

WHO TAKES ACTION FOR NATURE?

REPORT ON THE GREAT BIG NATURE SURVEY, NATIONALLY REPRESENTATIVE **SAMPLE 2024**

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Image credit: Guy Shorrock







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Summary

This report estimates rates of actions for nature in the UK, creates groups of individuals who take similar actions and relates these to 62 demographic and attitudinal measures. The analysis is based on a nationally representative sample of 2912 individuals who took The Wildlife Trusts 'Great Big Nature Survey' in August 2024. Across 31 actions for nature, most participants reported recycling in the past month, though levels of uptake were much lower (<40%) for all other actions. Six groups were identified: 'high action', 'low action' and 'diverse action' groups, as well as 'wildlife gardeners', 'communication averse' and 'recycler' groups. Membership of these groups could be predicted from demographic and attitudinal variables. Age and various measures of an individual's relationship and attitudes to nature were particularly important for predicting which action group they fell into. To increase actions taken for nature, this report suggests focusing on the 'diverse action' and 'communication averse' groups, which form 53% of the population.

Introduction to the Great Big Nature Survey

The Great Big Nature Survey was launched by The Wildlife Trusts in 2023 and asks respondents their attitudes to nature and how it should be protected, nature connectedness, pro-nature behaviours and perceived threats to nature¹. In August 2024, a nationally representative sample of 2912 individuals was collected by More in Common. This report focuses on the pro-nature behaviours reported by respondents to that survey. The survey asks individuals whether or not they have engaged in 7 actions for nature in the last month, and whether they have undertaken another 24 actions for nature in the last year. Respondents could also report whether they had engaged in any other actions for nature. Note that the question wording means individuals may not report if they do a particular action but do not do it for nature (e.g. if they do it to save money). To calculate the likely proportion of the UK population that have undertaken each action, responses were weighted by the intersection of age and sex, region, ethnicity and voting behaviour in the 2024 general election. Full details of weighting are provided in Appendix 1. The estimated proportions are shown in Figure 1 and reported in Appendix 1. The only action which more than half of people report doing is recycling in the past month, though around 2% of people still report doing the lease common action, raising issues of nature sustainability directly with companies, in the past year.

What actions do people take for nature?





Are there groups of people who take similar actions?

Latent Class Analysis was used to identify groups of people in the data who took similar actions for nature (see <u>Appendix 2</u> for more details). The generated six groups, and the proportion of people in each group which did each action is shown in Figure 2.



Figure 2: The proportion of people in each group which reported doing each action. Names have been assigned based on both action and characteristics associated with the group (see next section). The % in brackets shows the estimate of how much of the UK population falls into each of these groups, based on the weighted nationally representative sample.

Six groups were identified:

High action (4% UK population): This group is the smallest, but they do wide range of behaviours, averaging 16 per individual (range: 10-31). The least frequent action was 'organising a practical activity for nature' (16%) and the most frequent was recycling (96%).

Wildlife gardeners (11% UK population): This group takes an average of 10 actions per person (range: 5-17) and high proportions of this group engage in wildlife gardening behaviours. For example, growing fruits (66%) or creating habitats (55%) for wildlife, not using peat (52%), adding pollinator plants (65%), and not using herbicides and pesticides (35%). Individuals in this group also undertake relatively high levels of recycling, litter-picking and avoid buying new things.

Diverse action (27% UK population): This is the largest group and individuals undertake an average of 6 actions (range: 4-13). Individuals in this group take a wide range of actions. Although recycling was the most frequent action for individuals in this group, they are less likely to recycle than individuals in all other groups except the low action group. The least frequent actions were creating or maintaining a pond (4%) and charity membership (5%).

Communication averse (26% UK population): This is the second largest group, and individuals take an average of 4 actions for nature (range: 2-10). Participation in all actions apart from recycling are <50% but particularly rare for those which require communication with others. No-one in this group volunteers in local community spaces, participates in citizen science projects, contacts companies, participates in practical activities, engages in the planning system and very few (~1%) volunteer, persuade family and friends, make social media posts or contact representatives.

