Department of
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Abstract

Nature is valued by people for a multitude of reasons, and it contributes to human wellbeing. However, due to increased urbanisation and the development associated with it, people have less access to nature than ever. Biodiversity Net Gain (BNG) is an approach to development which aims for the gains in biodiversity to be greater than the losses. BNG has the potential to impact human wellbeing positively and negatively. As such, people and their values for nature need to be incorporated into BNG design to foster support for it. My research applies choice experiment methodology to a real-world development: Begbroke Science Park, Oxford. My aim was to evaluate preferences for BNG activities in order to incorporate them into BNG design. Using random parameters logit modelling, I show different groups of science park workers have distinct preferences for BNG activities. Members of biological organisations, pet owners, and those spending more time in nature have positive attitudes towards increased tree planting in developed areas and having at least equal woodland and grassland, if not more woodland, in an amenity park. However, respondents that would live or work onsite in the future have negative attitudes towards tree-planting and woodland in the park. My research contributes to the limited pool of empirical evidence on people's preferences for BNG activities. It also supports earlier work that found most nature interaction occurs locally, demonstrating the potential of onsite BNG to benefit human wellbeing.

Introduction

People value nature. Reasons for assigning this value are diverse and differ between groups. Biodiversity refers to the variety of life on Earth, including variation at genetic, species and ecosystem levels (CBD, 1993). Whilst biodiversity forms part of the nature people value, there are aspects of the environment beyond living organisms, habitats, and ecosystems that people value (e.g. NERC, 2011-2017). There are many ways to describe nature derived benefits, including ecosystem services, natural capital, and nature's contribution to people (Griffiths et al. 2018). Concepts such as "nature connectedness", which refers to how a part of nature people feel, further explore the complex relationship people have with nature (Tam, 2013, Richardson et al. 2019). A typology developed by Kellert (2008), describes ten different value systems linking people and the environment. These include aesthetic, humanistic (the ability of nature to provoke human affection), moralistic, and scientific (Kellert, 2008). Alongside theoretical work, more direct evaluations of how people value nature, such as Natural England's Monitor of Engagement with the Natural Environment (MENE) survey (2014-2020), have provided insight into how valuable nature is for people, by demonstrating that spending 120 minutes a week in nature is associated with good health and wellbeing (White et al. 2019).

Beyond White et al's 2019 study, there is growing consensus that nature is fundamental for human wellbeing (e.g. Capaldi et al. 2014, Hunter et al. 2019). There is international agreement that wellbeing can be defined as a positive physical, social, and mental state (Summers et al. 2012, Woodhouse et al. 2016, Beauchamp et al. 2018). Two principles apply to the understanding of wellbeing. The first is that wellbeing is multidimensional (Millennium Ecosystem Assessment, 2005), with three interconnected dimensions: the material (what you have), relational (what you can do with what you have), and the subjective dimensions (how you feel about what you have) (Figure 1). All three dimensions are important for a thorough assessment of human wellbeing (Britton and Coulthard, 2013). The second principle is wellbeing is heterogenous (Agarwala et al. 2014). Heterogeneity can be based on geographical factors or other socioeconomic influences such as gender, age, and previous experience (Beauchamp et al. 2018). For example, a study in Sydney, Australia, found that social and economic networks were not primarily based on place. Therefore, if wellbeing had been assessed purely by geography, it would have failed to reflect the true concerns and priorities of communities impacted by the development (Ziller, 2004).

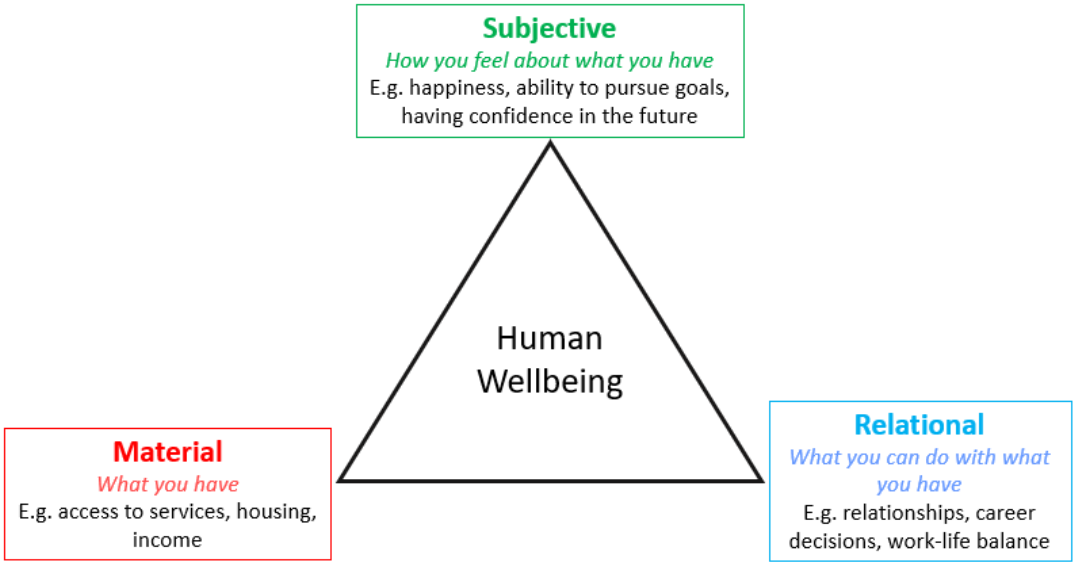


Figure 1: *The three dimensions of wellbeing. Based on White et al. 2009, Britton & Coulthard, 2013 and Woodhouse et al. 2016.*

Whilst there is awareness of the values people assign to nature and its impact on wellbeing, people are less able to access nature than ever due to increased global development (McPhearson et al. 2015), leading to negative impacts on wellbeing (WHO, 2016). For example, people are increasingly opting to live in urban environments: in 2018 23% of the world's population lived in cities of over one million people; this figure is projected to be 28% by 2030 (United Nations, 2018). With more people moving to cities, economic development levels have increased to meet demand for housing and other facilities. Increased development can limit people's access to nature in several ways. For example, environmental compensatory activities are often located close to developments to increase the areas desirability. However, this can increase environmental inequality and limit access to nature for already marginalised communities (Bateman and Zonneveld, 2019).

Alongside limiting peoples' nature access, increased development has contributed to habitat loss and fragmentation, the greatest drivers of biodiversity loss worldwide (WWF, 2020). As development levels increase, companies and governments are becoming more aware of mitigating the adverse environmental and social impacts of their activities. In line with international good practice, companies employ a hierarchy of mitigation measures (Figure 2). These emphasise avoidance and minimisation of environmental damage, for example by selecting an alternative location or by using environmentally friendly construction measures (Arlidge et al. 2018). However, these preventative measures are not always feasible, meaning compensatory actions are needed. These include restoration through remediation (e.g. reseeding affected land) and compensating for any residual, unavoidable impacts through biodiversity offsetting (Arlidge et al. 2018, Griffiths et al. 2018).

The mitigation hierarchy is often used to achieve No Net Less (NNL) for biodiversity (i.e. no change in overall biodiversity levels compared to the counterfactual or "no development" scenario; Figure 2).

Increasingly, companies are going a step further in aiming for Biodiversity Net Gain (BNG). BNG is an approach to development aiming to ensure overall gains in biodiversity are greater than losses (Bull et al. 2018). Local Planning Authorities, who are responsible for granting planning permission in the United Kingdom (UK), currently have the power to stipulate BNG (MHCLG, 2012). The Environment Act (DEFRA, 2021) goes further and will necessitate all developments requiring planning permission in England to achieve 10% BNG from 2023. This is in line with the UK government's 25 Year Environment Plan (DEFRA, 2018).

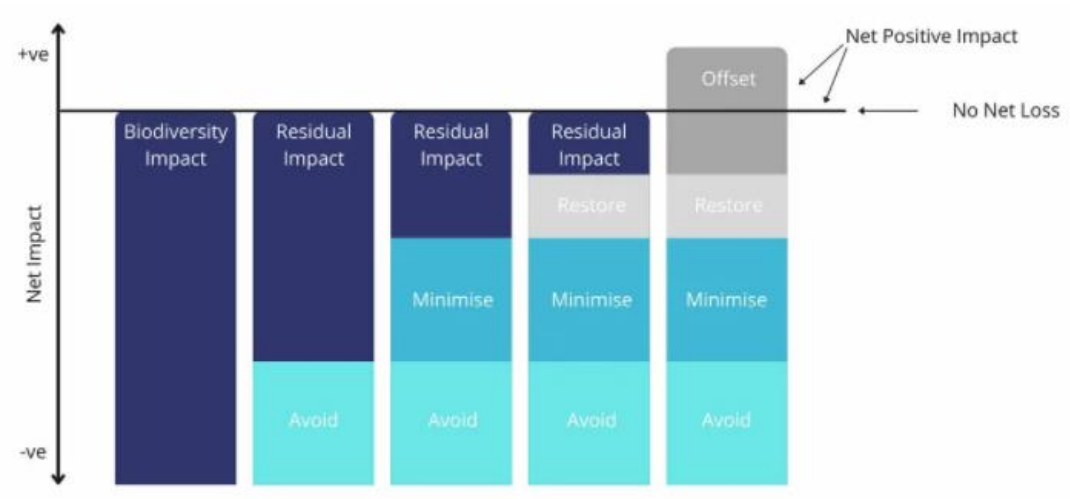


Figure 2: *A graphic representation of the mitigation hierarchy. This visualises how BNG goes above No Net Loss. Source: The Biodiversity Consultancy, 2020.*

Because nature contributes to human wellbeing, activities altering nature have the potential to impact people's lives. Therefore, it is important to consider how people value nature when designing mitigation measures such as BNG. BNG can benefit people through increasing their access to nature, for example by planning access for people with mobility issues (Public Health England, 2020). BNG can also have a negative impact on people by limiting nature access, for example through preferentially favouring BNG at sites benefitting expensive developments and neglecting social housing (Bateman and Zonneveld, 2019). Despite the potential benefits for people, BNG design has the tendency to focus on restoration of ecological function and doesn't always consider the nature people value (Tallis et al. 2015). Environmental protection measures can be rigorously planned yet prove ineffective due to not incorporating the nature people care about (Robertson and Hull, 2001). Furthermore, conservation measures and NNL activities have been shown to be more effective if the preferences of people they impact are considered (Ban et al. 2013). Investigating preferences gives a better understanding of people's values and can be translated into activities people are more likely to accept and support. Furthermore, integrating people into design encourages ownership, builds trust amongst stakeholders, and reduces conflicts between stakeholders and developers (Sterling et al. 2017, Baker et al. 2019). Overall, this facilitates BNG design that is more acceptable to people (Ekstrom and Pilgrim, 2014) and that not only benefits nature but also enhances people's wellbeing.

