Forest Research

Attitudes Towards Landscape Benefits and Woodland Creation in Southern Scotland

Survey Findings Summary Report

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Forest Research is the Research Agency of the Forestry Commission and is the leading UK organisation engaged in forestry and tree related research. The Agency aims to support and enhance forestry and its role in sustainable development by providing innovative, high quality scientific research, technical support and consultancy services.

Acknowledgements

The authors wish to thank Latimer Appleby for their assistance with collecting data from across the study area, much of which is remote and sparsely populated. In addition, we thank Paulo Ruhrländer for his help in building and hosting the survey app, allowing responses to be captured regardless of internet coverage.

Contents

1. Executive Summary

- This report documents a Forest Research led study into attitudes towards landscape benefits and woodland creation in Southern Scotland, commissioned by Scottish Forestry in light of the Scottish Government's tree planting targets.

- The study area surrounds New Cumnock, Douglas Moor, Duneaton and Lowther. These areas represent testbeds for exploring the potential to establish larger scale plantations, including productive woodland (as identified by Scottish Government and the area's Local Authorities).

- All findings contained herein are derived from a survey of members of the public residing in the study area. In total, 515 survey completions were received (from people aged 18 and over) during summer 2019.

- The survey proved to be inclusive, with different genders and age brackets being well-represented. The majority of the sample are long-term residents of the region, with many having lived there for over twenty years.

- Use of the landscape centres around i) physical activities and ii) relaxation, although it is also used for social gatherings, wildlife watching, and shooting, fishing or foraging. Almost half of respondents reported to use the landscape for such activities at least once a week (though not necessarily for a single type of activity).

- The overall landscape is valued as a multifunctional resource, with wildlife, recreation, scenic quality and revenue generation perceived by respondents to be particularly important considerations for land use planning decisions and policy.

- Through landscape preferences expressed via the LANDPREF tool, respondents can be classified into three groups of people described as either multi-functionalists (57% of the sample), naturalists (38%) or agriculturalists (5%).

- There is strong support for increasing the amount of land dedicated to wilderness and nature, timber production and - to a lesser degree - residence. In contrast, there is relatively little support for increasing land use for energy production and farming, or for the landscape remaining unchanged.

- Based on the rating of images, it appears that the most acceptable landscapes contain access opportunities (e.g. for recreation), a degree of openness and the absence of utilities infrastructure. Preferences around the species and habitats contained within a landscape appear to be secondary.

- Nevertheless, there is strong support for increasing trees, woodlands and forests in Scotland as a whole.

- Furthermore, the vast majority of respondents consider their local area to be either suitable or extremely suitable for the establishment of new woodlands and forests. Perceptions of suitability tend to be greater among younger generations, those residing in towns and suburbs, and respondents classed as naturalists.

- There is widespread agreement that an increase in trees, woodlands and forests in respondents' local areas would lead to a suite of positive impacts, with improvements to air quality being chief among these. Societal benefits such as carbon sequestration and flood prevention are perceived to be of relatively low importance.

- The most concerning aspects of new, larger scale productive woodlands include the potential impacts on i) wildlife and biodiversity ii) the rural road network and iii) the landscape's scenic quality. Concerns about wildlife are greatest among the region's long-term residents, those who spend more time outdoors, and those living in rural localities. Concerns about the landscape's scenic quality are greatest among older generations and those respondents classed as multi-functionalists.

- Were any new, larger scale productive woodland to be created, there is consensus that it would be important for a suite of opportunities and benefits to be delivered. Chief among these are benefits to wildlife and biodiversity, provision of local employment and training, and access for recreation.

- The methods used in this study are replicable in other areas where information pertaining to landscape preferences and attitudes towards woodland creation is sought. However, subtleties in how the methods are conducted should strive to reflect local circumstances (population density, presence of key stakeholders/groups, and consideration of locally sensitive issues). Given such nuances, there are limitations in generalising the findings in this report to areas beyond the study area, particularly if local policies, relationships, population demographics and current land use differ.

- While these findings suggest that new woodland creation would largely be viewed in a positive light, further public consultation and co-development would likely increase perceptions of legitimacy and acceptability e.g. discussions with communities about how their concerns can best be addressed, and how desired benefits and opportunities can best be realised.

2. Introduction

From historically low levels of woodland cover at the turn of the 20th Century, Scotland has seen a range of initiatives to reforest the country, resulting in rapid expansion of non-native conifer plantations which increased woodland cover by more than 20,000 ha per year from 1950 to 1990 (Thomas et al., 2015). This included the use of 'dedication schemes' and tax incentives (House et al., 2003) to encourage private landowners. However, harsh criticism of the environmental impact of 'blanket planting' of monocultures of Sitka spruce together with the increased public concern, for example through negative publicity over afforestation of the Flow country (Woodland Expansion Advisory Group, 2012), led to a revision of incentives and the introduction of grants that have promoted social and environmental benefits, as well as more woodland expansion on marginal agricultural land (Quine et al., 2013).

The current Scottish Government aspiration is to increase woodland cover to 21% (from the current 18%) by 2032 (Scottish Government, 2019). Despite increased amounts of planting in 2018/19 (11,200 hectares of new planting, Forestry Commission, 2019), there remains a significant gap between the aspiration and recent levels of woodland planting. Challenges remain through conflicting food and climate change policy goals, low acceptability of woodland planting among farmers, volatile stakeholder perceptions, and, in Scotland, grazing pressure from high deer populations (Duckett et al., 2016; Environment Climate Change and Land Reform Committee, 2016; Burton et al., 2018). These challenges may be exacerbated in relation to annual woodland creation targets increasing in 2020/21 from 10,000 ha to 12,000 ha, and then 14,000 ha in 2022/23 and to 15,000 ha in 2024/25.

These challenges have implications for how to undertake consultations with the public and community groups about woodland creation proposals to ensure a fair, transparent and considered approach is taken. Context is important; a comparison of two case studies in Ireland demonstrated positive public values for amenity and recreation of woodland with a long history of forest cover, but negative perceptions associated with a landscape a) with more recent forest cover and b) largely dominated by Sitka spruce (Dhubháin et al., 2009). For some, associations may still persist between 'woodland expansion' and dense conifer plantations managed on a clearfell basis. This may be the case in areas of Scotland with large proportions of conifer woodland. Forest and woodlands cover approximately 28% of the land area of Dumfries and Galloway which, along with agriculture, forms the predominant land-uses in this mainly rural landscape (Dumfries and Galloway Council, 2013). However, tree cover is dominated by conifers with less than 10% being broadleaved species, a lower percentage of which are native species.

Public consultation is undertaken in relation to new planting proposals and also for the development of national strategies, including views on a draft of Scotland's Forestry Strategy 2019-2029: its vision, objectives and priorities. The draft strategy received 442 responses to the public consultation, of which 102

(23%) of these were from organisations and 340 (77%) from individuals (although 216 of the responses from individuals (49% of the total number of responses) were identical and generated as part of a campaign led by Woodland Trust Scotland). This demonstrates that the public are engaged with forestry issues, but also that there are key stakeholders who are both interested and influential.

For Local Authorities in Southern Scotland with land deemed biophysically suitable for woodland expansion (Woodland Expansion Advisory Group, 2012), understanding the local public's attitudes towards landscape change is necessary if concerns and hopes are to be accounted for. Recognising the importance of taking account of local views, Scottish Forestry commissioned Forest Research to undertake a public attitudes survey in and around a number of the sites identified by the Local Authorities as having potential for woodland expansion, including new, larger scale productive woodland. This report details the methods used by Forest Research to elicit those attitudes, a summary of the key findings from the study, and a number of conclusions to assist future decisions and actions in relation to woodland expansion.

3. Methodology

3.1 – Survey Approach and Design

A survey approach was chosen to ascertain the attitudes of the study area's population (see Figure 1). This approach offered the opportunity to collect a relatively large number of responses from the area's inhabitants and to compare responses among different demographics.

The question framework itself was developed and piloted in consultation with Scottish Forestry, with the aim of being finishable in 15 minutes. Its design included four sections intended to explore respondents' i) connectedness to the landscape, ii) preferences for landscape features and benefits, iii) perceptions around the expansion of trees, woodlands and forests, and iv) demographic range (age, gender, location, land ownership).

As shown in Appendix A, a variety of questions types were utilised including multiple choice, rating (e.g. Likert-type scales) and weighting. The survey also made use of LANDPREF - an interactive landscape visualisation tool that allows respondents to adjust a virtual landscape using rich images (Schmidt et al., 2017). Specifically, the respondent can choose 6 possible quantity levels (0 – 5) for six potential land uses (wind turbines, recreation, sheep farming, commercial forestry, native woodland and habitat for wildlife). A carbon sequestration indicator represents the carbon storage potential for the chosen quantities of forest and woodland. The available combinations are constrained through a rule-based algorithm to represent the trade-offs and synergies among the different land uses.

Both LANDPREF and the survey as a whole were framed in such a way that they pose questions about a range of land uses and ecosystem services/benefits rather than focus solely on the topic of woodland expansion. This approach was adopted to ensure that the research could remain relevant and appealing to a wide range of individuals. In addition, a more holistic land use survey was deemed to be less likely to be perceived as antagonistic to those with concerns that the study belies a hidden agenda. If this were the case, respondents with a particular view of the topic may be more or less likely to participate or to adopt an extreme stance when providing their responses. The approach therefore helps to minimise response bias. Finally, this more holistic land use survey approach allows attitudes towards woodland expansion to be compared in respect of other land use scenarios, such as those dominated by agriculture or energy infrastructure.