Low action (9% UK population): All individuals in this group report that they don't do any of the 'monthly' behaviours, and overall they do the fewest actions (average 0.26, range 0-4). Very small numbers (<5%) of members in this group report doing the following behaviours: not buying new items, planting pollinator plants, growing fruits for wildlife, not using herbicide or pesticide, going peat free compost, creating habitats for wildlife, signing environmental petitions, persuading family and friends, donating, being a member of a charity, volunteering, avoiding air travel, making changes in their workplace, creating a pond, or creating other habitats.

Recyclers (23% UK population): Individuals in this group report doing some actions in the last month, such as recycling, picking litter, choosing lower impact transport or food, sustainably shopping or feeding wildlife. However, all individuals in this group report that they don't do any of the 'yearly' behaviours. On average they undertake 2 actions (range: 1-7).

What are the characteristics of the people in each of these groups?

A random forest model was used to investigate whether 62 demographic and attitudinal variables also collected as part of the survey could be used to distinguish between individuals in the 6 groups. These variables are shown below in <u>Appendix 3</u>. Overall, the model was able to correctly predict the group of 41% of individuals, significantly better than the 28% predicted by the null model (which predicts the most frequent class for all observations). All groups except the recyclers were most frequently classified into the correct group (Figure 3). The model was best at predicting individuals in the low action and communication averse groups, correctly assigning 51% of individuals in these groups. The recyclers were were most frequently misclassified, with only 16% of recyclers correctly assign to this group. The individuals in the recycler group were frequently misclassified as part of the low action group and communication averse groups. This suggests that the variables included in the model were not able to accurately distinguish this group. When the recycler group was included from analysis, the prediction accuracy of the model improved (49% percent of individuals correctly classified, with correct classification for each group ranging from 37-71%, see Appendix 3).



Figure 3: Model classifications (Group assigned) for individuals in each of the six groups. Individuals from each group are shown in separate panels, and the number of individuals assigned to each group by the random forest model are shown by the colour bars.

The extremely low detection rate for the recycler group suggests that the results of this analysis should be interpreted with caution, particularly for individuals in the recycler group. A different analysis, using different variables may provide better classification across all groups. However, as the 15 most important demographic variables used by the model to distinguish between individuals is identical in the analyses with and without recyclers (Appendix 3), some further information about the relationship between the 6 groups and these 15 variables are presented below. The most important variable for distinguishing between groups was age, followed by how motivating they find time in nature and a number of other variables which describe an individual's relationship with nature (Figure 4). How happy an individual is and their highest level of education followed. Below are descriptions of the six groups, based on mean values and most common answers for these 15 variables. This means that the descriptions hide the variation within groups. For example, although the low action group has the weakest overall relationship to nature (Figure 4). Full details of the relationship between the 6 groups and the other 47 variables are included in Appendix 2.



Figure 4: The 15 most important variables (out of 62) used by the model to distinguish between groups. Variables with a higher mean decrease in Gini are more informative for the model, meaning they are used by the model to distinguish between groups.



Figure 5: Reported relationship to nature by individuals in the six groups, using 'Schultz' inclusion of nature in self' scale. Individuals give a value from 1 (completely separate to nature) to 7 (completely overlapping with nature).

Individuals in the high and low action groups differed most on these 15 variables. For nine variables the high action group had the highest score and the low action group had the lowest (Table 1). The high action group also reported spending the most time in nature and the highest interest in nature, whereas the low action group reported the least time in nature and the lowest interest. Individuals in the diverse action group were similar to the high action group in their age and highest level of education. The high action group and the wildlife gardeners showed similar scores on various values statements, their interest in nature, happiness and time spent in nature.

Table 1: Relationship between the 6 groups and the 15 most important variables used by the model to distinguish between them. The variables are ordered by the importance in the model. Cells in each row are coloured from blue (highest values) through green and yellow to white (lowest values).