General frameworks and guiding principles highlight the importance of incorporating people into the design of environmental improvements (e.g. Bull et al. 2018, Cole et al. 2021). In addition, local contexts need to be considered during BNG design through understanding specific nature preferences (Cole et al. 2022). Choice experiments are a stated preference approach used to investigate the value people assign to different features of an approach or policy. They have been used to investigate preferences in a wide range of conservation contexts including bushmeat hunting (Moro et al. 2013, Travers et al. 2017) and consumer preferences within the illegal wildlife trade (Hinsley et al. 2015, Nuno et al. 2017). Choice experiments have also been used specifically in environmental compensatory contexts. They have revealed people's attitudes towards biodiversity offset activities (Burton et al. 2017, Rogers and Burton, 2017), shown preferences for social interventions as part of biodiversity offset programmes (Griffiths et al. 2018), and demonstrated people's willingness to accept woodland offsets as compensation for housing developments (Scholte et al. 2016). Cole et al (2022) also used a choice experiment to evaluate how closely academic recommendations for incorporating people into the design of NNL/BNG reflected actual preferences.

Considering people's preferences in BNG design shows a shift within environmental compensation. The primary focus is no longer to only mitigate biophysical changes, but also to consider the benefits nature provides to people (Lipton et al. 2018, Griffiths et al. 2019). However, studies looking at preferences for environmental compensation are limited, tend to focus on offsetting rather than BNG as a whole (e.g. Scholte et al. 2016, Burton et al. 2017), and are mainly based on hypothetical developments (e.g. Scholte et al. 2016, Cole et al. 2022). Choice experiment approaches need to be applied to specific development contexts, to enable developers to understand how effective they will be at translating people's preferences into BNG design that benefits human wellbeing as well as biodiversity.

Research aims and objectives

In this study, I applied a choice experiment approach to investigate the preferences of people working at Begbroke Science Park, Oxford, UK, for BNG activities occurring during large scale development of the science park. The aim of my research was:

- To evaluate preferences for different BNG activities which aim to integrate human wellbeing considerations into development design.

The objectives of my research were:

- To determine how the study population relate their wellbeing to biodiversity and to potential BNG activities.
- To explore the relative value of different BNG activities, in order to determine which BNG have the most potential to benefit wellbeing.

- To highlight heterogeneity of preferences for BNG activities between different groups within the study population and consider how these different preferences could be addressed.

The main hypothesis of my research was:

- People prefer BNG activities providing greater amenity benefit, even if these provide less biodiversity benefit.

Greenspaces with higher amenity value tend to contain less biodiversity due to increased levels of human disturbance. I hypothesised that people would have stronger preferences relating to BNG activities affecting amenity areas and that these would have a greater impact on wellbeing. The BNG activities investigated were placed on a biodiversity-amenity continuum to test this hypothesis (Figure 3).

My research was conducted in close collaboration with those responsible for the development and with operators of the science park. This was crucial for meaningful dissemination of results and increases the potential of my findings being translated into practical outputs relating to BNG design.

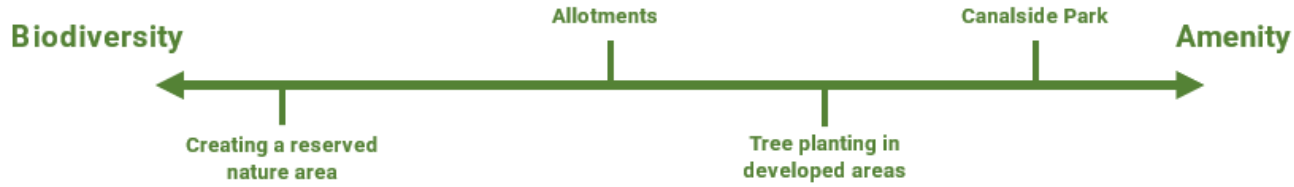


Figure 3: *The four BNG activities used in my study to test for peoples' preferences.*

Methods

To investigate peoples' preferences for BNG activities occurring as part of development projects, I conducted a choice experiment, at Begbroke Science Park. The choice experiment formed part of a wider online questionnaire containing demographic questions and questions investigating the importance of nature for people's wellbeing.

The study site

The chosen study site was Begbroke Science Park, a University of Oxford owned site located to the north of Oxford, near the villages of Begbroke, Yarnton, and Kidlington (Figure 4). Around 20 research groups and 30 companies from the physical and life sciences fields are based in 12,000m^2 of current building space. This site was chosen as a case study due to its accessibility, the willingness of the developers to engage with the study, and because the university has committed to achieving BNG.

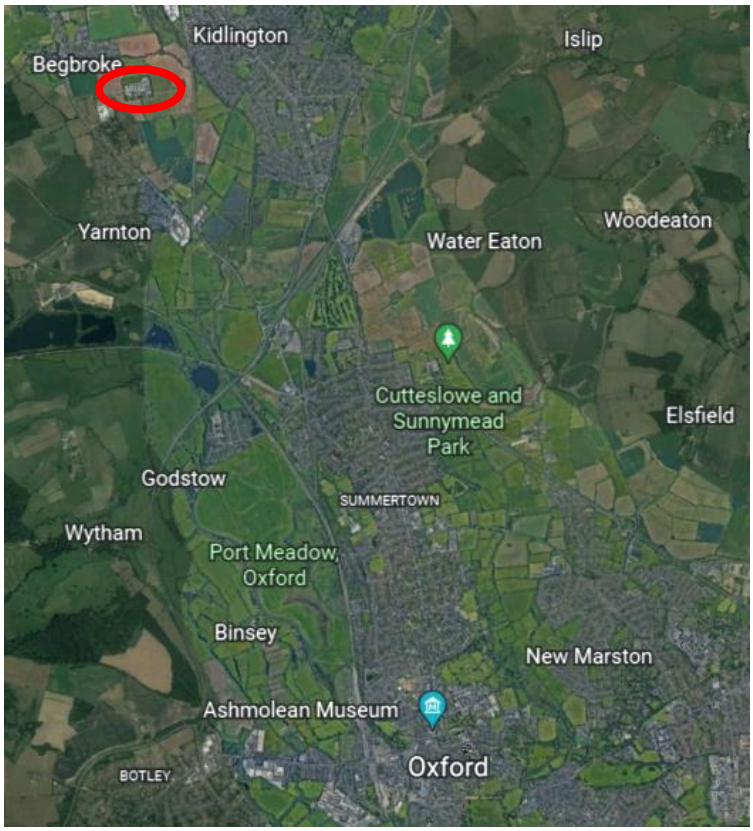


Figure 4: *Locality map showing Begbroke Science Park (circled in red) in relation to the city of Oxford.*

Site ecology

The science park buildings are set in a wider 190ha site, predominantly consisting of agricultural land. The habitats with highest biodiversity value are a shelter belt directly around the science park and hedgerows. There are several ponds and a brook with adjacent semi-natural woodland. Most of the land is intensively farmed and has low biodiversity, although some semi-improved and improved grassland exists along the north-east of the site.

The development

The science park has received extensive funding, with development set to begin in the next few years. Cherwell District Council, the Local Planning Authority, requires developments to achieve some BNG (Cherwell Local Plan 2011-2013 Part 1) in accordance with the National Planning Policy Framework (MHCLG, 2012). Development plans include approximately 1950 new homes and several schools, as well as expansion of the current research facilities (Figure 5). The detailed plans for residential and research areas are yet to be created, with a masterplan design team having only been selected in March 2022.

A report outlining the ecological opportunities informed the planning of three major greenspaces within the science park. There will be a Canalside Park, which will mostly comprise of amenity grassland. A Local Nature Reserve will also be created in the north of the site. Most of this land is currently arable, meaning the topsoil is likely to be high in nutrients such as phosphorus. Consequently, the creation of certain habitats such as species-rich grassland is likely to be difficult. Habitats that could realistically be created in the Nature Reserve include woodland, scrub, rough grassland, and wetland features. Finally, a non-publicly accessible Nature Conservation Area will be in the north-east of the site adjacent to the Canalside Park (Figure 5).