3.2 – Data Collection

The target population comprised of residents in an area surrounding New Cumnock, Douglas Moor, Duneaton and Lowther, as defined through discussion with Scottish Forestry. In respect of Local Authority areas, this area overlapped parts of East Ayrshire, Dumfries and Galloway and South Lanarkshire (Figure 1). Owing to the potential difficulties in gaining the necessary parental consent for minors, those under the age of 18 were deemed ineligible to participate.

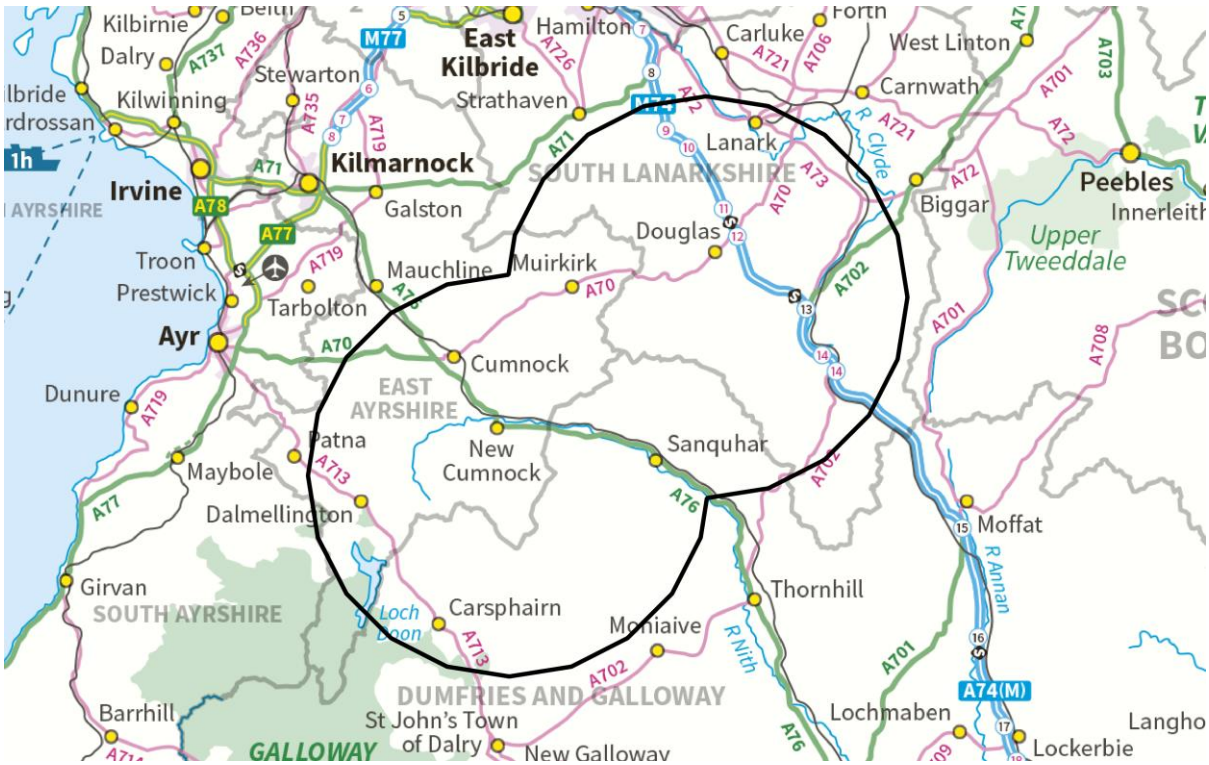

Figure 1 – Study area map indicating the population centres targeted (black boundary).

Given the interactive nature of the LANDPREF tool featured in the survey, it was necessary for respondents to see the questions first-hand. This ruled out the possibility of telephone surveys. Furthermore, since parts of the study area are somewhat remote, rural areas it was felt unlikely that a web-based survey would provide sufficient coverage or generate the desired number of responses. For this reason, the survey was built as an Android app and installed on a number of tablets allowing for data to be collected in-person via on-street surveys.

Potential respondents were approached over several days in summer 2019. These approaches typically involved on-street interceptions which were conducted on a variety of days (including weekends) and times of day. After a brief explanation of the research, potential respondents were asked to confirm their eligibility by indicating their age and where they live, either verbally or with reference to a map of the study area.

A desk-based review of the populations of the area's main settlements indicated that the area's total population is less than 50,000 people. A sample size calculator was used to determine that for a population of this size, 382 or more survey completions would be needed for confidence intervals (margin of error) and confidence level requirements to be met (i.e. to have a confidence level of 95% that the population's values would be within ±5% of the surveyed values).

In total, 515 survey completions were received from eligible individuals. Thus, the findings can be considered representative of the target population.

3.3 – Data Analysis

Much of the data were collected so that it could be analysed in its raw form. However, in order to make use of the postcode data supplied, this was transformed into categorical data, with each postcode becoming classed as either rural, suburban and town, or city (referenced using the Degree of Urbanisation dataset, Dijkstra and Poelman, 2014). In a similar vein, agglomerative Hierarchical Cluster Analysis (HCA) was employed to classify respondents based on the landscape preferences and trade-offs expressed through the LANDPREF tool. This resulted in respondents being classed as one of three categories (multi-functionalists, naturalists and agriculturalists, as referenced in Figure 7).

All applicable responses were quantified and summarised using counts and percentages. Subsequently, we explored if (and how) six demographic factors (age, gender, length of residency, urbanicity, frequency of landscape use and landscape preferences) are associated with attitudes and perceptions related to woodland expansion (perceived suitability of land for expansion, propensity for concern about different impacts, and perceived importance of realising different opportunities/benefits).

In some cases, it was necessary to combine similar response categories (e.g. 'important' and 'very important') in order to arrive at sample sizes large enough to test the statistical significance of the associations between variables[1]. Where such associations were found, these have been reported in the relevant sections of the ensuing chapter (see also Appendix B for details of the statistical outputs).

[1] Binomial general linear models were used to test associations, with model fit and diagnostics of residuals checked using the DHARMa package (Hartig, 2019) in R (version 3.5.2, R Core Team 2018). The false discovery rate was used to correct p-values for multiple testing of each question (Benjamini and Hochberg, 1995). Statistically significant associations were determined using the 95% confidence level ($p = <0.05$).

4. Findings

4.1 – Sample Characteristics

A total of 515 respondents aged 18 and over and residing within the study area completed the survey. Of these, 241 (47%) identified as male and 267 (52%) as female. The remaining 7 respondents selected either 'other' or 'prefer not to say'. As well as an even gender balance, all ages were well-represented in the sample, with a minimum of 35 responses (14%) from each age bracket. A breakdown of age bracket by gender is illustrated in Figure 2, demonstrating that no particular group was excluded from the study.

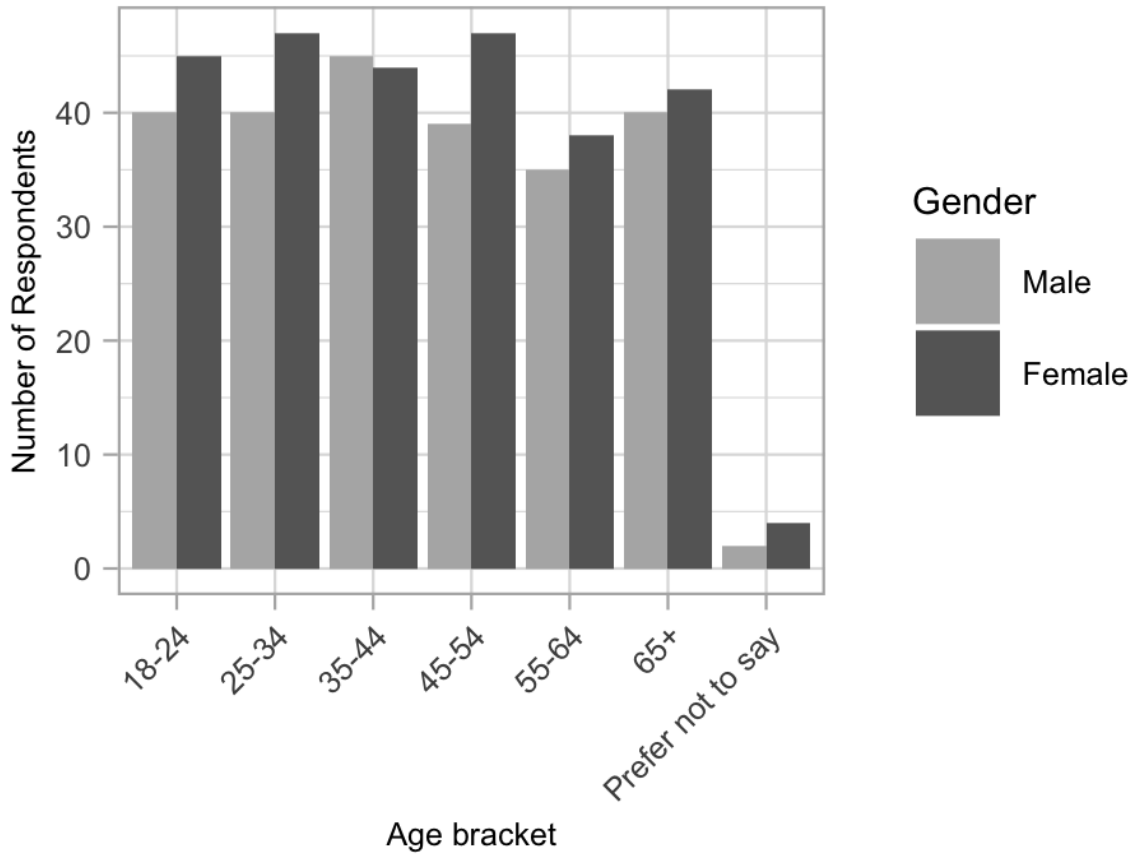

Figure 2 – Respondents' demographics (age and gender).