	High action	Wildlife gardeners	Recyclers	Diverse action	Communication averse	Low action	Overall
	(N=160)	(N=391)	(N=528)	(N=896)	(N=754)	(N=183)	(N=2912)
Age (years)							
Mean (SD)	48 (± 17)	58 (± 15)	52 (± 16)	41 (± 15)	54 (± 17)	49 (± 16)	49 (± 17)
How motivating do you find time in nature	? (0-10)						
Mean (SD)	7.8 (± 2.1)	6.7 (± 2.5)	4.5 (± 2.5)	6.7 (± 2.2)	5.1 (± 2.5)	3.6 (± 2.6)	5.8 (± 2.6)
How interested are you in nature?							
I have no interest whatsoever	1 (1 %)	0 (0 %)	35 (7 %)	15 (2 %)	12 (2 %)	39 (21 %)	102 (4%)
I have a little interest	7 (4 %)	35 (9 %)	204 (39 %)	202 (23 %)	259 (34 %)	76 (42 %)	783 (27%)
I have a moderate amount of interest	27 (17 %)	140 (36 %)	221 (42 %)	387 (43 %)	345 (46 %)	54 (30 %)	1174
							(40%)
I have a lot of interest	125 (78 %)	216 (55 %)	68 (13 %)	292 (33 %)	138 (18 %)	14 (8 %)	853 (29%)
Agreement with statements about the right	ts of animals	(6-30)					
Mean (SD)	19 (± 3.8)	18 (± 4.0)	18 (± 3.7)	18 (± 3.3)	18 (± 3.7)	16 (± 3.4)	18 (± 3.7)
Agreement with statements about the wild	iness of natu	re (7-35)					
Mean (SD)	25 (± 5.2)	24 (± 4.9)	24 (± 4.5)	24 (± 4.6)	23 (± 4.7)	22 (± 5.3)	24 (± 4.8)
How much does nature contribute to your	happiness?	(1-10)					
Mean (SD)	8.4 (± 1.5)	7.9 (± 1.6)	5.7 (± 2.6)	7.1 (± 2.0)	6.4 (± 2.2)	4.6 (± 2.8)	6.7 (± 2.4)
How strong is your relationship to nature	? (1-7)						
Mean (SD)	5.8 (± 1.2)	5.4 (± 1.3)	4.0 (± 1.6)	4.9 (± 1.5)	4.4 (± 1.4)	3.3 (± 1.8)	4.6 (± 1.6)
Agreement with statements about how na	ture should b	e valued (6-30)			_		
Mean (SD)	18 (± 4.2)	18 (± 4.0)	17 (± 3.2)	18 (± 3.2)	17 (± 3.4)	17 (± 3.1)	18 (± 3.4)
Agreement with statements about the rela	tionship betv	veen nature an	d business (6-30)			
Mean (SD)	19 (± 3.4)	19 (± 3.4)	18 (± 2.6)	18 (± 2.9)	19 (± 2.9)	18 (± 2.5)	19 (± 2.9)
Agreement with statements about the rela	tionship betv	veen people an	d nature (6-30)				
Mean (SD)	20 (± 2.9)	20 (± 2.7)	19 (± 2.4)	19 (± 2.6)	20 (± 2.6)	19 (± 2.3)	20 (± 2.6)