Although the sizes of these greenspaces have been determined, the proportions of habitats within them have not. Furthermore, little has been decided regarding the design of green features such as trees and parks within the residential and research areas. Consequently, there is scope to advise on the design of BNG activities within the major greenspaces and the developed areas.

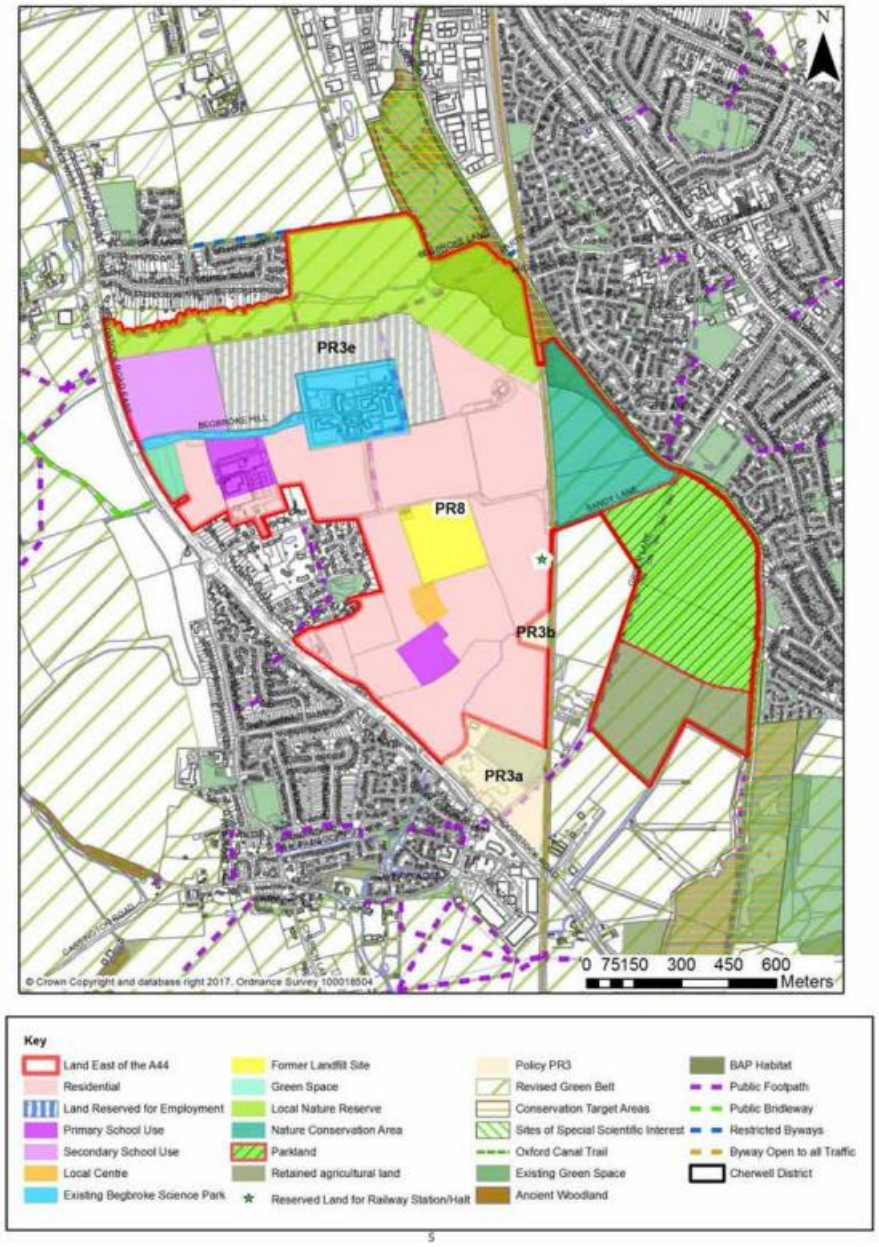


Figure 5: *The plan for the development of Begbroke Science Park. Source: Cherwell Local Plan 2011-2031.*

Study population and data collection

Several groups could be impacted by development of the science park, including local residents and science park employees. Due to time limitations and because of their importance to the university as employees and as potential users of the site's housing, I selected current science park workers as the study population. These workers will include long- and short-term residents living locally, relatively short-term researchers, and long-term employees commuting to the science park from other areas.

An online questionnaire was used due to COVID-19 restrictions at the time of planning. In addition, in person interviews were considered unfeasible due to the time they require. The questionnaire was emailed to the main Begbroke worker mailing list, consisting of approximately 300 individuals. Weekly reminders were sent, and the questionnaire was available online for a total of two weeks.

As well as emails, I visited the site twice during the two-week period. During these visits I talked to science park workers, encouraging them to fill in the questionnaire and handing out flyers explaining my research aim and its objectives.

Questionnaire design

We conducted a pilot study with workers at the University of Oxford's Zoology Department's Wytham Field Station using an online questionnaire. I chose this group because they were easy to access and because the field station has similarities to the science park such as being based in an area of greenspace.

The questionnaire was created using Jisc Surveys. A combination of closed and open-ended questions was used to solicit information known by respondents and were designed to be interpreted consistently (Newing, 2010). Closed questions were used as they target specific information and are easily quantifiable. Open questions invited greater detail and allowed for unexpected findings. A Likert rating scale was also used, during which respondents were asked the extent to which they agreed or disagreed with statements relating to valuing nature. The questionnaire was divided into three sections (Appendix 1).

Section 1: Socio-demographic questions and wellbeing conceptualisation

The first section was designed to gather information on respondent characteristics such as age and gender. These closed questions funnelled into more complex open-ended questions about respondents' conceptualisations of wellbeing. The question "What does it mean to you to lead a good life?" was deliberately placed in this section, prior to any mention of nature in the questionnaire, to see if respondents independently attributed wellbeing to nature and/or the outdoors.

Section 2: Nature and wellbeing

This section investigated how respondents value nature and how much wellbeing they assign to it. Asking this directly would result in divergent interpretations and responses that would be hard to compare and analyse. Therefore, I broke the overall question into variables that could act as indicators (Newing, 2010). Interaction with nature was the first variable of interest. I investigated this through several questions including how much time respondents spent in nature, what they most commonly did whilst in nature, whether they were members of biological organisations, and how many times they went outside in a working day. I was also interested in how people valued nature. Understanding nature values is important as they run deeper than and form the basis of preferences (Jones et al. 2016). I investigated nature connectedness, a concept describing how a part of nature people feel. Increased nature connectedness has been found to benefit human health and wellbeing, as well as helping promote pro-environmental behaviours (Abrahamse et al. 2005, Otto and Pensini, 2017). I adapted a psychological model for nature inclusion created by Schultz (2002), which has been used in

numerous studies as a measure of nature connectedness (e.g. Richardson et al. 2020) (Figure 8). Following this question, I used a Likert rating scale for a series of statements to investigate how strongly respondents related to different value systems detailed in Kellert's typology (Kellert, 2008). Value systems that were covered included aesthetic (the physical attraction and appeal of nature, "I find beauty in nature"), humanistic (emotional bonding with nature, "Being in nature makes me happy"), and moralistic (moral and spiritual relation to nature, "I find being in nature amazing").

By understanding how people interact with and value nature, my aim was to understand the potential of BNG activities for increasing nature interaction (i.e. did people interact with nature through activities that could be carried out at the science park) and for appealing to nature values as well as preferences.

Section 3: the choice experiment

The final section was comprised of the choice experiment investigating preferences for specific BNG activities.

Before people began the questionnaire and after they had read the Participant Information Sheet, they were asked to consent to participate in the research. To minimise hypothetical bias and to elicit sincere preferences, I used a solemn oath ("*I declare that I will answer to the best of my ability, based on my true preferences*"). This approach has been found to be effective at reducing bias during choice experiments (e.g. De-Magistris et al. 2013, Hinsley et al. 2015).

Ethical considerations

The research proposal went through a rigorous ethical review conducted by the Central University Ethics Committee's (CUREC) Medical Sciences Division. All participants were over the age of 18 years and consented to taking part in the research after reading a detailed Participant Information Sheet. All response data were stored securely on a password protected Nexus365 OneDrive. Responses were anonymous and only I had access to the response data. Respondents were given the opportunity to leave their email to be kept informed on the findings of the research. Emails were only used to contact participants for this purpose. The study received ethical clearance, CUREC reference number R79052/RE001.

Questionnaire analysis

Analysis of the questionnaire, beyond the basic socio-demographic information, was broken down into three sections.

Local conceptualisations of wellbeing

This involved analysis of responses to the question "*What does it mean to you to live a good life*?". I carried out a thematic analysis following the six-phase guide set out in Braun and Clarke (2006). This is a widely used method in qualitative research, during which recurring themes are identified and

coded in the data. Thematic analyses are useful for processing large amounts of qualitative data. I identified a list of key themes in the responses and recorded the frequency at which each was mentioned. I also looked at how often nature/outdoor related themes were mentioned.

Wellbeing and nature

I generated graphics for people's reasons for not going outside more during the working day and for what they most commonly did whilst spending time in nature. Several of the nature interaction and nature value variables used to investigate peoples' relationships with nature were included as socio-demographic variables in the choice experiment analysis (Table 1).

The third section was the choice experiment, details of which are covered in the next section.