Using postcode data and the Degree of Urbanisation dataset, we determined that half of the sample reside in rural areas, with the other half in towns, suburbs and cities. Sixty-five percent of respondents reported owning no land, with a further 23% reporting to have up to 0.5 hectares. Only 33 of the sample (6%) reported owning more than 0.5 hectares of land, with the remainder (6%) preferring not to say.

4.2 – Place Attachment

Length of residency in a region is frequently used as a proxy for 'place attachment' and is often shown to correlate with a particular attitude towards local landscape change (Kienast et al., 2018), for example, increased tourism facilities (Williams et al., 1995) and new energy infrastructure (Vorkinn & Riese, 2001). Figure 3 illustrates the proportion of our sample who have lived in the region for different durations.

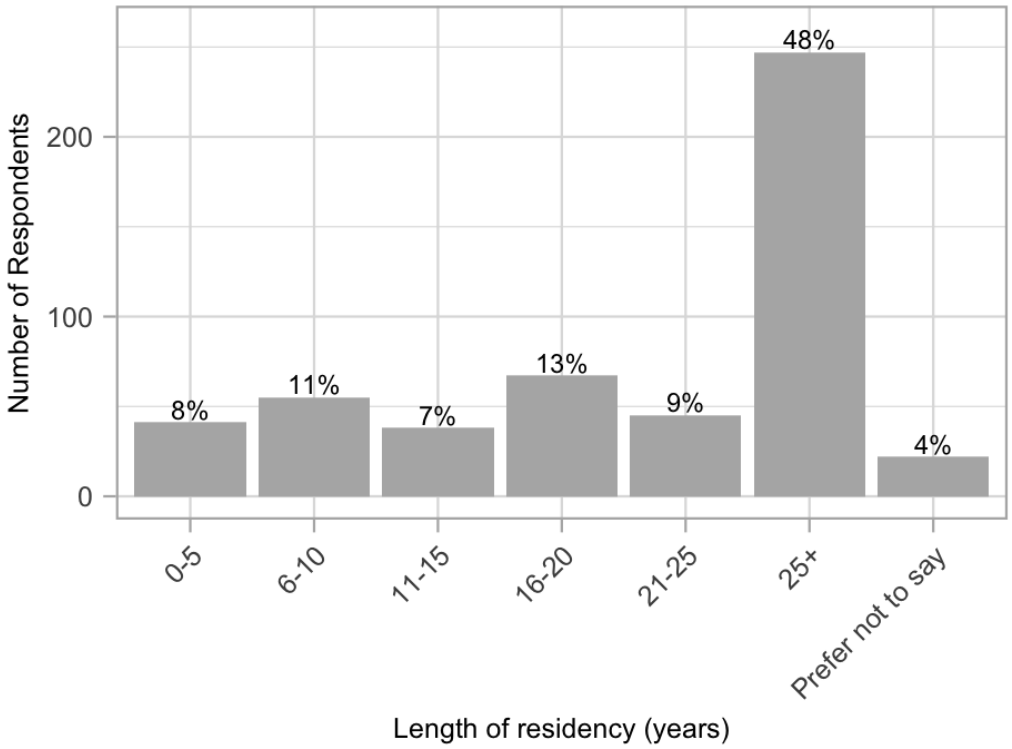

Figure 3 – Respondents' length of residency in Southern Scotland.

Many of the respondents have lived in the region for a substantial proportion of their lives, with almost half (48%) having lived there for over 25 years. For the purpose of further analysis, we refer to those who have lived in the region up to 10 years as 'short term residents' (19% of the sample), those who have lived in the region between 11 and 20 years as 'medium-term residents' (20% of the sample), and those who have lived in the region for over 20 years as 'long-term residents' (57% of the sample). In addition to length of residency, place attachment can also be explored in respect of how people use the landscape, both in terms of the type of activities participated in and the frequency of time spent in the landscape. Findings from these enquiries are illustrated in Figures 4a and 4b.

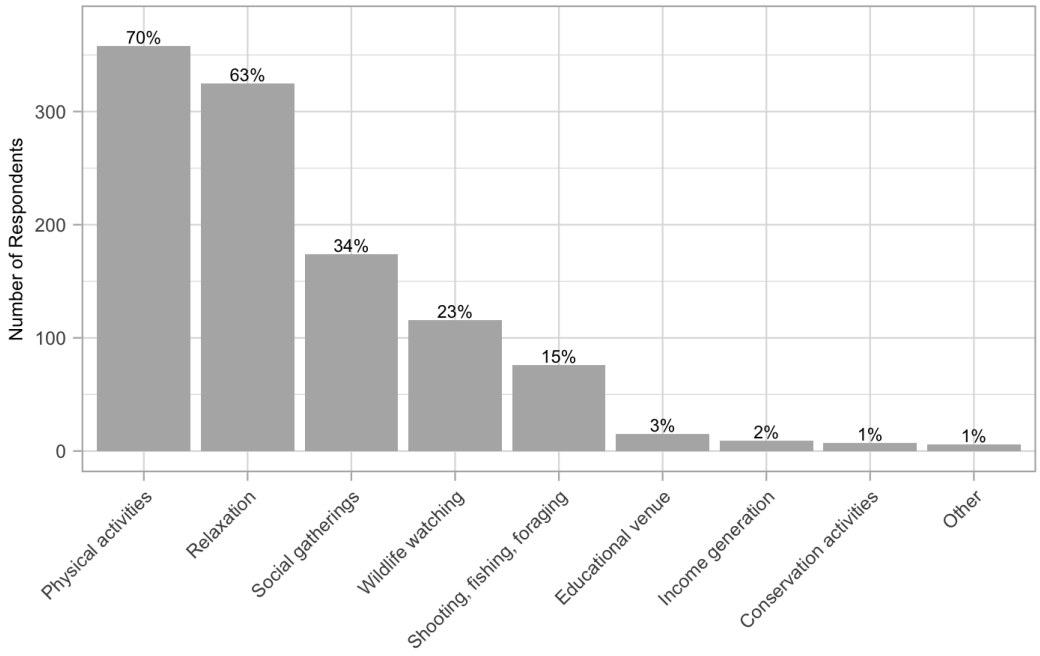

Figure 4a – Respondents' use of the local landscape. Respondents could choose more than one category.

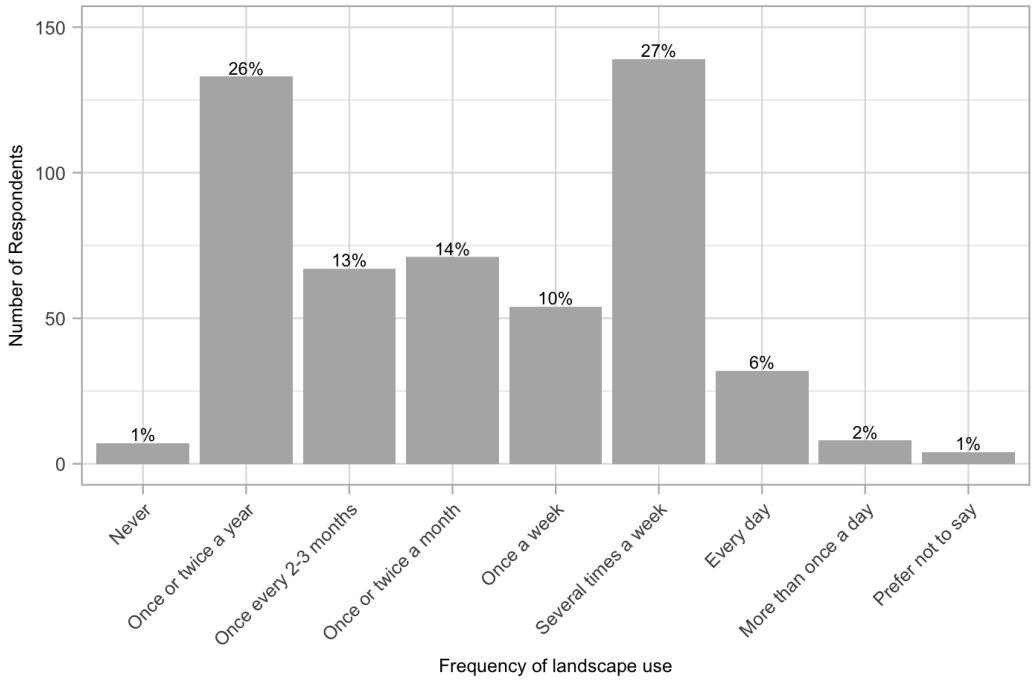

Figure 4b – Frequency of landscape use by respondents.

As Figure 4a illustrates, physical activity and relaxation are the most popular means of using the landscape, with levels of participation among the sample reaching 70% and 63% for these respective activities. Use of the landscape for

participation in social gatherings (34%), wildlife watching (23%) and shooting, fishing or foraging (15%) further demonstrate its value as a multifunctional resource for the local population. Moreover, use of the landscape for such activities is often frequent, with almost half of respondents (45%) reporting to use it at least once a week, though not necessarily for a single type of activity. However, more than a quarter of the sample (27%), use the landscape only once or twice a year, or not at all.

4.3 – Landscape Values and Visions

While direct use of the landscape in support of activities represents one means of ascertaining its importance to the local population, there are many other potential benefits a landscape can provide. Although some of these additional benefits may be indirect and/or less visible, this is not to say they are perceived as being of low importance. Figure 5 illustrates the importance respondents believe should be ascribed to nine landscape benefits in the context of land use planning decisions and policy.