	High action	Wildlife gardeners	Recyclers	Diverse action	Communication averse	Low action	Overall
	(N=160)	(N=391)	(N=528)	(N=896)	(N=754)	(N=183)	(N=2912)
How much time do you spend in nature?							
Daily	82 (51 %)	159 (41 %)	86 (16 %)	167 (19 %)	147 (19 %)	23 (13 %)	664 (23%)
Several times a week	55 (34 %)	158 (40 %)	132 (25 %)	349 (39 %)	260 (34 %)	36 (20 %)	990 (34%)
About once a week	18 (11 %)	45 (12 %)	111 (21 %)	222 (25 %)	162 (21 %)	28 (15 %)	586 (20%)
Once or twice a month	4 (2 %)	19 (5 %)	78 (15 %)	96 (11 %)	96 (13 %)	21 (11 %)	314 (11%)
Less than once a month	1 (1 %)	9 (2 %)	93 (18 %)	55 (6 %)	77 (10 %)	42 (23 %)	277 (10%)
Never	0 (0 %)	1 (0 %)	28 (5 %)	7 (1 %)	12 (2 %)	33 (18 %)	81 (3%)
Agreement with statements about the rela	tionship betv	veen nature an	d science (6-30)				
Mean (SD)	18 (± 3.3)	17 (± 2.9)	18 (± 2.6)	18 (± 2.9)	17 (± 2.8)	18 (± 3.0)	18 (± 2.9)
How far is your nearest greenspace (minu	tes)?						
Mean (SD)	9.8 (± 12)	7.1 (± 8.7)	8.8 (± 7.8)	12 (± 14)	8.6 (± 10)	8.8 (± 11)	9.6 (± 11)
In general, do you feel happy? (1-10)							
Mean (SD)	7.2 (± 2.1)	7.1 (± 2.1)	6.3 (± 2.2)	7.0 (± 2.2)	6.7 (± 2.2)	6.1 (± 2.6)	6.8 (± 2.2)
What is your highest level of education?							
Incomplete Secondary Education	1 (1 %)	10 (3 %)	32 (6 %)	20 (2 %)	30 (4 %)	13 (7 %)	106 (4%)
Some Vocational or Technical	6 (4 %)	22 (6 %)	25 (5 %)	38 (4 %)	37 (5 %)	9 (5 %)	137 (5%)
Qualifications							
Vocational or Technical Qualifications	28 (18 %)	87 (22 %)	91 (17 %)	117 (13 %)	146 (19 %)	29 (16 %)	498 (17%)
GCSE /O Level /CSE or equivalent	24 (15 %)	100 (26 %)	178 (34 %)	151 (17 %)	204 (27 %)	48 (26 %)	705 (24%)
A Level or equivalent	18 (11 %)	46 (12 %)	73 (14 %)	122 (14 %)	113 (15 %)	33 (18 %)	405 (14%)
Degree e.g. BA, BSc	47 (29 %)	87 (22 %)	90 (17 %)	260 (29 %)	154 (20 %)	34 (19 %)	672 (23%)
Masters	27 (17 %)	30 (8 %)	33 (6 %)	148 (17 %)	50 (7 %)	13 (7 %)	301 (10%)
Doctorate, Post-doctorate or equivalent	7 (4 %)	8 (2 %)	4 (1 %)	38 (4 %)	19 (3 %)	3 (2 %)	79 (3%)
Prefer not to answer	2 (1 %)	1 (0 %)	2 (0 %)	2 (0 %)	1 (0 %)	1 (1 %)	9 (0%)

Recommendations

This report identifies six distinct grouping of individuals based on the actions they take for nature.

- This action-focused grouping identified a smaller group of individuals who do a lot for nature. Targeting communications at this group is unlikely to result in a substantial increase in action for nature, both due to the size of the group and the high levels of action they are already taking.
- Individuals in the diverse action group form a large part of the UK population (27%) have some demographic and attitudinal similarities with those in the high action group, thus it may be possible to encourage individuals in the diverse action group to undertake more action.
- Likewise, individuals in the communication averse group form another substantial proportion of the UK population (26%) and the actions they do are similar to those in the wildlife gardening group. However, a lower proportion of this group take these actions, and they take fewer actions than those in the wildlife gardening group. Engaging with these individuals to encourage more of them to undertake more action for wildlife in their gardens may be productive.
- Engagement with the low action group is likely to be more challenging, as they reported the lowest interest in and weakest relationship with nature, and spent little time in nature. This group forms a relatively small part of the UK population (9%). Lower effort actions which are accessible to all and appeal to other values which this group hold (see Appendix 2) may result in some action.
- The inability of the model to correctly identify the final group, Recyclers, suggests this group may have considerable overlap with other groups in the 62 demographic and attitudinal variables considered. Therefore, no specific recommendations are made to target this group, even though it forms another large part of the UK population.

Conclusions

This analysis suggests that groups of individuals who take similar actions for nature can be identified, and associated with demographic and attitudinal measures. Six groups were identified, and membership of five of these could be predicted using a random forest model. To increase actions taken for nature, this report suggests focusing on the 'diverse action' and 'communication averse' groups, which form 53% of the population. However, it should be noted that this analysis should be interpreted with caution, as it focuses on self-reports of behaviours which individuals have already done, rather than their willingness to undertake additional actions. Analysis which considers willingness to engage in new behaviours may be more informative for identifying groups where targeted communications can support behaviour change.

A further nationally representative survey is planned, asking about an expanded list of 63 behaviours identified in a parallel study. This planned survey will not only ask about the behaviours people engage in, but individuals' willingness to undertake new actions, and the facilitators and barriers for specific actions. It is hoped that this analysis can be repeated on this new sample. The expansion of behaviours may allow better identification and description of individuals in the Recycler group, though it is also possible that this expanded list generates new behavioural groupings. This future study should provide more information about individuals and actions, potentially allowing more accurate identification of target groups to increase action for nature.