Table 1: *Variables used as indicators of nature interaction and/or how people value nature that were included as socio-demographic variables in the choice experiment. Also included is the rationale for investigating these particular variables and the expected impact they would have on preferences for BNG activities.*

Variable	Levels/Units	Rationale for Investigating	Expected Relationship with Preferences
Time in nature per week	Hours (0-2, 3-5, 6-8, 9+)	Used to investigate the level of nature interaction respondents had.	The longer respondents spent in nature per week, the stronger their preferences would be. Furthermore, they would have stronger preferences for BNG activities benefitting biodiversity (Richardson et al. 2020).
Times outside in working day	Number of times/day (Never, 1-2, 3-4, 5+)	Another nature interaction variable. This could indicate the potential of BNG onsite to increase nature interaction, i.e. if people aren't going outside at all during the working day then BNG is unlikely to increase interaction.	The more people go outside, the stronger their preferences for BNG activities (e.g. MENE Survey 2014-2020).
Member of biological organisation	Yes/No	A third nature interaction variable. Being a member shows a direct interest and investment in nature.	Member of biological organisations have stronger preferences for BNG activities than those that aren't. They are also more likely to value activities creating more biodiverse areas (e.g. MENE Survey 2014-2020).
Nature connectedness	Image 1-6 (1 being the least connected)	Used to determine how a part of nature people feel and whether people assign deeper value to nature than simple preferences.	Those with a stronger nature connection have stronger preferences and prefer more biodiverse BNG activities (Richardson et al. 2020).

Attribute and level selection for the choice experiment

During a choice experiment, respondents choose between sets of hypothetical scenarios, "alternatives", presented on a choice card. On each choice card, respondents are asked to select their most preferred alternative. These alternatives are formed of several characteristics, or "attributes", each of which can occur at different "levels". The attributes were different BNG activities, and the levels represented the different degree at which the attribute could be implemented. One level always represented the baseline condition. A conditional choice design was used, meaning that the choice sets did not include a fourth "opt-out" alternative.

We chose attributes and levels through consultation with key development personnel including ecologists and project managers, following Griffiths et al (2018). This ensured that the attributes selected (i.e. BNG activities) were realistic and could be feasibly implemented as part of the development activities. A literature review of UK BNG projects was conducted and used to compile a list of potential, site relevant BNG activities. Following this, meetings were held with the lead ecologist of the development to discuss the ecological reports and BNG at the site. Finally, a two-hour focus group with eight key development personnel was held to discuss the list of attributes and levels. The feedback provided was used to create the final set used on the choice cards.

Following the focus group, I selected attributes that fell at differing points on an amenity-biodiversity continuum (see Figure 3), as well as those that were feasible. This allowed me to test my hypothesis that people had stronger preferences for BNG activities providing amenity benefits over those mainly providing biodiversity benefits. Four attributes/BNG activities each comprised of three levels were selected for use in the choice experiment (Table 2). Pictures were sourced to help respondents visualise the different BNG activities. Pictures were chosen to have similar aspects and levels of "attractiveness", to avoid the introduction of image-based bias.

Table 2: The attributes and levels used in the choice experiment.

Attribute (BNG Activity)	Description	Levels	Images
Creating a reserved nature area	An area has been set aside for nature that people will be able to see but not go into. There are different options for the habitats that can be created within this no-access area. The first of these is wildflower meadow. The flowers in the meadow would bloom for a few months in the summer but wouldn't be present all year round. The other habitat is scrub, which is a mixture of small bushes and trees, some of which have blossom in the spring. Both types of habitats are valuable for various kinds of biodiversity, including insects and birds.	1. 0% meadow, all scrub 2. 30% meadow, rest scrub 3. 60% meadow, rest scrub	Meadow:  Scrub: 
Tree planting in developed areas	Within the research and residential areas at the science park, native trees can be planted. There are already some trees on the site that will remain. New trees can be planted in one of two ways: in lines along streets or in patches in small parks. These trees will support some biodiversity (e.g. birds and lichens), more as they age, and will also provide shade and structure for people.	1. No planting of new trees 2. Trees along streets 3. Trees in small parks	No planting of new trees: 

			Trees along streets:  Trees in small parks: 
Canalside park	A park is being created that will be the main recreational area close to the science park. The park can have different proportions of grass (e.g. sport pitches, space for picnics and walking dogs) and woodland with paths for walking. The park will not harbour much biodiversity but will be accessible to people for recreation. The woodland will contain slightly more biodiversity.	1. All grassland, no woodland 2. Equal grassland and woodland 3. Some grassland, mostly woodland	Grassland:  Woodland: 

Allotments	An area is being set aside for allotments. Allotments are small patches assigned to individuals within the community that they can grow vegetables, flowers etc in. Anyone living or working at Begbroke would have the opportunity to be allocated an allotment. There is also the option to have community orchards. Community orchards are collections of fruit trees which are managed jointly by the community, with the fruit often shared amongst them. The trees would bear fruit for a couple of months during the autumn each year, and people working and living at Begbroke would be able to harvest them. Allotments and community orchards are good for biodiversity (e.g. pollinators) if chemicals are not used.	1. 100% allotments, no orchard 2. 60% allotments, rest orchard 3. 20% allotments, rest orchard	Allotments:  Community orchard: 

Choice experiment design

Choice experiments can be designed using full or fractional factorial designs (ChoiceMetrics 2018a). Full factorial designs consider all possible combinations of attributes and levels. As a result, their use is not feasible for most choice experiments. Fractional designs consider only a subset of all combinations and can be either orthogonal or efficient in their approach. Orthogonal designs are more traditional and ensure no correlation between attribute levels. However, it can be hard to find an orthogonal design, meaning the number of choice cards can be very large. Alternatively, efficient designs aim to minimise the standard errors of the attribute parameters and maximise the amount of information taken from each choice situation. Efficient designs have been growing in popularity and are now the most common method used in choice experiment design.

I used the specialist software Ngene, Version 1.1.1 (ChoiceMetrics, 2018b), to generate an unlabelled efficient design using a Bayesian D-error approach. A Bayesian D-error approach refers to the way in which the efficiency of the efficient design in measured. Various efficiency measures exist but D-error is the most common, with Bayesian D-error approaches assuming priors are normally distributed around a given mean. We also assumed a standard deviation of 0.2 for the priors to account for uncertainty and make the design more robust.

Respondents were presented with a series of five choice cards (Figure 6), each with a set of three hypothetical scenarios to choose from. The number of cards was chosen to avoid an excessive cognitive burden and respondent fatigue. Feedback on survey design, attributes and levels was collected at the end the pilot questionnaire.

This feedback was used to alter the final questionnaire. Changes included making it simpler to select the preferred alternative on each choice card and editing the phrasing of several questions. We ran a multinomial logit (MNL) model on the pilot data and the parameter estimates it provided were used as priors in the final choice experiment design. The number of choice cards remained the same.

	Alternative 1	Alternative 2	Alternative 3
Creating a reserved nature area	30% meadow, rest scrub 	0% meadow, all scrub 	30% meadow, rest scrub 
Planting of trees in developed areas	No planting of new trees 	No planting of new trees 	Trees along streets 
Canalside park	Equal grassland & woodland 	Some grassland, mostly woodland 	All grassland, no woodland 
Allotments	100% allotments, no orchard 	100% allotments, no orchard 	20% allotments, rest orchard 

Figure 6: *An example of a choice card.*

Choice experiment statistical analysis

Nlogit 5 was used for choice experiment analysis. Dummy coding was used to capture non-linear preference variation across attribute levels for "Tree planting in developed areas" and "Canalside Park". Dummy coding allows for incorporation of categorical variables by assigning them numerical values. "Creating a reserved nature area" and "Allotments" were linear, so no dummy coding was required.

Choice experiment data were explored using a multinomial logit model (MNL), then a random parameters logit model (RPL). The MNL was used as a preliminary analysis to ensure the software was functioning correctly and that the data was structured appropriately. RPLs are more robust as they consider heterogeneity and error correlation across each respondent's choices. For the RPL model, 500 Halton draws were used to simulate distributions of attributes that were assumed to be normally distributed.

To investigate preference heterogeneity, an RPL model was run on the choice data, with eleven socio-demographic variables interacted multiplicatively with all the attributes and levels. I explored the effect of: gender, age, time worked at the science park, whether respondents would work at the science park in five years, whether respondents would live onsite, children, pets, time spent in nature a week, nature connectedness, membership of biological organisations, and finally how many times respondents went outside during the working day. Each of these variables had an expected effect on preferences for BNG activities (Table 1, Table 3).

Table 3: *Variables used to investigate the heterogeneity of respondent's preferences and their expected relationships with those preferences.*

Variable	Levels/Units	Expected Relationship with Preferences
Gender	Male, Female, Non-binary, Other, Prefer not to say	Females value BNG activities leading to greater biodiversity benefits. Based on the concept of the "eco-gender gap" which refers to the tendency of women to be more environmentally conscious than men (e.g. Zainulbhai 2020).
Age	Years (18-30, 31-45, 46-60, 61+)	Older respondents value BNG activities leading to greater biodiversity benefits (e.g. Wang et al. 2021).
Time worked at science park	Years (<1, 1-3, 4-6, 7-9, 10+)	Those that have worked at the science park for a longer amount of time have stronger preferences for BNG activities. This has not been directly investigated before, but I hypothesise those with greater individual investment in the site will have stronger opinions on onsite BNG.
Would work at the science park in 5 years	Yes/No	People that would work at the science park in 5 years have greater preferences for BNG activities due to higher investment in the site. This has not been directly investigated before, but I hypothesise those with greater individual investment in the site will have stronger opinions on onsite BNG.
Would live at the science park	Yes/No	People that would live at the science park have greater preferences for BNG activities due to higher investment in the site. This has not been directly investigated before, but I hypothesise those with greater individual investment in the site will have stronger opinions on BNG.
Children	Yes/No	People with children have less strong preferences for BNG activities (Nordström et al. 2020).
Pets	Yes/No	People with pets have less preferences for BNG activities, given the environmental damage associated with owning a pet (e.g. Martens et al. 2019).

