the apple tree in their garden was now called by the cat's name, in tribute to the place where it died. Trees also carried childhood memories for some. Tina, for example, spoke of visiting:

"Somewhere I had been as a child and there was this tree, this really old like gnarly kind of tree that my Mum and Dad were like, 'We've got a photo of you with your brothers there', so what we did is we photo my kids there and then we Zoomed my family."

Tina: White, female, age 43 years

Emily recalled her friend's wedding, which was celebrated in a park that held so many memories for the couple:

"It was such a lovely, lovely day, and my friend just wouldn't stop crying, she's 'it's so lovely'... we were just in this little tiny patch of field, but it meant something to them because they'd always take their kids there, right before they got married. And we were under some trees and we stayed there until late evening."

Emily: White, female, age 25 years

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

4.2 Connecting with Nature

Many participants spoke of engaging with, observing, and appreciating different aspects of nature (animals, plants, fungi, etc.) on and around trees. For some, such as Rashid, engaging with trees replaced the lost social connections during the lockdown period: "you're still meeting the trees and they're meeting you". For several participants, both before, during and after lockdown, engaging with trees was very important to them, with some describing profound, spiritual experiences. For example, Charlotte recalled an encounter with a red squirrel in Russia:

> "It was in the middle of February, so it's freezing and there's snow everywhere. And in the gardens these underline beautiful little red squirrels kept coming up to us… then we got up to this tree which had little bird houses on it and this Russian woman was feeding the squirrel some nuts. And I was so enchanted. This woman gave me some of her nuts and I held out my hand to this little red squirrel…. I was holding it out and it was eating and then I would pull my hand away and… it would put it's little paw on my hand and pull it closer. And it was so magical I couldn't believe it. That was the best part of my whole trip, I love animals so, so much."
>
> Charlotte: White, female, age 18 years

Several participants seemed to feel an enhanced connection to nature during the lockdown period, with some noticing more nature in the places around them. Katie, for example, said of some fungi she found during lockdown:

> "I've never seen fungi like it, I was just like, Wow, what is that?… But it was all over the tree. And just weird and quite pretty [laugh]. Maybe I had more time to see things that we wouldn't normally notice or see, like the fungi… or different birds, there definitely seemed to be more birds when the first lockdown came."
>
> Katie: White, female, age 41 years

Charlotte: White, female, age 18 years [cropped]

Katie: White, female, age 41 years

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

4.3 Other Worldly, Magical Experiences

Some participants described treed places and experiences around trees as magical, other-worldly, and as if from a fairytale. Places with trees that appeared untouched by humans, also seemed to hold a magical quality. Sunsets and sunrises in treed environments were part of this magical experience for some. Ashleigh, for example recalled experiencing a sunset on a walk with a friend, describing with reverence the interplay between the light and trees:

> "We… were coming back from this big circular walk… as the sun was setting and… it was just like something out of a dream, the way the light was all pink and gold and it was backlighting some trees, but the shape of the trees made it look almost like a castle on a hill in the distance, and with these silvery clouds and the, it was just like something out of a dream or a fairytale."
>
> Ashleigh: White, female, age 53 years

Weather phenomena also featured in these magical experiences. Penny, for example, described taking a walk amongst trees in the snow:

> "I didn't expect all the snow to still be on the trees, that felt like Narnia. Yeah, that was really quite special."

Penny: White, female, age 54 years [cropped]

4.4 Variety, Change & Transitions

Trees and treed places provided variety in the environment, through their different shapes and colours, as well as providing key indicators of change over time. Some spoke of the changes that could be observed day-to-day, as leaves slowly emerged, while others spoke of observed changes to an environment between visits, or over the seasons. These changes offered hope and joy at the transitioning to, or beginning of, a new season, as well as more generally marking the passing of the seasons and the persistence of life in times of dormancy.

Stephanie spoke both of her joy at noticing the spring blossom, and of conkers in the autumn. While both offered different qualities, she was excited at observing the beginnings of both periods of the year:

> Spring: "…that was the first sign of spring that I saw, and I'd already enjoyed noticing the first signs of different seasons… and I remember sending that [photograph of blossom] to my mum and a friend and saying, 'Look, I've seen this, it's spring now'."
>
> Autumn: "I don't really like summer, it's probably my least favourite season… everything's really nice because everything's incredibly green but there isn't that change… but definitely autumn is my favourite and noticing the first conker that you see and, there's lots of firsts in autumn that I like."

Stephanie: White, female, age 31 years [cropped]

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

Participants sometimes saw metaphors for coping with challenging times in their own lives in the changes and transitions they observed in trees. For example, Gillian described her hope at seeing the emergence of catkins in the winter and early spring period before the lockdowns began:

> "It was bleak, there were no... leaves on the trees, but it was just hopeful indicator that you know, life was going to start coming back again."