References

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- 2. Rudkin, A. autumn: Fast, Modern, and Tidy-Friendly Iterative Raking. Preprint at https://github.com/aaronrudkin/autumn/ (2024).
- 3. Office for National Statistics (ONS). *Population Estimates for the UK, England, Wales, Scotland, and Northern Ireland Mid-2022*. (2024).
- 4. NISRA. *Main Statistics for Northern Ireland Statistical Bulletin Ethnic Group*. (2022).
- 5. Cracknell, R. & Baker, C. General Election 2024: Research Briefing. Preprint at (2024).
- 6. Linzer, D. A. & Lewis, J. B. poLCA: An R Package for Polytomous Variable Latent Class Analysis. *J Stat Softw* **42**, 1–29 (2011).
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Appendix 1: Sample weighting and estimated proportion of people undertaking each action

Note also that this analysis does not use the full dataset provided to TWT by More in Common, as it excludes all respondents who failed an attention check question (n=1115). Samples were weighted using the 'autumn' package in R version 4.3.3 ². All other analyses in this report were also conducted using the same R version. Information on the intersection of the UK age and sex distribution was taken from the 2021-based interim national population projections by age and sex³. Information on England and Wales regional populations and ethnicity in England and Wales in 2021 were taken from an ethnicity by region query from Nomis – UK government official census and labour market statistics. Information for ethnicity for Scotland was taken from the 2022 Scottish Census, and for Northern Ireland from an NISRA statistical bulletin⁴. Information about voting behaviour was taken from the General Election report produced by the House of Commons library⁵. For all statistics, population counts were converted to proportions of the UK population. The code used is shown below.

library(autumn)

Dataset<-read.csv(file.choose(),header=T,encoding = "UTF-8")</pre> ns target<-list(Agesex = c(`F18-24`= 0.05182559,`F25-34`= 0.08594353, `F35-44`=0.08684628, `F45-54`=0.07877556, `F55-64`=0.08271277, F65-74`= 0.06281435, F75+`=0.06628895, M18-24`=0.05429219,`M25-34`=0.08352361,`M35-44`=0.08197751,`M45-54`=0.07600097 ,`M55-64`=0.07922044,`M65-74`=0.05830011,`M75+`=0.05147814), Region = c(`East Midlands`= 0.07290131, `East of England`=0.09463723, `Greater London `=0.13145582, `North East England `=0.03954276, `North West England`=0.11080575,`Northern Ireland`=0.02843082,`Scotland`=0.08126378,`South East England`=0.13860154,`South West England`=0.08516790,`Wales`=0.04642170,`West Midlands = 0.08889615, Yorkshire and the Humber = 0.08187525), Ethnicity=c(`Asian/Asian British`=0.11128512,`Black/Black British`=0.03610356, `Mixed descent (e.g. White & Asian, White & Black) `=0.02604658, `Other`=0.01910200, `White (British/Irish/Other) `=0.80746275), GE2024=c("Alliance"=0.0017506728, "Another party"=0.0150769003,"Conservative"=0.1020147728,"DUP - Democratic Unionist Party"=0.0025703105,"I did not vote"=0.5706281768,"I was too young to vote"=0.0009899231, "Labour"=0.1450349004,"Liberal Democrat"=0.0525711695,"Plaid Cymru"=0.0029102091 , "Reform UK"=0.0615114456, "Scottish National Party (SNP)"=0.0108268904, "SDLP - Social Democratic and Labour Party"=0.0012975842 ,"Sinn Fein"=0.0031504223, "The Green Party"=0.0275234667, "TUV -Traditional Unionist Voice"=0.0007272871,"UUP - Ulster Unionist Party"=0.0014158683))

newdata<-harvest(Dataset, ns_target,convergence=c(pct=0.0001, absolute=1e-8),max_iterations = 5000)