To test for correlations between attributes, I ran Chi squared tests. The only significant correlation was between age and the number of years worked at the science park (Chi^2 value = 24.919, df = 9, p-value = 0.003). Following this significant result, age was removed from the interaction RPL as there was deemed no reason a priori that age would have a significant impact on preferences, whereas length of time worked could affect an individual's personal investment in the site.

Results

Respondent Characteristics

A total of 60 individuals answered the online questionnaire. Table 4 summarises respondent characteristics.

Table 4: *Summary of key respondent characteristics*

Characteristic	Number
Gender	
Male	28
Female	31
Prefer not to say	1
Age	
18-30	19
31-45	19
46-60	13
61+	7
Prefer not to say	2
Children	
Yes	20
No	40
Pets	
Yes	26
No	34
Time worked at Begbroke	
<1 year	14
1-3 years	19
4-6 years	18
7-9 years	0
10+ years	9
Imagine themselves working at Begbroke in 5 years	
Yes	38
No	23
Imagine themselves living at Begbroke	
Yes	11
No	50

Local conceptualisations of wellbeing

Before I investigated peoples' relationships with nature, I wanted to understand what was important for their wellbeing. I asked respondents "*What does it mean to you to lead a good life?*", which the majority answered (n=54). I built a list of 28 themes which fell across all three dimensions of wellbeing, e.g. happiness (subjective), housing (material), and family (relational). I recorded the frequency each theme was mentioned. Themes relating to nature/the outdoors were mentioned explicitly by a quarter of respondents (Figure 7), which demonstrates people consider nature important for their wellbeing independently of it being mentioned in the questionnaire.

Figure 7: *Quotations from the online questionnaire in response to the question "What does it mean to you to lead a good life?".*

Wellbeing and Nature

The next section focused on respondent's relationships with nature. Most respondents felt an intermediate connection to nature (Figure 8).

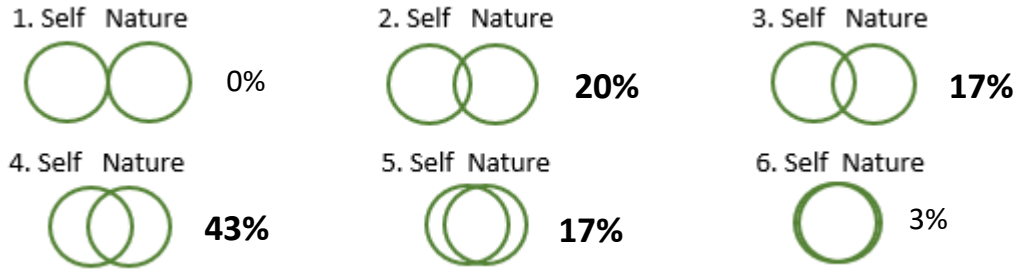
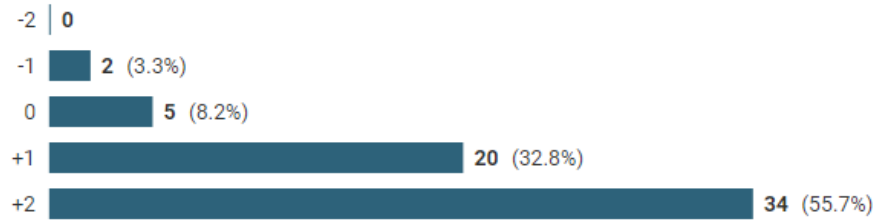
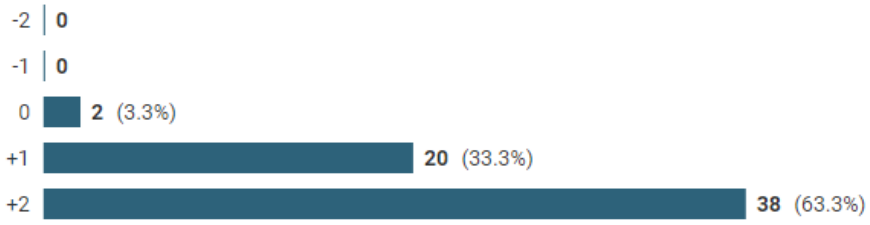
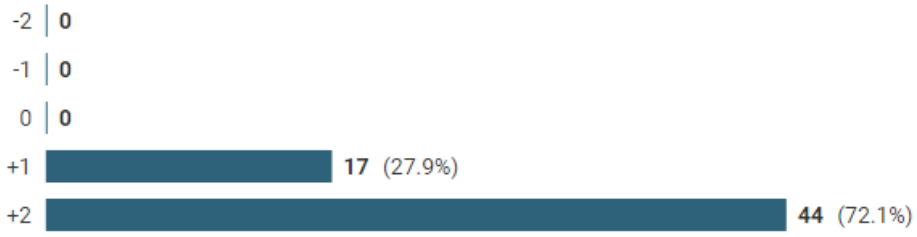
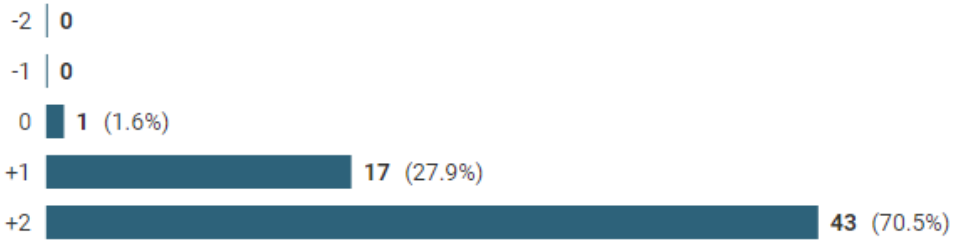


Figure 8: *Respondents reported connection to nature based on nature connectedness diagrams. Respondents were asked to select the image which they felt most closely resembled their relationship with nature. Based on Schultz, 2002 and Richardson et al. 2020. The greater the overlap between the circles, the greater the level of nature connection.*

A Likert scale was used to reflect how people valued nature. It reflected the respondents' strong positive feelings towards nature (Table 5). Despite these positive views, many of the respondents spent very little time in nature over a week (37% spent less than 2 hours, whilst 12% spent more than 9 hours). People also went outside very few times in a day (63% went outside 1-2 times), which was mainly attributed to having limited time (65%). Time being the main restrictor of being outside indicates having nature in proximity is important for increasing access. Furthermore, very few respondents never went outside (<1%), demonstrating most people would benefit from having nature close to work. Furthermore, the activities people did whilst spending time in nature (walking 82%,

gardening 23%) can be done at the science park. Therefore, having BNG onsite is likely to allow people to increase their overall nature interaction.

Table 5: *Responses on a Likert scale to a series of statements about nature.*

Statement	Likert Scale Responses (%)
"I find being in nature amazing"	
"Spending time in nature is important to me"	
"Being in nature makes me happy"	
"I find beauty in nature"	
"I treat nature with respect"	

Preferences for BNG Activities

I first treated choice data as homogenous across the respondents and analysed it using a multinomial logit model (MNL), which found all attributes had a significant effect on choice at least at the 5% level (Table 6).

I then ran a random parameters logit (RPL) model with no interactions between socio-economic variables (Table 7). The McFadden's pseudo R^2 reported good model fit and the Akaike Information Criterion (AIC) value showed a lower prediction error than for the MLN model. Three attributes were found to have a significant effect on choice: trees along streets, trees in small parks, and equal grassland and woodland, all at the 1% level.

To investigate choice heterogeneity, I interacted ten socio-demographic variables with the attributes (Table 8). The most significant differences between groups related to whether respondents would live onsite, the time spent in nature, pet ownership, and biological organisation membership. Those who would live onsite had negative attitudes towards the planting of trees, both in developed areas and in the Canalside park. In comparison, pet owners, those spending more time in nature, and biological organisation members all had positive attitudes towards planting trees in developed areas and having higher proportions of woodland in the Canalside park (Figure 9).

Table 6: *Multinomial logit (MNL) estimates of utility function for each attribute, along with standard errors and confidence intervals. The baseline levels were: 0% meadow all scrub, 100% allotment with no orchard, no planting of new trees, and all grassland no woodland. Model properties are also shown.*

Attribute	Coefficient	Standard Error	Confidence Interval
Creating a reserved nature area	0.013**	0.006	0.001; 0.024
Allotments	-0.008**	0.004	-0.015; -0.001
Trees along streets	2.359***	0.284	1.802; 2.917
Trees in small parks	2.340***	0.614	1.135; 3.544
Equal grassland & woodland	1.778***	0.257	1.275; 2.282
Some grassland, mostly woodland	1.127**	0.546	0.057; 2.196
Model Properties			
Log-likelihood	-194.701		
McFadden's pseudo R^2	N/A		
AIC/N	1.338		
n (observations)	300		
k (parameters)	6		

***, **, * Significance at 1%, 5%, 10% levels

Shading shows significant values.