Gillian: White, female, age 59 years

4.5 Feeling Guided, Comforted & Nourished

Some participants experienced a sense of an external provision of security and restoration (from an unnamed, identified source) in treed environments. For example, Gemma talked about the effect that the light through the trees had on her, providing her with a sense of being looked after, seen and guided by a higher force, which she seemed to find calming and comforting:

"[That photograph is] lovely because you see the sun through the trees, and that's like someone guiding you, that's like a light saying, 'You're- It's alright, I'm here'... that's like someone shining a torch saying, 'I know you're here', yeah light through the [trees] I like that... it's quite calming."
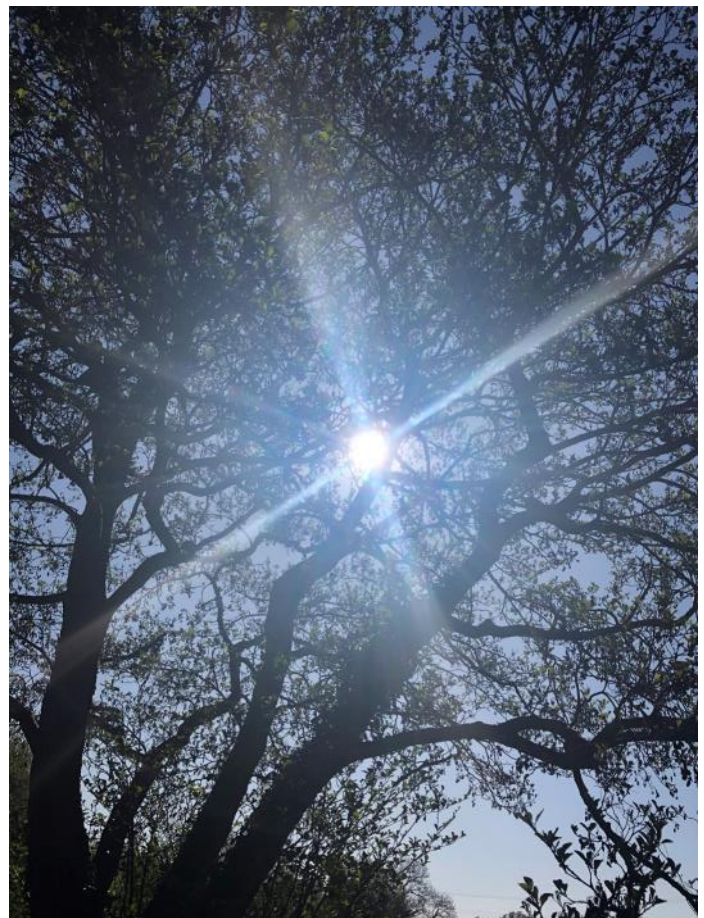
Gemma: White, female, age 52 years

Treed environments were seen as exuding a nourishing energy by Lorenzo, who spoke of missing a wooded area which he was unable to visit during lockdown:

"Well maybe this is a bit [of a] hippy... expression but it's a different type of energy. I always say the sea is cleansing, woods and mountains are nourishing".

Lorenzo: White, male, age 47 years

Trees & Wellbeing

What wellbeing benefits did interview participants experience from visiting trees?

4.6 Experiencing Transcendence: Feeling Small & Sensing Time

Trees and treed places also helped participants feel grounded and experience a shift in perspective, be that through seeing tall trees which dwarfed the person, or seeing an old tree or woodland which provided a sense of time and ancientness. These transcendent experiences helped to remind the participant of their fleeting presence in the world and the importance of things beyond their own everyday lives. For some, this transcendence related to their religion, but for others it did not. Judith, for example, talked about:

> "A <u>huge</u> <u>beech tree</u> just down the lane on the edge of a farm... and it is <u>massive</u>. And it's good to lean against and <u>think</u>, wow this <u>tree</u> was <u>here before me</u> and <u>it'll be there when I'm gone</u>."
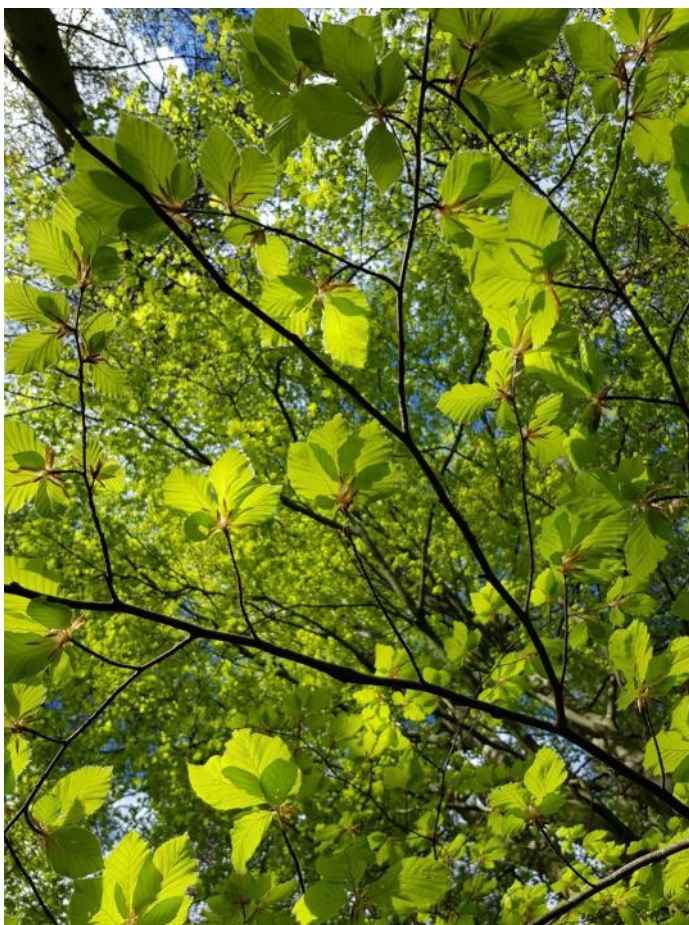
Judith: White, female, age 50 years

Judith went on to explain how this and other similar experiences related to her own faith, and helped her gain a sense of wellbeing:

> "I suppose it's that in nature you get that sense of awe and wonder that you often don't experience in any other place... that's kind of <u>transcendent</u>... So standing looking up at a <u>tree</u> can do that or you know, watching like [laughs] the other day I was watching a mouse on my bird feeder trying to work out like how to get [laughing] the peanuts out. It didn't, it fell off... So I suppose the <u>transcendence</u>, for me, it points towards a <u>Creator</u>. So that's really important in my <u>faith</u>. And it teaches me... that <u>I'm not the centre of all things</u>... 'Cause I think that there is a <u>relief</u> in realising that <u>you're quite small</u>. The whole of the world is <u>not your responsibility</u>... and I suppose for me it's <u>comforting</u> because it pointed me towards <u>something bigger</u>, so <u>God</u>."

Nishanth had a similar, religious experience when encountering two large trees while walking in some woodland during a period of snowfall. But his overwhelming feeling was more one of gratitude and an awareness of the length of time the trees had taken to grow, of their age in comparison to his:

> "There was this <u>huge</u> <u>tree</u> and I was going through the <u>woods</u> and... [I] suddenly saw, like, <u>wow</u>, that was really <u>huge</u>, actually. It was like two <u>trees</u> growing together and they were so <u>tall</u>. And when I looked at it, I was <u>feeling grateful</u> to be there because the <u>tree</u> was not born in... the year that I was born. The <u>tree</u> was <u>before my dad</u> and, I think, even before my dad was born. So, I <u>feel so grateful</u>, like how nice the world is for us, <u>a world which is prepared for us long before even we were born</u>... Those <u>trees</u> were <u>there for me</u>. I think, <u>God created that for me</u>, so that, when I cross that, I will get... <u>happiness</u>, or <u>peace of mind</u> and all those things. So, <u>He created that for me</u>... it was a feeling of <u>gratitude</u> and <u>wonder</u>."

Nishanth: Asian, male, age 28 years

Key Findings

Four key findings can be drawn from the analyses presented in the report, which relate to each of the four research questions:

1. Terms for Nature

General terms for "tree" were found to be in much wider use than specific terms, across both survey and interview responses. This may reflect a loss of language in relation to trees, reminiscent of the loss of nature-related terms highlighted by Robert MacFarlane in his book, *Landmarks*[27], in which he identifies words no longer in general use in the UK. Another explanation is that it reflects an "extinction of experience", as described by Soga & Gaston[33]. They suggest that with fewer people, especially children, having daily contact with nature, we may be observing a reduced affinity and understanding of nature. The National Curriculum in England does, however, require students to be taught how to identify and name common wild and garden plants, including trees. Other factors which may influence language use could include education level, workforce sector, and whether respondents live in urban or rural areas; although examining these factors was beyond the scope of the current report.

2. Naturalness and Connection to Nature

Despite concerns that a lack of specific terms might be associated with an "extinction of experience"[33], survey respondents perceived high levels of naturalness (equating to an average score of "quite a lot" of naturalness). The amount of naturalness was perceived to be higher in tree-focused than non-tree-focused places, especially in relation to the level of greenery, the presence of animals, birds and insects, natural sounds, and natural materials. On average, respondents also agreed that they felt connected to nature, with those visiting tree-focused places experiencing greater connection to nature.