	Action	Estimated proportion of the UK population	Lower 95% confidence interval	Upper 95% confidence interval
	No action	9.3	7.4	11.6
	Recycled items	75.5	72.4	78.3
-C	Picked up litter	37.5	34.3	40.8
ontl	Provided food for birds and other wildlife	32.7	29.7	35.8
Ŭ.	Shopped with sustainability in mind, excluding for food (e.g. buying second-hand or plastic free items)	28.7	25.8	31.8
This	Tried to avoid disturbing wildlife when walking in nature with or without a dog	29.9	27	33
	Chosen to use transport which is better for the environment	25.6	22.9	28.6
	Chosen food with a lower environmental impact	15.8	13.6	18.2
	Other action this month	1	0.5	2.1
	No action	31.3	28.1	34.6
	Signed a petition for an environmental cause	11.9	9.9	14.1
	Repaired or maintained items instead of buying new	27.6	24.8	30.7
	Tried to persuade friends and family to take actions which help nature	10.8	9	13
	Used a renewable energy provider	13.7	11.7	15.8
ar	Posted on social media about environmental issues	6.6	5.3	8.2
yea	Voted for MPs, Councillors, or other representatives because of their environmental policies	4.5	3.6	5.6
his	Joined or renewed membership of an environmental charity	2.5	1.8	3.4
Т	Donated to an environmental charity	8.8	7.2	10.6
	Grew plants with fruits for wildlife (e.g., apples or berries)	16.5	14.4	18.9
	Created or maintained homes for wildlife (e.g., bug hotels, bird or bat boxes)	11.7	9.9	13.9
	Used alternatives to chemical pesticides and herbicides	10.4	8.6	12.5
	Used peat-free composts	13.5	11.6	15.6
	Grew pollinator-friendly plants	13.9	11.9	16.2

Table A1.1 The estimated proportion of the UK population which have done each action, calculated using the weighted sample of 2912 individuals.

Action	Estimated proportion of the UK population	Lower 95% confidence interval	Upper 95% confidence interval
Participated in a citizen science project (e.g., recorded birds in the garden or counted butterflies)	2.9	2.1	3.9
Raised issues of nature and sustainability directly with companies	2.3	1.6	3.3
Contacted MPs, Councillors, or other elected representatives about an environmental issue	3.9	2.9	5.4
Created or looked after spaces for nature in my local community	4.6	3.5	6
Organised a practical activity for nature, such as beach cleaning or tree planting	2.9	2.1	4.1
Volunteered my time for an environmental cause or charity	5.1	3.8	6.7
Avoided air travel in favour of lower carbon transport	11.7	9.8	14
Made changes in my workplace (e.g. encouraging nature-friendly practices)	5.1	3.9	6.7
Engaged in the planning system for nature (e.g., commented on a planning application or a Local Plan)	3.1	2.3	4.3
Created or maintained a wildlife friendly pond	3.8	2.8	5
Created other habitats for nature (e.g. planting a hedge or left an area untouched)	12.1	10.1	14.4
Other action this year	0.8	0.4	1.8

Appendix 2: Latent class analysis

Latent class analysis can be used to identify segments or groups of similar individuals within a dataset, based on multiple dichotomous variables - in this case, whether an individual reports doing each of 31 actions for nature. The model minimises the similarity in these variables within groups, and maximises the differences between groups. The aim of latent class analysis is to identify informative groups, thus comparisons between groups are examined using both statistical measures and researcher assessment of the interpretability and usefulness of classes.

Latent class analysis was conducted using the poLCA package⁶, and models with 2 to 9 clusters were compared. 20 replicates of each model were generated and the model with the lowest likelihood retained. A comparison of these shows that the model with 8 groups produces the lowest BIC (Table A2.1) and Chi-squared drops for 6 groups then stays relatively stable for 6-8 groups. Entropy is very high for the models with 3-5 clusters, but still acceptable (over 0.8) for the models with 6+ groups. Estimated class population shares and modal class assignments have similar probabilities for all models (see Table A2.2 for these values for the selected model). From 7+ groups, prediction ability drops below 0.8 for at least one group (not shown) and at least one class contains less than 5% of the sample.

Table A2.1	Statistics	for the I	latent clas	s models	with 2-	-9 classes	LL = lc	og likelihood,	BIC =
Bayesian I	Informatior	n Criterio	on.						