Table 7: *Random Parameters Logit model.*

Attribute	Coefficient	Standard Error	Confidence Interval
Creating a reserved nature area	0.008	0.010	-0.012; 0.028
Allotments	-0.009	0.007	-0.022; 0.039
Trees along streets	3.924***	0.745	2.464; 5.383
Trees in small parks	2.917***	0.946	1.062; 4.771
Equal grassland & woodland	2.423***	0.455	1.532; 3.314
Some grassland, mostly woodland	-0.494	1.282	-3.006; 2.018
Model Properties			
Log-likelihood		-181.914	
McFadden's pseudo R^2		0.448	
AIC/N		1.293	
n (observations)		300	
k (parameters)		12	

***, **, * Significance at 1%, 5%, 10% levels

Shading shows significant values.

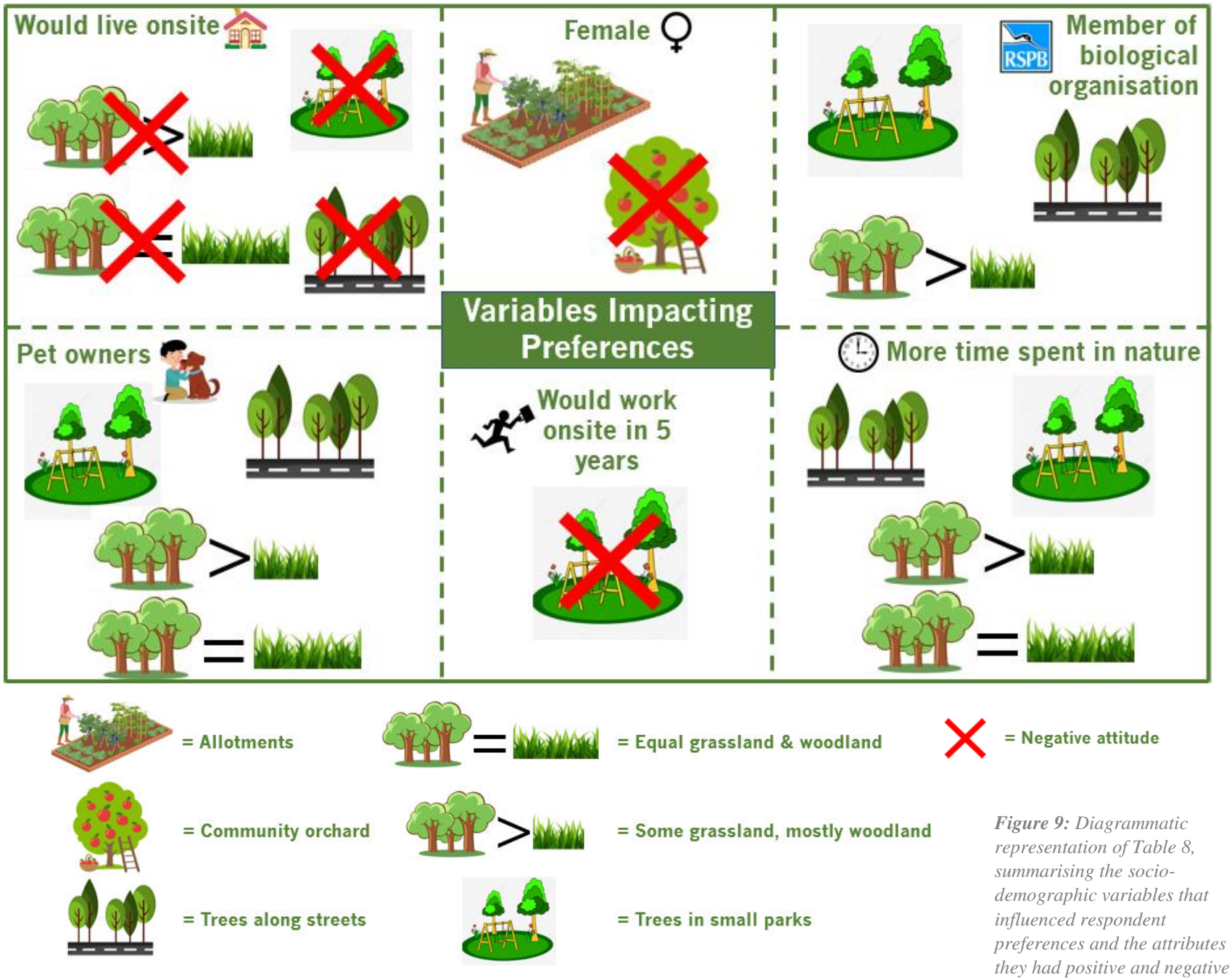


Figure 9: Diagrammatic representation of Table 8, summarising the socio-demographic variables that influenced respondent preferences and the attributes they had positive and negative attitudes towards.

Table 8: Random Parameters Logit (RPL) model. Baseline/reference values, to which each level is compared, are shown at the end of the table.

Attribute/level	Mean RPL model estimate	Socio-demographic variable interaction									
		Gender[a]	Time worked[b]	Work in 5 years[c]	Live onsite[d]	Children[e]	Pets[f]	Time in nature[g]	Nature connection[h]	Biological org.[i]	Times outside[j]
Creating a reserved nature area	-0.064 [0.048]	-0.009 [0.016]	-0.004 [0.005]	0.002 [0.023]	-0.036 [0.030]	0.011 [0.027]	0.051* [0.030]	0.007 [0.005]	0.017 [0.013]	0.052 [0.032]	0.003 [0.010]
Allotments	-0.006 [0.023]	-0.031** [0.013]	-0.002 [0.002]	-0.004 [0.012]	-0.001 [0.016]	-0.025* [0.016]	0.018 [0.015]	-0.007* [0.003]	0.009 [0.007]	0.012 [0.017]	0.008 [0.007]
Trees along streets	-0.223 [2.044]	-1.195* [0.693]	-0.272 [0.280]	-1.221 [1.024]	-4.859** [1.680]	1.652 [1.422]	4.427** [1.779]	0.669** [0.269]	0.589 [0.558]	5.394** [2.036]	0.913* [0.547]
Trees in small parks	-3.921 [4.253]	-0.076 [1.632]	-0.171 [0.517]	-5.187** [2.640]	-7.854** [3.360]	4.489 [2.940]	9.310** [3.810]	1.910*** [0.698]	-0.142 [1.148]	9.310** [3.810]	0.671 [0.997]
Equal grassland & woodland	-0.045 [1.841]	-0.051 [0.727]	-0.134 [0.231]	-0.699 [0.869]	-2.827** [1.364]	0.818 [1.267]	3.417** [1.549]	0.754** [0.313]	0.137 [0.507]	2.562 [1.606]	0.319 [0.451]
Some grassland, mostly woodland	-7.536** [4.431]	-0.061 [1.560]	0.000 [0.445]	-1.546 [2.179]	-6.845** [3.031]	2.869 [2.583]	8.542** [3.326]	1.857** [0.712]	-0.601 [1.127]	7.374** [3.240]	0.584 [0.891]

Model Properties	
Log-likelihood	-133.901
McFadden's pseudo R^2	0.594
AIC/N	1.373

***, **, * Significance at 1%, 5%, 10% levels

Shading shows significant values.

Baseline/Reference Values:

a Gender: Male = 0; Female = 1; Non-binary = 2; Other = 3; Prefer not to say = 4

b Years worked at Begbroke: <1 = 1, 1-3 = 2; 4-6 = 5; 7-9 = 8; 10+ = 12

c Would work at Begbroke in 5 years: No = 0; Yes = 1

d Would live at Begbroke: No = 0; Yes = 1

e Children: No = 0; Yes = 1

f Pets: No = 0; Yes = 1

g Time spent in nature a week (hours): 0-2 = 1; 3-5 = 4; 6-8 = 7; 9+ = 10

h Nature connectedness

i Member of biological organisation: No = 0, Yes = 1

j Number of times outside in working day: Never = 0; 1-2 = 1; 3-4 = 3; 5+ = 5

Discussion

Preferences for BNG activities

Six groups had significant preferences for BNG activities. Females had negative preferences for decreasing levels of allotments, i.e., they preferred having a higher proportion of allotments relative to community orchards. As there isn't a large difference in the biodiversity value of allotments and community orchards and given there were no other gender-related preferences, this result doesn't shed light on whether women are more conscious of biodiversity than men. This finding contrasts with the idea of the "eco-gender gap", a concept that refers to the tendency of women to be more environmentally conscious than men (e.g. Zainulbhai 2015, Saunders et al. 2020).

Being a member of a biological organisation was correlated with stronger preferences for BNG activities, which supports my hypothesis. Preferences were mainly linked to tree-planting, both in developed areas and having a greater proportion of woodland in the Canalside Park. Woodland will support more biodiversity than amenity grassland which indicates an awareness of biodiversity within this group. Being a member of a biological organisation has been linked to pro-environmental behaviours (e.g. MENE Survey, 2014-2020) and is indicative of a greater personal engagement with, and investment in, nature. These results therefore support previous findings.

In contrast to my expectations, pet owners had strong positive preferences for BNG activities. This group had more positive attitudes towards attributes than biological organisation members. They felt positively towards both types of tree planting in developed areas and liked both Canalside Park levels involving woodland. Given pets are known to have a negative environmental impact, for example through the production of meat-based pet food (Martens et al. 2019), pet owners may be less environmentally conscious, hence my hypothesis that they would have less preferences for BNG activities. However, owning a pet may increase owners time outdoors, and thus may increase people's connection to nature. More work investigating the relationship between owning a pet and nature connectedness could explore this.