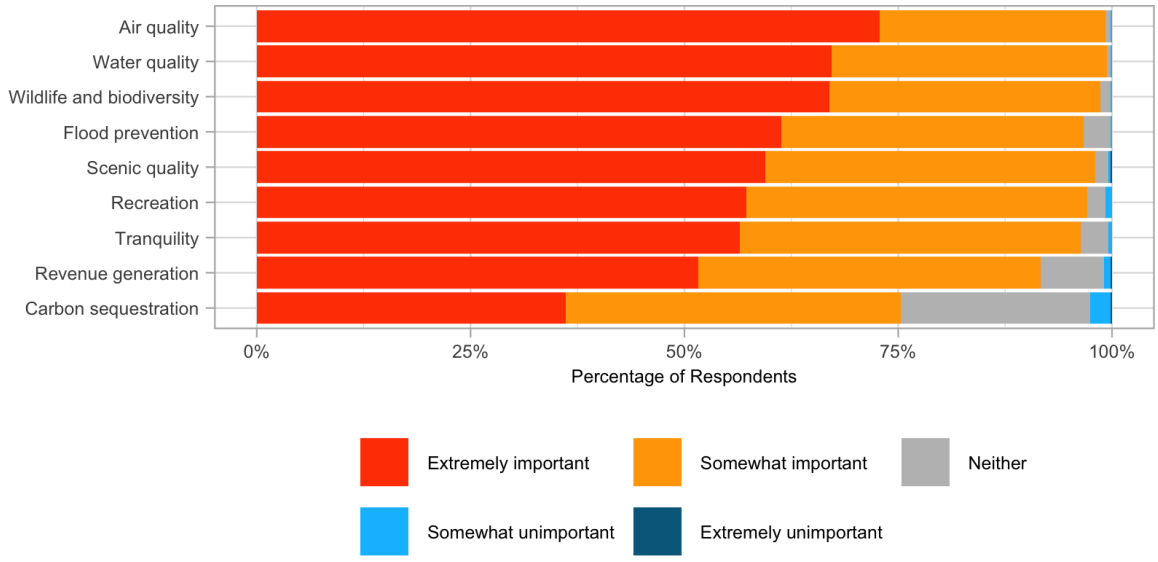

Figure 5 – Perceived importance of potential landscape benefits by respondents.

All of the nine factors were considered to be either extremely or somewhat important for land use planning decisions and policies by at least 75% of respondents. This finding further substantiates respondents' appreciation for the landscape as a multi-functional resource benefitting not only themselves, but

also wider communities/society and non-human species. In fact, of the nine factors, air quality, water quality and wildlife were those most frequently considered to be extremely important in the context of land use planning decisions and policy (73%, 67% and 67% respectively). In contrast, carbon sequestration was by far the least important factor, being considered extremely important by only 36% of respondents.

While these findings serve to demonstrate that respondents recognise the value of the landscape as a multi-functional resource, their freedom to rate all factors as important negates the need to consider their relative importance. As a result, it is possible to assert that all benefits should be maximised, as Figure 5 goes someway to demonstrate. This scenario may actually quash ambitions of policymakers and land managers to alter the landscape for the better, since little indication about how time and resources should be focussed can be derived. However, by allowing respondents to ascribe importance through the allocation of a finite number of points (to as many or as few of the landscape benefits as they wish) a more useful measure of values and priorities can be produced. For example, if a respondent were to consider all of the nine factors as equally important, they would allocate their points (e.g. 100 points) equally across all categories, resulting in ~11 points per category. Figure 6 shows the results of this exercise, with the mean points allocated for each factor depicted.

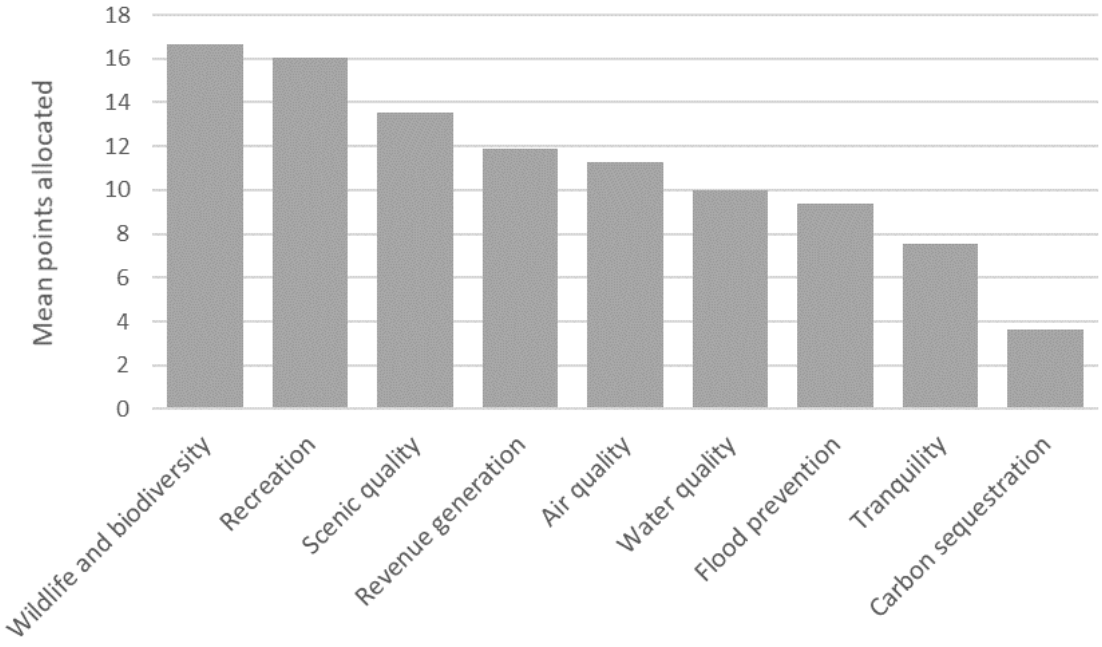

Figure 6 – Relative importance ascribed to landscape benefits by respondents.

In this instance, wildlife again proved to be of high importance having attracted the greatest number of the respondents' points (mean 16.6). Recreation (16.1),

scenic quality (13.5) and revenue generation (11.9) were also among those factors considered to be of highest importance. In contrast, the importance of carbon sequestration again proved relatively unimportant, having attracted the fewest points (3.7). Tranquillity (7.6) and flood migration (9.4) also proved comparatively unimportant.

Expanding the idea of prioritising landscape benefits, respondents used the LANDPREF tool, which incorporates trade-offs between land uses, to design their own preferred landscape. Using Hierarchical Cluster Analysis (HCA), it was possible to identify three types of respondent based on the preferences expressed (Figure 7). For the purpose of further analysis, we refer to these three groups as 1) naturalists, 2) multi-functionalists and 3) agriculturalists.

Group 1, the naturalists, who make up 38% of the sample, are characterised by their strong preference for wildlife and native woodland. Group 2, the multi-functionalists, who make up 57% of the sample, value many different landscape components. Finally, Group 3, the agriculturalists, who make up only 5% of the sample, demonstrate a strong preference for sheep (perhaps illustrative of more broader livestock farming) while ascribing no value to commercial forestry and native woodland, and little value to wildlife and wind turbines (energy production).

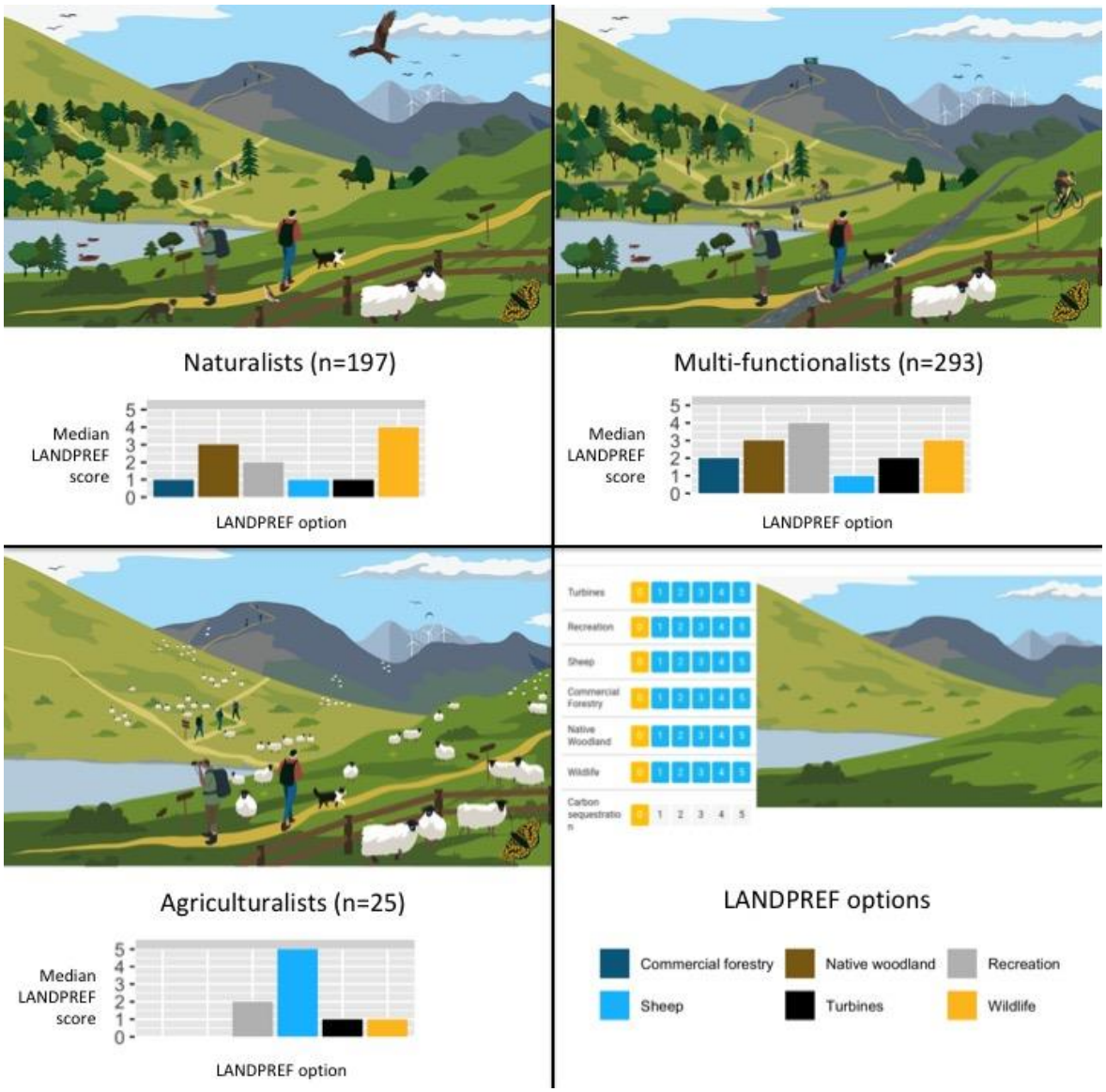

Figure 7 – Respondent types based on values ascribed to landscape components using the LANDPREF tool.