Number of groups	LL	BIC	No parameters	Entropy ²	X²	Proportion of sample in smallest group	Proportion of sample in largest group
2	-34450	69466	71	0.77	1.73 x10 ¹⁹	0.49	0.51
3	-33012	66878	107	0.93	1.66 x10 ¹³	0.15	0.62
4	-32534	66209	143	0.89	6.59 x10 ¹⁰	0.09	0.52
5	-32124	65675	179	0.90	6.77 x10 ¹⁰	0.06	0.51
6	-31869	65453	215	0.84	1.17 x10 ¹⁰	0.06	0.31
7	-31685	65372	251	0.83	1.25 x10 ¹⁰	0.04	0.32
8	-31521	65333	287	0.82	1.39 x10 ¹⁰	0.02	0.25
9	-31433	65443	323	0.81	8.39 x10 ⁹	0.01	0.18

The model with 6 groups balances statistical performance with interpretability. It does not produce any very small groups, but does split one very large group which contains more than 50% of the population in the models with 2-5 groups. Such a large group is unlikely to generate actionable insights on actions for nature. Further statistics for this model are shown in Table A2.2. The group names were generated by examining the action profiles of the six groups.

Table A2.2 Stat	istics for the a	selected latent	class model	with 6 classes
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	Estimated	Predicted class	Classification	Predicted				
	class	membership (by	probability	proportion of the				
	population	model posterior		population using				
	share	probability)		weighted sample				
High action	0.057	0.055	0.90	0.04				
Wildlife gardeners	0.134	0.134	0.85	0.11				
Diverse action	0.313	0.308	0.86	0.27				
Low action	0.063	0.063	1.00	0.09				
Communication averse	0.252	0.259	0.80	0.26				
Recyclers	0.181	0.181	1.00	0.23				

Appendix 3: Random forest model analysis and results

Random forests are used to identify variables which are associated with a specified response variable, in this case to identify attitudinal and demographic variables associated with six 'classes' (groups) of people who differ in the actions they take for nature. Random forests are non-linear models which create a number of decision trees, each of which uses a subset of the data. Each tree has a series of branches which split the data, with the aim of clustering datapoints which are in the same category. In this case, the decision trees aim to create groups where all the datapoints fall into the same 'action for nature' category. At each branching event, the decision tree is presented with a subset of the potential explanatory variables which can be used to split the data, and selects the variable which minimises the entropy in the branch nodes. Entropy is lowest when all the datapoints in the node are in the same group, and highest when there are equal numbers of datapoints for each category. The decision tree adds branches and continues to split the data until either 1) all the datapoints in a branch fall into the same category or 2) a minimum 'node size' is reached – the minimum number of datapoints which should be grouped together. The random forest then combines the results of these individual trees, identifying variables which are more informative for correctly classifying datapoints. Here, variables are ranked by 'mean decrease in Gini', which is a measure of how informative the variable is for correctly classifying datapoints. Variables with higher values are more informative.

The random forest model used 62 variables (see Table A3.2) to predict individuals falling into 1 of 6 classes of 'action for nature'. 2000 trees were built using the randomForest function⁷, with 10 variables selected at random at each branch split and a minimum node size of 4. These parameters were selected to maximise accuracy in repeated cross-validation using the 'train' function in the randomForest package⁷, from an expanded grid of mtry 2-10, nodesize 1-5 and ntree 1000, 1500 or 2000. 80% of the data was used for training and to ensure equal weight was given to each category, 100 samples were selected from each of the six categories for each tree. Out-of-bag error rates were calculated within the training set, and for the separate test set which included 20% of the data. Figures reported in the main text are for this separate test set. Overall accuracy was 0.41 (95% CI: 0.36 - 0.46), p<0.001, Kappa=0.27. The sensitivity, specificity and other related variables for each group are shown in Table A3.1. The mean Gini decrease for each variable is shown in Table A3.2.

	High action	Wildlife gardeners	Diverse action	Low action	Communication averse	Recyclers
Sensitivity	0.39	0.34	0.49	0.52	0.51	0.16
Specificity	0.87	0.93	0.87	0.90	0.77	0.94
Pos Pred Value	0.11	0.47	0.59	0.29	0.46	0.36
Neg Pred Value	0.97	0.89	0.81	0.96	0.81	0.84
Prevalence	0.04	0.15	0.28	0.08	0.28	0.18
Detection Rate	0.02	0.05	0.14	0.04	0.14	0.03
Prevalence	0.14	0.11	0.23	0.14	0.31	0.08
Balanced Accuracy	0.63	0.64	0.68	0.71	0.64	0.55

Table A3.1 Sensitivity, specificity and other related statistics for each of the six classes, based on the 20% test data not used to train the model.