Time spent in nature was another strong predictor of BNG activity preferences. Those spending more time in nature had significant positive attitudes towards the same attributes/levels as pet owners. This aligns with previous findings that more time in nature leads to greater nature connection and pro-environmental behaviours (Richardson et al. 2020). Investigating whether increasing the amount of time people spent in nature leads to changes in preferences for BNG activities would be an area for future investigation.

The final groups which had significant preferences were those that would work at the science park in five years, and those that would live onsite. Both groups had negative attitudes towards the planting of trees in small parks, with those that would live onsite also having negative preferences for trees along

streets and both Canalside Park levels involving woodland. I hypothesised these groups would have strong preferences for BNG activities but had not expected these to be negative. People may prefer open grassland, hence the negative attitude to trees. More investigation would be needed to shed light on this relationship, particularly given the small number who would live onsite (n=11). Furthermore, through my conservations with workers whilst visiting the science park, I found little was known about the development. Without sufficient knowledge of plans, individuals may have misunderstood what living onsite entailed. Given how advanced plans are, this lack of dissemination of development information highlights a gap in stakeholder engagement. Engagement is key to increase support and acceptance of BNG and other conservation activities (Ban et al. 2013). Following increased engagement with workers, responses to questions involving individuals' future investment in the science park would become more insightful.

My overarching hypothesis that respondents would have stronger preferences for BNG activities towards the amenity end of the biodiversity-amenity continuum (Figure 3) was supported. The two attributes I judged to have higher amenity but lower biodiversity value (the Canalside Park and tree planting in developed areas) elicited the strongest preferences. Using Kellert's (2008) typology, value systems such as utilitarian (material and physical exploration of nature) could underlie these preferences. Further direct investigation into nature values would shed further light on the reasons behind preferences.

Experience of nature is local and most BNG is achieved onsite

The qualitative investigations of this study further show how BNG at the science park could benefit workers. Previous studies found the majority of peoples nature engagement is local (MENE survey 2014-2020). Respondent's nature engagement was mainly occurring through walking and/or gardening, which could both be done at the science park. A recent study also found that BNG in England is almost exclusively achieved onsite (zu Ermgassen et al. 2021). Therefore, BNG at the science park is likely to influence people's ability to access nature locally and as this is where most nature engagement occurs, the potential impact on wellbeing could be significant. This potential is an exciting opportunity and a large social, as well as environmental, responsibility for developers and those involved BNG design.

The importance of empirical studies

Another key aspect of BNG design highlighted is the importance of empirical studies. There are very few studies using actual developments to investigate preferences (Griffiths et al. 2018), with hypothetical case studies being the more common focus (e.g. Scholte et al. 2016, Cole et al. 2022). For recommendations of research to be useful in industry and for them to further academic understanding, those designing and implementing developments and their required BNG need to be involved in preference investigation (Woodhouse et al. 2016). Academic frameworks and

recommendations need real world application and grounding to make them relevant to developers and other stakeholders. Without this, research findings are less likely to be translated into BNG design. Despite this being a scoping study, it demonstrates how collaboration between academic research and developers leads to more productive and empowering discussion that increases the potential for BNG design benefitting wellbeing and nature.

Limitations and future work

Due to my timeframe and having one researcher for questionnaire distribution, the sample size was limited (n=60) and only involved a subset of those that will be impacted by BNG. Future work needs to involve all local people, especially given the negative attitudes many have to development in Oxford as a whole. An understanding of their preferences will be needed if people's wellbeing is to be benefitted by BNG. Monitoring of preferences, wellbeing, and biodiversity, which all change overtime, will also be needed. There are currently no long-term studies into the impacts of BNG after people's preferences have informed its design. Begbroke science park provides an excellent opportunity to do this as developers have committed to long-term collaboration and monitoring of wellbeing and biodiversity.

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Management Report

Having worked with two of my supervisors Julia Baker and E.J. Milner-Gulland for a year on my second-year project which couldn't happen because of COVID-19, I was excited to get the opportunity to get to carry out research in this area when we were offered a fourth year. Victoria Griffiths, a past DPhil student of E.J.'s was brought on board given her experience in conducting choice experiments.

We met online during Trinity 2021 to discuss the project and made broad plans for what the aims of the research would be. Upon returning to Oxford for Michaelmas 2021, the main focus became getting my CUREC form submitted and approved. This required all participant facing information and scripts for interviews/online questionnaires to be written. Whilst reading around the subject area, I started designing a questionnaire and gathering information about BNG and the study. I met with members of Oxford University Development, the Development Office, and the ecologists involved in the Begbroke Science Park development. Some of these meetings were in person, some online, and some involved visits to the site. I was also simultaneously writing my introduction and background site information.

I completed all the materials needed to accompany the CUREC form by the end of November, including the Participant Information Sheet, Consent Forms, Questionnaire and Focus Group scripts. These were submitted for review and received approval in early January 2022. Meanwhile, preparations for running a focus group with key development personnel were underway, including receiving training in how to run focus groups from a member of my lab group. The focus group was run in early Hilary 2022 with eight participants. During the meeting, we discussed a long list of possible attributes and levels which I had collated from my research into the literature on BNG and the specific development. The session went well and produced some good feedback.

However, the focus group didn't produce a definitive list of attributes so following the focus group my supervisors and I discussed and selected the final set. These were used in the design of my pilot study with a total of four attributes, each with three levels being selected. Originally, my pilot was going to be sent via email to the Plant Sciences Department, but we later decided the Wytham Field Centre mailing list would be suitable due to its similarity to Begbroke. The pilot questionnaire was sent out in mid-February 2022 and was left out for just over a week. Responses were fairly slow at coming in and several reminder emails had to be sent, as well as encouraging people to fill it out. Around 30 individuals responded in the end, which was sufficient for the pilot, but it also made me apprehensive for the final questionnaire. The pilot provided valuable feedback which I used to edit the questionnaire. The results from the choice experiment were analysed and the coefficients produced were also used as attribute parameters in the final choice experiment.

Following its re-design, the final questionnaire and choice experiment were sent out to the Begbroke workers mailing list at the end of Hilary 2022. The questionnaire was carried out online, as with the pilot, as it was decided a hybrid approach would over-complicate the experiment and lead to inconsistencies in choice experiment results. The questionnaire was left out online for a total of two weeks. During this time, several reminder emails were sent. I also spent time at Begbroke in person, chatting to people who worked there about my research and encouraging them to complete the questionnaire, as well as handing out flyers. This proved fairly effective, and I managed to get a total of 60 responses by the end of the two week period.

Following completion of data collection, I set about organising and coding the choice experiment data for input into Nlogit. Coding took around a week and I then ran a series of models including a Multinomial Logit (MLN) model and several Random Parameters Logit (RPL) models. The RPL models differed in the number of socio-demographic variables that were included, with the original model not having any and subsequent models having nine or ten. “Age” was removed as a variable due to finding significant correlation between it and “Time worked at Begbroke” from a Chi squared test (which was also run on all other combinations of variables).

Once the models had been run and outputs given, I carried out analysis of the choice experiment and the other data collected by the questionnaire. I had been working on my methods and introduction throughout the other stages of my research. My final write-up draft was completed in week 4 of Trinity 2022.

Appendices

Appendix 1: Online Questionnaire

Introduction

Hello, my name is (*Name removed for thesis submission*) and I am a biology Masters student at Oxford. Thank you for taking the time to answer this survey.

My research is exploring how the University's office and housing development projects can be designed to make them better for those that live and work in them, focusing particularly on the role of natural spaces. My study is based on the development of Begbroke Science Park.

How this questionnaire will work

This questionnaire will take 15-20 minutes and will be composed of 3 sections:

Section 1: *You & Your Lifestyle*

Section 2: *Nature & Wellbeing*

Section 3: *Nature Improvement at Begbroke Science Park*

If you choose to participate, all answers you give will be kept confidential. You don't have to answer any question you don't want to and can choose to withdraw at any time.

I will analyse the information from respondents of this questionnaire, which will all be kept anonymous. The results will be included in my thesis as part of my Masters degree. It may also be published in peer reviewed journals.

This study has been reviewed by and received ethical clearance through the University of Oxford Central University Research Ethics Committee (Ethics reference number R79052/RE001).

If you have any questions

If you have any concerns or questions about this research, please get in contact with me (*Name removed for thesis submission)* and I will do my best to answer.

If you remain unhappy or wish to make a formal complaint, I can provide you with the contact details of the Research Ethics Committee at the University of Oxford.

Are you happy to take part in this questionnaire?

Yes/No

Section A: Socio-demographic Information

First, I would like to ask questions about yourself:

1. Gender: Male/Female/Non-binary/Other/Prefer not to say
2. Age:

☐ 18 - 30 ☐ 31 - 45 ☐ 46 – 60 ☐ 61+

3. How long have you worked at Begbroke for?

☐ <1 year ☐ 1-3 years ☐ 4-6 years ☐ 7-9 years ☐ 10+ years

4. Can you imagine yourself working at Begbroke in 5 years?

Yes/No

5. Can you imagine yourself living at Begbroke?

Yes/No

Section B: Household & Lifestyle

1. How many people do you currently live with?

_____

2. Do you have any children living with you? Yes/No

3. If you have children living with you, how many?

_____

4. If you have children, how old are they currently?

_____

5. Do you have any pets?

_____

6. If so, what kind?

_____

7. How has life been for you over the past year? (tick one)

☐ Good ☐ So-so ☐ Hard ☐ Don't know / would rather not say

8. Why?

_____

9. What does it mean to you to lead a good life?

_____

_____

_____

Section C: Nature & Wellbeing

Now I would like to ask about how you interact with nature as an individual, and how nature contributes to your wellbeing. Here we are talking about wellbeing as a positive physical, mental, and social state. Nature refers to all types of natural environment and all the plants and animals living there. It can be close to where you live in towns, as well as the countryside or wilderness areas further away.