3. Importance of Trees & Different Treed Settings

Trees featured in the majority of photographs taken by interview participants, illustrating the central role of trees in participants' nature experiences. Trees within and outside of woodland both featured prominently in these treed photographs, with trees outside of woodland being photographed both in urban and rural locations. This indicates the importance of the presence of trees in different settings: in woodland, outside of it, in rural areas and in urban areas. There is growing evidence to support the importance of forests[14] and urban trees[13,34] to people in the UK, but there is relatively little research on trees outside of woodland; something recently highlighted by Forest Research[18]. The present research suggests that trees outside of woodland in rural areas merit the same level of attention as trees in these other settings.

4. Trees and Wellbeing

Trees appeared to help support wellbeing in a range of different ways. Firstly, those who chose a tree-focused place to get away experienced significantly greater levels of hedonic wellbeing and eudaimonic wellbeing, and greater restoration, compared with those who chose another outdoor place to get away. These findings were supported and enhanced by those of the interview analyses, with participants experiencing emotional, physical, social and spiritual benefits from trees and treed places.

Recommendations for Future Research

Based on the data, a series of recommendations relating to the four main research questions of this report, can be made for future research:

1. Language

Terms for Trees and Treed Places: The findings suggest that people are either choosing to use more general terms for trees and treed places, or are unable to identify different characteristics and species of tree. More research could help to tease apart the underlying cause for the usage of these general terms. We recommend taking on board peoples' preferences and understanding of terms for trees and treed environments in future research and practice. We also suggest exploring other ways to investigate how people react to and engage with trees. For example, photographs could be used in conjunction with other methods of data collection, with experts used to identify information in photographs, such as the type of tree or treed place and the species of tree, rather than relying solely on participant vocabulary to communicate this. The use of imagery and visual methods could help convey a much wider range of experiences, perceptions, and values, across a wider range of settings.

2. Naturalness and Connection to Nature

Perceived Naturalness and Perceived Diversity: Our survey respondents perceived more nature in tree-focused places, including more greenery, more animals, birds and insects, more natural sounds, and more natural materials, such as rocks and mud. They also felt more connected to nature in some tree-focused places. This suggests that researchers and practitioners could explore the potential value of 'the presence of trees' as a proxy for greater perceived diversity (of sounds, habitats, lifeforms) in an environment, with the understanding that environments perceived as more diverse may be linked to people feeling more closely connected to the natural world.

Recommendations for Future Research

3. Importance of Trees and Different Treed Settings

Rural Trees Outside of Woodland: To date, research on the perceptions and benefits of trees has tended to focus more on urban trees and woodland/forest. But 26% of photographs containing trees were neither in an urban setting, nor in woodland, indicating the need to further study the perceptions and benefits of trees outside of woodland in more rural areas.

Activities and Motivations for Engagement: Our findings demonstrated that participants engaged in a range of different activities in treed places, such as walking, observing different aspects of nature, socialising, and listening to music. Future research might look at further capturing the range of activities or motivations people have for engaging with different treed settings.

Methods of Analysis: The analyses of photographs in the present study used categories which were indicative of their setting. They could only be considered indicative, since it was not possible to identify the exact surroundings of the trees in the photographs and we had to classify based on what was presented in the photographs. Future studies are needed to further quantify the presence and role of rural trees outside of woodland in human perceptions and wellbeing, by developing accurate assessments of urbanness and whether trees are in woodland or outside of it. Geographic information systems (GIS) could be deployed to examine tree canopy cover, including density and the area of cover.

4. Trees and Wellbeing

The Wellbeing Benefits of Trees: The presence of trees in different settings may have benefits for public health (both physical and mental), as well as enhancing social cohesion and connectedness. Researchers and practitioners should further explore, understand and promote these different wellbeing benefits of trees, as well as explore ways that promoting the public health benefits of trees could further support other areas of tree-related research, policy and practice, such as tree and land management.

Trees at Different Times of the Day and in Different Conditions: Participants photographed trees and treed environments at different times of day, capturing not just photographs of trees in daylight, but sunrises, sunsets, and nighttime scenes. Several interview participants also discussed their positive perceptions when discussing the interplay between trees and light during sunsets and sunrises. Participant photographs were also taken in different weather conditions (overcast conditions, with clouds, in snow, etc.), not just sunny conditions. And yet, much nature engagement research focusses on the daytime period and sunny conditions. It would be interesting to further examine the perceptions of trees and treed environments during a variety of periods of the day and under different conditions, as well as look more at the phenomenological aspects of nature. Indeed, other research has highlighted the importance of natural phenomena in the nature experience[10], and found that people particularly value the ephemeral phenomena of sunsets and sunrises[35].

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This research underlying this report was funded by the Economic and Social Research Council (ESRC) and conducted by the following multidisciplinary team of researchers. The report was commissioned by Forest Research and managed by Dr Beth Brockett.

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