Respondents were subsequently asked to indicate their degree of support for increasing different types of land use in the future (Figure 8). Strong support emerged for increasing the amount of land dedicated to wilderness and nature (89% supportive or extremely supportive). Similarly, the proposition of increasing land for timber production is also well supported (81%). Residential land use was the third most popular option, garnering support from two-thirds of respondents (67%). In contrast, the prospect of increasing land use for energy production (39%) and farming (42%) proved comparatively less appealing, as did the prospect of no change (42%).

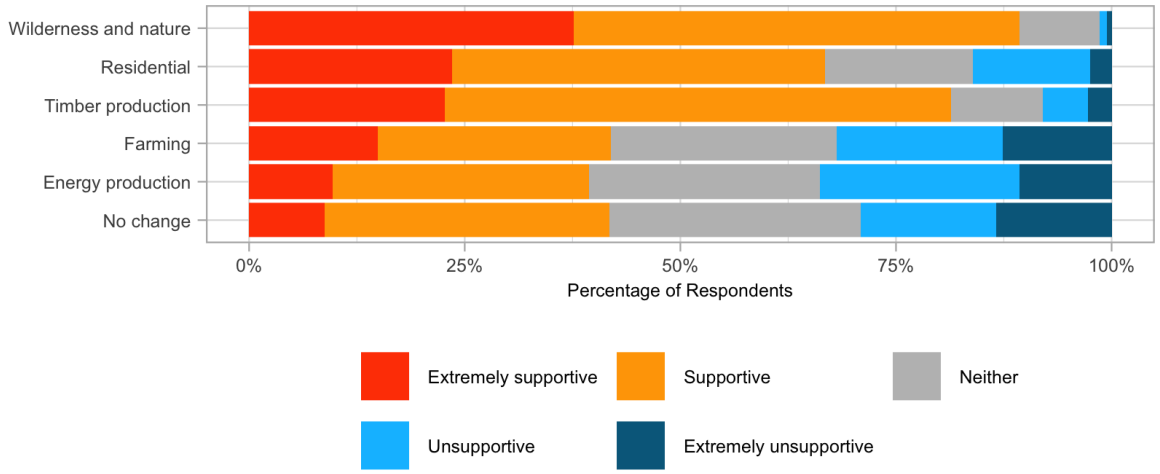

Figure 8 – Respondent's support for increasing different land uses in future.

Acceptability of landscapes and land uses was further explored through the rating of twelve photographs (Figure 9). Notably, the three images deemed most acceptable depicted trails/boardwalks for cycling or other uses, as well as a degree of open space (images 10, 2 and 7). The only other picture to illustrate a trail - passing through a more densely planted forest stand - proved less acceptable (image 8). Interestingly, although the most acceptable landscapes all encompassed a degree of openness, the landscapes themselves differed notably, ranging from predominantly coniferous forest, to open countryside with few trees, to native deciduous woodland. The two images which proved least acceptable both depicted open landscapes but contained utilities infrastructure (images 12 and 1 showing wind turbines and telephone lines respectively).

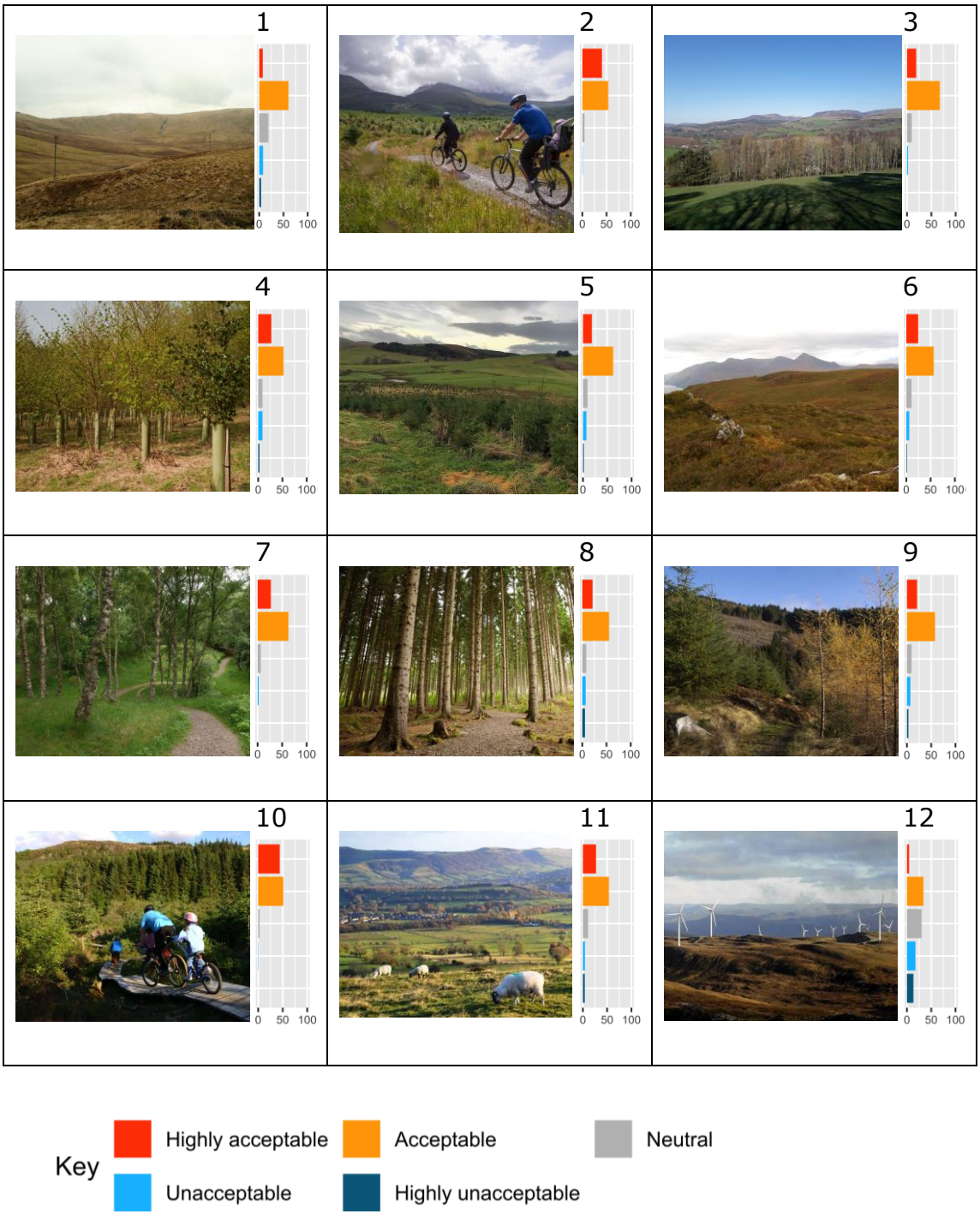

Figure 9 – Acceptability of different landscapes by respondents. Graphs show frequency of responses to each image (% of respondents).

4.4 – Trees, Woodlands and Forests

There is large support for increasing trees, woodlands and forests across Scotland, with 83% of respondents reporting to be either supportive or extremely supportive of this idea (11% neutral and only 3% either unsupportive or extremely unsupportive). Furthermore, the vast majority of respondents agree that an increase in trees, woodlands and forests in their local area would lead to a suite of positive impacts (Figure 10), including environmental benefits (e.g. improved air and water quality, and benefits to wildlife), social benefits (e.g. recreation, scenic quality and tranquillity) and economic benefits (revenue generation). While the impact that trees, woodlands and forests could have on wider society – through carbon sequestration and flood mitigation – were perceived to be the least positive, these impacts were still regarded as positive or extremely positive by 68% and 80% of respondents, respectively.