1. How much time would you estimate you spend in nature a week? (Note: this refers to time deliberately spent in nature, e.g. walks in nature, hiking, spending time in parks, birding etc)

☐ 0 - 2 hours ☐ 3 - 5 hours ☐ 6 – 8 hours ☐ 9+ hours

2. What do you most commonly do when spending time in nature?

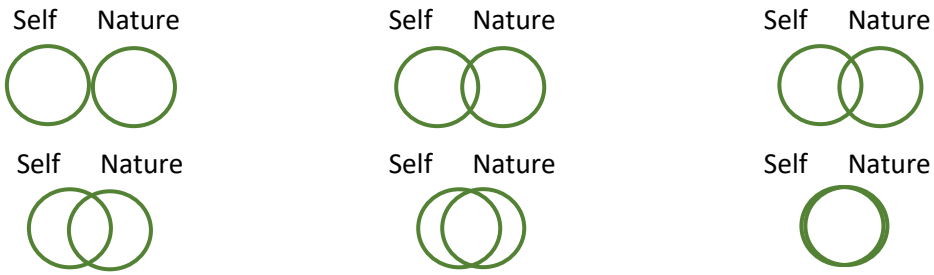
_____

_____

_____

3. Select the image that best describes your current relationship with nature.

Imagine one circle represents you and the other nature. When the two circles overlap to a greater extent it represents you feeling a greater connection to nature.



4. To what extent do you agree with the following statements? Choose on a scale with -2 being “Strongly disagree” and +2 being “Strongly agree”.

-2	-1	0	+1	+2
Strongly disagree		**Neutral**		**Strongly agree**

i) I find being in nature amazing ____
ii) Spending time in nature is important to me _____
iii) Being in nature makes me happy _____
iv) I find beauty in nature _____
v) I try hard not to damage natural areas_____

5. Are you a member of any nature/environmental organisations? If “yes”, which ones? (e.g. RSPB, National Trust, Woodland Trust, Wildlife Trust)

_____
_____
_____

6. How often do you go into open outdoor spaces in an average working day (whether on purpose or in order to get from one place to another)?

☐ Never ☐ 1 – 2 times ☐ 3 – 4 times ☐ 5+ times

7. Are you satisfied with this amount? (Circle one)

Y / N

8. If this is not as much as you would want, why not? (tick all that apply)

i) Not enough suitable space within easy access ☐
ii) Not enough time ☐
iii) Colleagues/other people don’t show interest in coming with me ☐
iv) Weather ☐
v) Other ☐
(Please specify) _____

Section D: Nature Improvement at Begbroke Science Park

Imagine the development at Begbroke is planning to improve nature around the science park, and that people's preferences for these improvements are being incorporated into planning. A number of different nature improvement activities have been proposed and the developers would like to understand which people prefer. Below is a table outlining four activities; each can occur at one of three levels.

Activity	Description	Levels	Images
Creating a reserved nature area	Imagine an area has been set aside for nature and wildlife that people will be able to see but not go into. There are different options for the habitats that can be created within this no-access area. The first of these is wildflower meadow. The flowers in the meadow would bloom for a few months in the summer but wouldn't be present all year round. The other habitat is scrub, which is a mixture of small bushes and trees, some of which have blossom in the spring. Both types of habitats are valuable for various kinds of biodiversity, including insects and birds.	4. 0% meadow, all scrub 5. 30% meadow, rest scrub 6. 60% meadow, rest scrub	Meadow:  Scrub: 

Tree planting in developed areas	Within the research and residential areas at the science park, native trees can be planted. There are already some trees on the site that will remain. New trees can be planted in one of two ways: in lines along streets or in patches in small parks. These trees will support some biodiversity (e.g. birds and lichens), more as they age, and will also provide shade and structure for people.	4. No planting of new trees 5. Trees along streets 6. Trees in small parks	No planting of new trees:  Trees along streets: 

			Trees in small parks: 
Canalside park	A park is being created that will be the main recreational area close to the science park. The park can have different proportions of grass (e.g. sport pitches, space for picnics and walking dogs) and woodland with paths for walking. The park will not harbour much biodiversity but will be accessible to people for recreation. The woodland will contain slightly more biodiversity.	4. All grassland, no woodland 5. Equal grassland and woodland 6. Some grassland, mostly woodland	Grassland: 

			Woodland: 
Allotments	An area is being set aside for allotments. Allotments are small patches assigned to individuals within the community that they can grow vegetables, flowers etc in. Anyone living or working at Begbroke would have the opportunity to be allocated an allotment. There is also the option to have community orchards planted within this area. Community orchards are collections of fruit trees which are managed jointly by the community, with the fruit often shared amongst them. The trees would bear fruit for a couple of months during the autumn each year, and people working and living at Begbroke would be able to harvest them.	4. 100% allotments, no orchard 5. 60% allotments, rest orchard 6. 20% allotments, rest orchard	Allotments: 

	Allotments and community orchards are good for biodiversity (e.g. pollinators) if chemicals are not used.		Community orchard: 

Please note: *I do not own any of the photos shown. Photo references are available on request.*

How the choice experiment will work

You will now be shown a series of 6 cards. On each card, there are 3 different scenarios for improving nature at Begbroke. These scenarios have different combinations of the nature activities and their levels.

For each of the 6 cards, select one scenario based on your preferences for nature improvement.

Even if you don't like any options, or you find the choice hard, please choose the one you prefer.

I declare that I will answer to the best of my ability, based on my true preferences:

I do/I do not

1. Which alternative would you prefer?

	Alternative 1	Alternative 2	Alternative 3
Creating a reserved nature area	0% meadow, all scrub 	60% meadow, rest scrub 	0% meadow, all scrub 
Planting of trees in developed areas	Trees along streets 	Trees in small parks 	Trees in small parks 
Canalside park	Some grassland, mostly woodland 	All grassland, no woodland 	Equal grassland & woodland 
Allotments	60% allotment, rest orchard 	100% allotment, no orchard 	60% allotment, rest orchard 

Alternative selected: _____

	Alternative 1	Alternative 2	Alternative 3
Creating a reserved nature area	30% meadow, rest scrub 	0% meadow, all scrub 	30% meadow, rest scrub 
Planting of trees in developed areas	No planting of new trees 	No planting of new trees 	Trees along streets 
Canalside park	Equal grassland & woodland 	Some grassland, mostly woodland 	All grassland, no woodland 
Allotments	100% allotments, no orchard 	100% allotments, no orchard 	20% allotments, rest orchard 

Alternative selected: _____

	Alternative 1	Alternative 2	Alternative 3
Creating a reserved nature area	0% meadow, all scrub 	30% meadow, rest scrub 	60% meadow, rest scrub 
Planting of trees in developed areas	Trees in small parks 	Trees along streets 	No planting of new trees 
Canalside park	All grassland, no woodland 	Equal grassland & woodland 	Some grassland, mostly woodland 
Allotments	60% allotment, rest orchard 	60% allotment, rest orchard 	60% allotment, rest orchard 

Alternative selected: _____

	Alternative 1	Alternative 2	Alternative 3
Creating a reserved nature area	30% meadow, rest scrub 	0% meadow, all scrub 	30% meadow, rest scrub 
Planting of trees in developed areas	Trees along streets 	No planting of new trees 	Trees along streets 
Canalside park	All grassland, no woodland 	All grassland, no woodland 	Equal grassland & woodland 
Allotments	100% allotment, no orchard 	20% allotment, rest orchard 	100% allotment, no orchard 

Alternative selected: _____

	Alternative 1	Alternative 2	Alternative 3
Creating a reserved nature area	60% meadow, rest scrub 	30% meadow, rest scrub 	0% meadow, all scrub 
Planting of trees in developed areas	No planting of new trees 	Trees along streets 	No planting of new trees 
Canalside park	Equal grassland & woodland 	Equal grassland & woodland 	All grassland, no woodland 
Allotments	20% allotment, rest orchard 	60% allotments, rest orchard 	100% allotments, no orchard 

Alternative selected: _____

	Alternative 1	Alternative 2	Alternative 3
Creating a reserved nature area	0% meadow, all scrub 	30% meadow, rest scrub 	60% meadow, rest scrub 
Planting of trees in developed areas	Trees in small parks 	Trees along streets 	No planting of new trees 
Canalside park	All grassland, no woodland 	Equal grassland & woodland 	Some grassland, mostly woodland 
Allotments	60% allotment, rest orchard 	60% allotment, rest orchard 	60% allotment, rest orchard 

Alternative selected: _____

Finally, if you have any questions or comments about my research, please leave them below. If you would like to be kept updated with the findings of this study, please also leave your email address (this will only be used to contact you for this purpose).

_____

_____

_____

Thank you

Thank you very much for taking the time to participate in this questionnaire. The information you have provided will help give insight into what elements of nature people value and will make a valuable contribution to my work.

If you have any questions about the questionnaire or my research in general, please do get in touch (*Email removed for thesis submission*