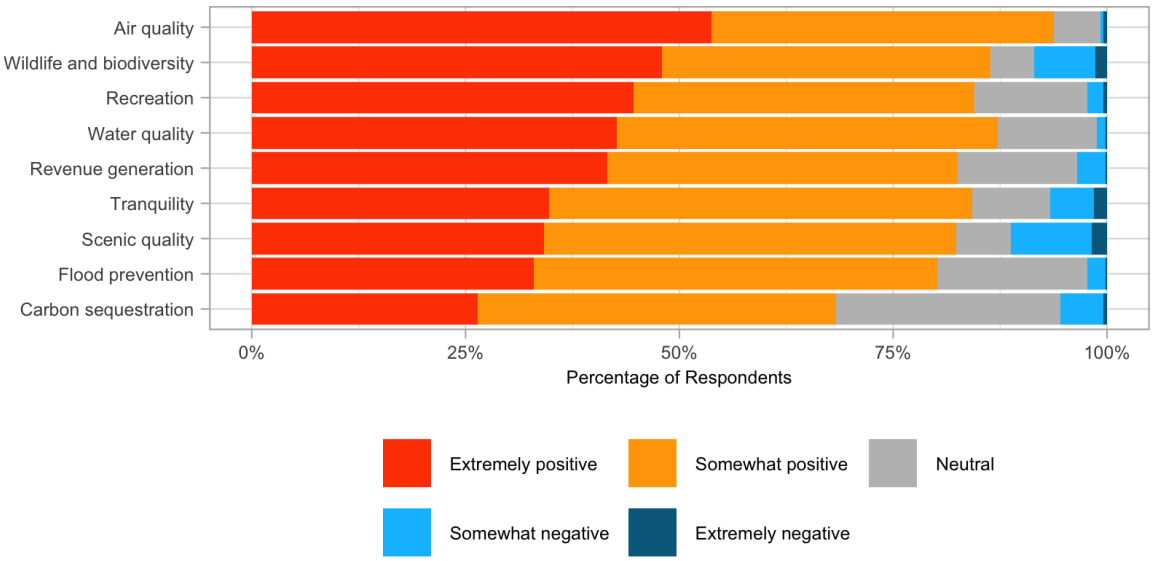

Figure 10 – Perceived impact of increased trees, woodlands and forests by respondents.

Eighty-three percent of respondents consider their area to be either suitable or extremely suitable for the establishment of new woodlands and forests (41% selecting 'extremely suitable' i.e. having potential for many/large areas of establishment, and 42% selecting 'suitable' i.e. potential for several/small areas of establishment).

Those in younger age brackets were found to be significantly more likely to perceive their local area as being suitable for the establishment of new woodlands and forests, compared to those in older age brackets. Likewise, those

residing in towns and suburbs are more likely to hold this perception, compared to those residing in rural areas. Finally, those classed as 'naturalists' (on the basis of their landscape preferences) are more likely to perceive their local area as being suitable than 'multi-functionalists' (note that there are too few 'agriculturalists' to test with any confidence how they compare to these groups).

While these findings reflect perceived suitability for woodlands and forests generally, we also explored perceptions around the creation of larger scale, productive woodland (see Box 1).

Box 1: Definition of productive woodland provided to respondents

Productive woodland refers to trees planted at high densities on productive soils to allow for high timber yields. These woodlands may be comprised of conifers and/or broadleaves, and often have a varied structure in terms of tree age, species and open space.

The most concerning aspects of the prospect of new, larger scale productive woodland are the potential impacts on the rural road network, wildlife and biodiversity, and the landscape's scenic quality (Figure 11). In contrast, potential impacts on current land use, cultural heritage and quality of life in local communities are of concern to only around one quarter of respondents (24%, 23%, 25%), with only 5% - 7% being extremely concerned about such impacts.

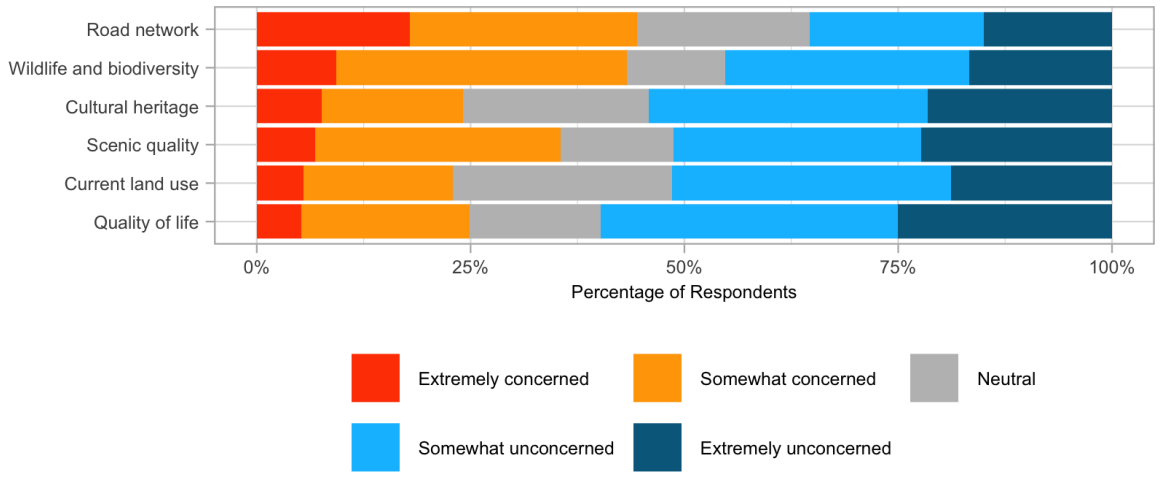

Figure 11 – Respondent's concerns for various factors in the face of large, productive woodland creation.

Almost half of the sample (44%) expressed that they are concerned or extremely concerned about the impacts that new larger productive woodlands would have on the rural road network. The region's long-term residents,

individuals who spend more time outdoors and those living in rural localities are all significantly more likely to be concerned about this potential impact.

The potential impact of larger productive woodlands on wildlife and biodiversity is of concern to 43% of the sample, though in this case, none of the demographic factors were found to be associated with greater concern.

Impacts on the landscape's scenic quality is of concern to over a third of respondents (36%). Older respondents are more concerned about this impact than younger respondents, as are multi-functionalists (compared to naturalists).

Were large scale productive woodlands to be created, several potential opportunities and benefits may feasibly be realised as a result. Figure 12 details how important respondents feel it would be to deliver such opportunities and benefits.

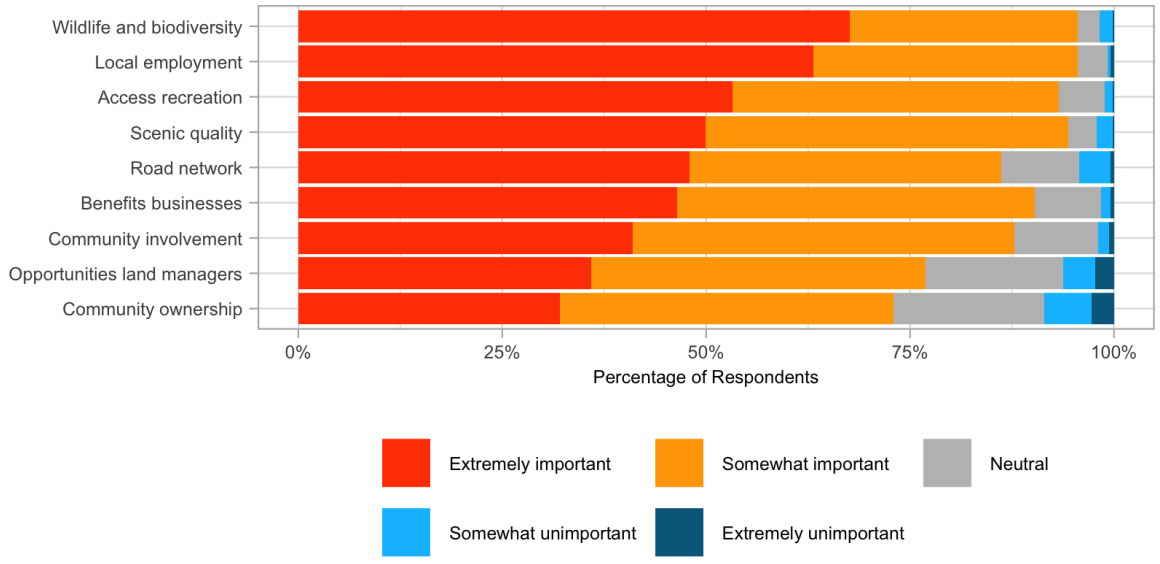

Figure 12 – Respondent's opinions of the importance for various opportunities and benefits to be delivered through the creation of large, productive woodland.

More than three-quarters of respondents consider all of the featured potential opportunities and benefits to be important, with the exception of the opportunity for community ownership of woodlands (73% deeming this to be important/very important). Notably, substantial proportions of respondents feel that the delivery of benefits to wildlife and biodiversity (67%), the provision of local employment and training (63%) and access and recreation (53%) would be extremely important. However, none of the demographic factors were associated with a greater propensity for perceived importance.

5. Conclusions

The study demonstrates that many of the people within the area exhibit strong place attachment or connectedness to their landscape, either as a result of a substantial period of residency in the region and/or use of the landscape for particular activities, most notably, physical activities and relaxation.

While it is clear that many people in the area have a strong connection to the landscape, not everybody has the same opinion about what an ideal landscape should consist of, and relatedly, what benefits it should provide. The largest proportion of respondents (57%) hold multifunctionalist values, and are typified by their desire for a diverse landscape, allowing many different stakeholders to elicit some degree of benefit. Naturalists, characterised by their strong preference for the landscape to support wildlife and native woodland, also make up a substantial proportion of the sample (38%). Finally, the smallest group (5%), the agriculturalists, wish to see a landscape dominated by sheep, which is perhaps illustrative of broader interests in pastoral farming.

For the sample as a whole, it is felt that wildlife should be the most important consideration in the context of land use change. Relatedly, 89% of respondents support the idea of increasing the amount of land dedicated to wilderness and nature. Recreation and scenic quality are also important considerations, as is revenue generation. Again, these findings reflect an overall perception that the landscape should provide a range of benefits. This is further evidenced by the fact that 81% of respondents support the idea of increasing the amount of land dedicated to timber production, and 67% support the idea of increasing land dedicated to residences. In contrast, the prospect of increasing land dedicated to energy production (39%) and farming (42%) proved comparatively less appealing to respondents, as did the prospect of no change (42%).

Societal benefits (carbon sequestration and flood prevention) are perceived to be of relatively low importance. Nevertheless, it is worth noting that a number of the study area's main settlements are located within Potentially Vulnerable Areas in respect of flooding (SEPA, 2016). In fact, Kirkconnel in Dumfries and Galloway and New Cumnock in East Ayrshire have experienced notable flooding within recent years (e.g. December 2013). While carbon sequestration and flood prevention can be tackled through landscape change, for example by increasing trees (Bravo et al., 2017; Daigneault et al., 2016), their potential to be addressed (at least in part) outwith landscape change may have contributed to the factors being considered of lower importance. It is also possible that the finding is a result of these benefits being less tangible i.e. less visible and supporting less meaningful day-to-day interaction, or that respondents are simply less aware of how landscape change may contribute to these potential benefits. Notably, respondents were also less likely to recognise (or accept) carbon sequestration and flood prevention as benefits that would result from

additional trees, woodlands and forests (relative to other benefits). Despite the lower importance attached to these societal benefits, there are strong grounds to assume that they will become increasingly important considerations in future land use practices and land use change, for example the Scottish Government's 2045 net-zero emissions target outlined in the Climate Change (Emissions Reduction Targets) (Scotland) Bill, 2019. Policies and incentives designed to meet such targets are likely to garner more support if public understanding and appreciation for the benefits are improved.

The study demonstrates that there is widespread support for the establishment of new trees, woodlands and forests in Scotland generally, as well as strong consensus that respondents' local areas are suitable for new planting. The sample as a whole perceive that an increase in trees, woodlands and forests within their local areas would lead to a suite of positive impacts (including improvements to air quality, wildlife and biodiversity, recreation and water quality). In the case of new, larger scale productive woodland the main concerns are for the rural road network and wildlife and biodiversity. Potential impacts on the road network were not explored in-depth but might reasonably be expected to derive from concerns over new roads and/or increased volumes of traffic, including HGVs. Such impacts could have additional consequences such as air and noise pollution, reduced tranquillity, reduced public safety, increased congestion and potholes, increased habitat fragmentation and increased roadkill. While it is important to better understand the precise concerns of the community, it is also possible to consider upfront measures which might curtail concerns. For example, landscape design which screens road infrastructure, wildlife bridges/tunnels, speed bumps and signage to encourage safe road use, and fleet management of forestry vehicles to minimise the number of journeys or to focus journeys at off-peak times. Likewise, if concerns about existing wildlife (and that which comes to occupy new woodland) are to be addressed, measures should be negotiated and co-developed with interested parties so that specific concerns can be voiced and mitigated.

Although the prospect of new larger scale productive woodland comes with some concerns, there are also a number of potential benefits and opportunities. Were expansion of this type to occur, it is clear that the sample would wish to see improvements for wildlife and biodiversity realised. This may encompass issues such as the creation, diversification and connectivity of habitats. The provision of local employment and training is also considered an important potential benefit. Depending on the scale of new woodland, such opportunities may come in the form of jobs, apprenticeships and training courses in forestry operations, logistics, recreation or ecotourism. In addition, opportunities for recreation would be well received, reflecting the sample's existing use of the landscape for physical activities and relaxation, among others. To fully realise this opportunity, it may be necessary to consider vehicular access and parking when thinking about impacts to rural road networks.

In terms of aesthetics, it appears that the most pleasing landscapes are those which permit access while maintaining open space so as to allow light to penetrate. More generally, high-quality landscapes are characterised as those which evince many positive feelings, warmth, security, relaxation, freedom or happiness, while a low-quality landscape evinces expressions of claustrophobia, insecurity, gloom and anxiety (Lee, 1989). Ratings of different images in our study suggest that the structure and opportunities provided by the landscape are more important than the species it contains. Again, these findings parallel those of previous studies (see Edwards 2010a; 2010b) which concluded that public '*criticism directed towards non-native conifers, and perceived preferences for broadleaves across Europe, may not be due to the choice of tree species per se, but the use of conifers in intensive management regimes characterised by dense even-aged monocultures and short rotation lengths'*. This understanding underpins the value of 'viewshed analysis' whereby researchers are able to identify areas of low visibility for productive conifers, and to help inform future harvesting intensity.

The methods used in this study are replicable in other areas where information pertaining to landscape preferences and attitudes towards woodland creation is sought. However, subtleties in how the methods are conducted should strive to reflect local circumstances (population density, presence of key stakeholders/groups, and consideration of locally sensitive issues). Given such nuances, there are limitations in generalising the findings in this report to regions beyond the study area, particularly if local policies, relationships, population demographics and current land use differ. Any project involving change, be it to the landscape or otherwise, is likely to be deemed more acceptable and legitimate if concerns and opportunities are deliberated and co-developed through participatory processes which include the public and other key stakeholders (Beckley et al., 2006). Thus, while this study has sought to identify and quantify the range of attitudes within the study area, the authors recommend further consultation for any future large scale productive woodland creation proposals.

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Appendix A – Public Survey

Section 1 – Connectedness to the landscape

Q1. How long have you lived in the South of Scotland?

1. 0 - 5 years
2. 6 - 10 years
3. 11 – 15 years
4. 16 – 20 Years
5. 21 – 25 years
6. 25+ years

Q2. How often do you spend time in the local landscape (the outdoor environment composed of fields, moor/heath, trees, water courses etc. lying beyond built-up areas)?

1. Never
2. Once or twice a year
3. Once every 2-3 months
4. Once or twice a month
5. Once a week
6. Several times a week
7. Every day
8. More than once per day

Q3. Do you use the local landscape for any of the following? (Select all that apply)

1. Social gatherings and events
2. As an educational venue
3. Income generation
4. Physical activities including walking, cycling, horse riding etc.
5. Relaxation
6. Wildlife watching/studying nature
7. Shooting, fishing or foraging
8. Conservation activities
9. Other (specify)

Section 2 –Landscape Features and Benefits

Q4. How important/unimportant do you feel the following features/factors should be in land use planning decisions and policies?

	Extremely important	Somewhat important	Neither important nor unimportant	Somewhat unimportant	Extremely Unimportant
Scenic quality					
Wildlife and Biodiversity					
Revenue generation					
Recreational opportunities					
Tranquillity					
Air quality					
Water quality					
Flood prevention					
Carbon sequestration (storage)					

Q5. How would you allocate 100 points to reflect the value you place on the landscape features/factors? The more you value a feature/factor the more points should be allocated. Note that you may allocate for as many or as few features/factors as you wish.

Feature/Factor	Points (must total 100)
Scenic quality	
Wildlife and Biodiversity	
Revenue generation	
Recreational opportunities	
Tranquillity	
Air quality	
Water quality	
Flood prevention	
Carbon sequestration (storage)	

Q6. Score the landscape components to create your preferred future landscape for your local area.

Use 0 for your lowest priority/priorities and 5 for your highest priority/priorities. Note that land uses and benefits can be conflicting so some compromises or trade-offs may be necessary!

Turbines
0 1 2 3 4 5
Recreation
0 1 2 3 4 5
Sheep
0 1 2 3 4 5
Commercial Forestry
0 1 2 3 4 5
Native Woodland
0 1 2 3 4 5
Wildlife
0 1 2 3 4 5
Carbon sequestration
0 1 2 3 4 5

Q7. How would you feel about the following 'land-use futures' in your local area?

	Extremely Supportive	Supportive	Neither supportive nor unsupportive	Unsupportive	Extremely Unsupportive
No change (landscape remains as it currently exists)					
Increased residential developments					
Increased farming					
Increased energy production (e.g. wind turbines & hydroelectricity)					
Increased productive woodland (timber production)					
Increased wilderness and nature reserves					

Q8. What is your opinion of the landscape depicted? (Same question for each of the 12 images)

1. Highly acceptable
2. Acceptable
3. Neutral
4. Unacceptable
5. Highly unacceptable

Section 3 – Trees, Woodlands & Forests

Q9. How do you feel about the idea of increasing trees, woodlands and forests in Scotland as a whole?

1. Extremely supportive
2. Supportive
3. Neither supportive nor unsupportive
4. Unsupportive
5. Extremely unsupportive

Q10. What impact do you feel a move towards more trees, woodlands and forests would have on your local area relative to the current landscape and use?

	Extremely Positive	Somewhat positive	Neutral	Somewhat negative	Extremely Negative
Scenic quality					
Wildlife and Biodiversity					
Revenue generation					
Recreational opportunities					
Tranquillity					
Air quality					
Water quality					
Flood prevention					
Carbon sequestration (storage)					

Q11. How suitable to do you consider your local area to be for the establishment of new woodlands and forests?

1. Extremely suitable (potential for many/large areas of new woodland)
2. Suitable (potential for several/small areas of new woodland)
3. Largely unsuitable (potential for very few/very small areas of new woodland)
4. Extremely unsuitable (no or almost no potential for new woodland)

Productive woodland refers to trees planted at high densities on productive soils to allow for high timber yields. These woodlands may be comprised of conifers and/or broadleaves, and often have a varied structure in terms of tree age, species and open space.

Q12a. To what extent would you be concerned about the potential impacts of new larger scale productive woodlands on the following?

Potentially impacted features	Extremely Concerned	Somewhat Concerned	Neutral	Somewhat unconcerned	Extremely unconcerned
Scenic quality					
Cultural Heritage					
Wildlife & biodiversity					
Rural Road Network					
Quality of life in local communities					
Other current land use					

Q12b. Please use this space to note any other potential impacts of new larger scale productive woodlands that you would be concerned about

Character limit: 500

Q13a. If larger scale productive woodlands were created, how important do you think it would be to deliver the following additional opportunities and benefits?

Improvements to	Extremely Important	Somewhat Important	Neutral	Somewhat unimportant	Extremely unimportant
Scenic quality					
Wildlife & biodiversity					
Upgrading of rural road networks					
Community involvement in land management					
Community ownership of woodlands					
Benefits for local businesses					
Business opportunities for existing land managers					
Local employment & training					
Access and recreation opportunities					

Q13b. Please use this space to detail any further opportunities or benefits that you feel it would be important to deliver alongside any future larger scale productive woodlands?

Character limit: 500

Section 4 - Demographic Questions

These questions will allow us to understand whether our sample reflects the make-up of the wider population. Responses will not be used to identify individuals or to send information and requests.

Q14. Which age bracket do you belong to?

1. Under 18
2. 18-24
3. 25-34
4. 35-44
5. 45-54
6. 55-64
7. 65+
8. Prefer not to say

Q15. What is your gender?

1. Male
2. Female
3. Other
4. Prefer not to say

Q16. Where are you located (postcode) _ _ _ _ _ _ _ _

Q17. How much land do you own in the South Scotland region?

1. 0 Ha (0 acres)
2. Up to 0.5 Ha (up to 1.25 acres)
3. 0.6 – 5 Ha (1.26 – 12.5 acres)
4. 6 – 10 Ha (12.6 – 24 acres)
5. 11 – 15 Ha (25 – 37 acres)
6. 16 – 20 Ha (38 – 50 acres)
7. 21 – 25 Ha (51 – 62 acres)
8. 26 – 30 Ha (63 – 75 acres)
9. 30+ Ha (75+ acres)
10. Prefer not to say

<Submit>

Appendix B – Statistical Outputs

B1 – Suitability of local area for new woodlands and forests

Individuals living in rural areas were more likely to believe that their local area was unsuitable for the establishment of new woodlands and forests (p=0.04). Older people and multi-functionalists (vs. naturalists) were also more likely to believe their local area was unsuitable for the development of new woodlands and forests (both p=0.05).

Results for Q11 - 'How suitable to do you consider your local area to be for the establishment of new woodlands and forests?'

	Estimate	Std. Error	z value	Pr(>|z|)	FDR	OR	LCI	UCI
Q01_how_long_lived	-0.033	0.084	-0.390	0.697	0.788	0.968	0.823	1.146
Q02_how_often_outdoors	0.130	0.082	1.595	0.111	0.194	1.139	0.972	1.340
Q12_age	0.206	0.089	2.309	0.021	0.049	1.229	1.033	1.468
Q13_genderFemale	0.073	0.270	0.269	0.788	0.788	1.075	0.633	1.834
DGURBA_CLATown_sub	-0.850	0.304	-2.797	0.005	0.036	0.428	0.232	0.767
landprefMulti-func	0.884	0.381	2.320	0.020	0.049	2.421	1.180	5.321
landprefAgriculturalists	0.970	0.656	1.479	0.139	0.195	2.638	0.653	9.053

B2 Key concerns around new, larger scale productive woodland

B2i Concerns about impact on rural road networks

Individuals who had lived in an area longer were more likely to be concerned about the impact of new woodland on rural road networks (OR = 1.20 [95% C.I. = 1.06-1.37], p=0.01). Individuals who spent more time outdoors were also more likely to be concerned about the impact of new woodland on rural road networks (OR = 1.20, [95% C.I. = 1.07-1.35], p=0.01). Individuals living in towns and suburbs were less likely to be concerned about the impact of woodland on rural road networks than rural respondents (OR=0.55, [95% C.I. = 0.36-0.85], p=0.02).

Results for Q12a - 'To what extent would you be concerned about the potential impacts of new larger scale productive woodlands on rural road networks?'

	Estimate	Std. Error	z value	Pr(>|z|)	FDR	OR	LCI	UCI
Q01_how_long_lived	0.185	0.064	2.891	0.004	0.013	1.204	1.063	1.367
Q02_how_often_outdoors	0.181	0.059	3.054	0.002	0.013	1.198	1.067	1.346
Q12_age	-0.009	0.066	-0.140	0.889	0.889	0.991	0.870	1.129
Q13_genderFemale	0.309	0.204	1.519	0.129	0.180	1.363	0.916	2.037
DGURBA_CLATown_sub	-0.593	0.219	-2.708	0.007	0.016	0.552	0.359	0.849
landprefMulti-func	0.591	0.237	2.498	0.012	0.022	1.807	1.137	2.881
landprefAgriculturalists	-0.246	0.523	-0.470	0.639	0.745	0.782	0.261	2.095

B2ii Concerns about impact on the landscape's scenic quality

Older respondents were more concerned about the impact of new woodland on scenic quality than younger respondents (OR = 1.21, [95% C.I. = 1.06-1.39], p=0.01). Also, multifunctionalists were more concerned about the impact of new woodland on scenic quality than naturalists (OR = 2.10 [95% C.I. 1.30-3.42], p=0.02).

Results for Q12a - 'To what extent would you be concerned about the potential impacts of new larger scale productive woodlands on scenic quality?'

	Estimate	Std. Error	z value	Pr(>|z|)	FDR	OR	LCI	UCI
Q01_how_long_lived	0.029	0.064	0.456	0.648	0.756	1.029	0.909	1.168
Q02_how_often_outdoors	0.126	0.060	2.113	0.035	0.081	1.135	1.009	1.276
Q12_age	0.191	0.068	2.815	0.005	0.017	1.210	1.061	1.385
Q13_genderFemale	0.264	0.205	1.292	0.197	0.344	1.302	0.874	1.949
DGURBA_CLATown_sub	-0.220	0.224	-0.983	0.325	0.456	0.802	0.517	1.246
landprefMulti-func	0.739	0.247	2.988	0.003	0.017	2.095	1.296	3.424
landprefAgriculturalists	0.028	0.523	0.053	0.958	0.958	1.028	0.343	2.757

B2iii Concerns about impacts on wildlife and biodiversity

None of the demographic factors were associated with increased concern for impact on wildlife and biodiversity

Results for Q12a - 'To what extent would you be concerned about the potential impacts of new larger scale productive woodlands on wildlife and biodiversity?'

	Estimate	Std. Error	z value	Pr(>|z|)	FDR	OR	LCI	UCI
Q01_how_long_lived	0.040	0.061	0.662	0.508	0.593	1.041	0.924	1.174
Q02_how_often_outdoors	0.137	0.057	2.380	0.017	0.068	1.146	1.025	1.284
Q12_age	0.087	0.065	1.350	0.177	0.330	1.091	0.962	1.240
Q13_genderFemale	0.220	0.197	1.122	0.262	0.367	1.247	0.849	1.836
DGURBA_CLATown_sub	-0.283	0.215	-1.314	0.189	0.330	0.754	0.494	1.150
landprefMulti-func	0.543	0.232	2.340	0.019	0.068	1.721	1.094	2.720
landprefAgriculturalists	-0.117	0.498	-0.234	0.815	0.815	0.890	0.317	2.301

B3 – Key benefits and opportunities perceived as important alongside the establishment of new, larger scale productive woodlands.

B3i – Access and recreation opportunities

None of the demographic factors were associated with a perception that opportunities for access and recreation are of high importance.

	Estimate	Std. Error	z value	Pr(>|z|)	FDR	OR	LCI	UCI
Q01_how_long_lived	-0.140	0.130	-1.073	0.283	0.737	0.869	0.660	1.107000e+00
Q02_how_often_outdoors	0.094	0.117	0.804	0.421	0.737	1.098	0.877	1.387000e+00
Q12_age	0.016	0.124	0.125	0.901	0.986	1.016	0.794	1.297000e+00
Q13_genderFemale	0.669	0.386	1.734	0.083	0.580	1.953	0.927	4.271000e+00
DGURBA_CLATown_sub	0.109	0.433	0.251	0.802	0.986	1.115	0.474	2.617000e+00
landprefMulti-func	0.396	0.446	0.887	0.375	0.737	1.485	0.618	3.588000e+00
landprefAgriculturalists	15.293	850.952	0.018	0.986	0.986	4381366.268	0.000	2.678437e+111

B3ii – Wildlife and biodiversity

None of the demographic factors were associated with a perception that wildlife and biodiversity are of high importance.

	Estimate	Std. Error	z value	Pr(>|z|)	FDR	OR	LCI	UCI
Q01_how_long_lived	0.050	0.137	0.366	0.714	0.833	1.051	0.792	1.364
Q02_how_often_outdoors	0.206	0.134	1.536	0.125	0.253	1.229	0.943	1.604
Q12_age	-0.215	0.143	-1.505	0.132	0.253	0.806	0.605	1.065
Q13_genderFemale	0.289	0.455	0.634	0.526	0.736	1.335	0.547	3.331
DGURBA_CLATown_sub	0.757	0.519	1.458	0.145	0.253	2.131	0.808	6.378
landprefMulti-func	-2.694	1.069	-2.521	0.012	0.082	0.068	0.004	0.369
landprefAgriculturalists	13.709	1380.802	0.010	0.992	0.992	899404.054	0.000	NA

B3iii – Local employment and training

None of the demographic factors were associated with a perception that opportunities for local employment and training are of high importance.

	Estimate	Std. Error	z value	Pr(>|z|)	FDR	OR	LCI	UCI
Q01_how_long_lived	-0.203	0.167	-1.215	0.224	0.523	0.816	0.567	1.105
Q02_how_often_outdoors	0.342	0.154	2.216	0.027	0.187	1.407	1.051	1.932
Q12_age	0.067	0.151	0.446	0.656	0.790	1.069	0.794	1.440
Q13_genderFemale	0.849	0.487	1.743	0.081	0.284	2.336	0.924	6.420
DGURBA_CLATown_sub	0.217	0.520	0.416	0.677	0.790	1.242	0.446	3.495
landprefMulti-func	-0.414	0.570	-0.727	0.467	0.790	0.661	0.209	1.994
landprefAgriculturalists	-0.091	1.117	-0.081	0.935	0.935	0.913	0.143	17.955