Table A3.2 Mean Decrease in Gini for each of the 62 variables included in the random forest analysis. Values are shown for both the analysis presented here and the analysis without recyclers, which is reported in more detail in Appendix 3. The top 15 variables are the same in both analyses. The variables shown here are not the questions used in the GBNS, but are rewordings to ensure clarity and brevity within this report.

Variable	All	Without
Valiable	categories	recyclers
Age (years)	25.26	24.97
How motivating do you find time in nature? (0-10)	21.15	20.05
How interested are you in nature? (coded 1-4)	19.33	18.76
Agreement with statements about the rights of animals (6-30)	17.74	16.68
Agreement with statements about the wildness of nature $(7-35)$	17.38	17.01
How much does nature contribute to your happiness? (1-10)	17.24	18.04
How strong is your relationship to nature? (1-7)	16.23	16.76
Agreement with statements about how nature should be valued (6-		
30)	15.79	15.66
Agreement with statements about the relationship between nature		
and business (6-30)	15.39	15.10
Agreement with statements about the relationship between people		
and nature (6-30)	15.07	14.20
How much time do you spend in nature? (coded 1-4)	14.87	15.33
Agreement with statements about the relationship between nature		
and science (6-30)	14.47	14.61
How far is your nearest greenspace (minutes)?	13.27	13.21
In general do you feel happy? (1-10)	12.68	11.90
What is your highest level of education? (coded 1-8)	12.35	11.60
How financially comfortable are you? (coded 1-4)	8 27	8 91
L consider climate change to be an important issue (ves/no)	8.09	7 78
How much do you know about nature?	7 14	7 33
Do you support TWT? (ves/no)	6 78	5 76
Do you have a private garden? (ves/no)	4.33	4 41
Do you own your own home? (yes/no)	3 72	2.85
L consider the NHS to be an important issue (ves/no)	3.65	3.46
Are you in good health? (yes/no)	3 58	3.06
L consider the cost of living to be an important issue (ves/no)	3 54	3.28
What is your gender? (male / female)	3 53	3 41
Are you in full time employment? (ves/no)	3.28	3 15
L consider immigration to be an important issue (ves/no)	3 25	2 72
How did you yote in the 2024 general election? (Labour party)	0.20	2.12
	3 22	2 93
Where do you live? (City centre) (yes/no)	3.00	2.30
Are you retired? (ves/no)	3.05	2.75
Where do you live? (Small town) (ves/no)	3.05	2.33
What is your ethnicity? (white) (yes/ho)	2.00	2.70
Where do you live? (Midlands) (yes/no)	2.07	2.52
Do you have any mental health conditions? (yes/no)	2.01	2.00
Where do you live? (Large town) (ves/no)	2.70	2.14
Do you rent your home privately? (yes/no)	2.72	2.00
Where do you live? (Suburb) (ves/no)	2.71	2.22
Do you own your own home? (mortgaged) (yes/no)	2.67	2.20
How did you yote in the 2021 general election? (Conservative)	2.00	2.00
	2.63	2 37
How did you yote in the 2024 general election? (I did not yote)	2.00	2.07
	2 57	2.03
Other employment status (neither full time part time or retired)	2.01	2.00
	2 57	2 21
Is lack of time a harrier to accessing greenspace? (ves/no)	2.57	2.21
Where do you live? (Village) (ves/no)	2.00	2.20
Are you in part time employment? (ves/no)	2.40	2.10
, ao you in purt ano ompioyment. (you'no)	6 .71	2.10

Where do you live? (Southeast England) (yes/no)	2.38	2.01
How did you vote in the 2024 general election? (Reform UK)		
(yes/no)	2.32	2.20
Where do you live? (Scotland) (yes/no)	2.31	1.94
Where do you live? (Northeast England) (yes/no)	2.25	2.10
Do you work in conservation? (yes/no)	2.17	2.11
Where do you live? (Northwest England) (yes/no)	2.13	1.84
Where do you live? (Southwest England) (yes/no)	2.08	1.55
Where do you live? (East England) (yes/no)	1.97	1.74
Where do you live? (Wales) (yes/no)	1.94	1.62
Do you have access to any garden (including shared etc.)?		
(yes/no)	1.90	1.60
Do you rent your home from the council? (yes/no)	1.89	1.80
Where do you live? (Rural area) (yes/no)	1.89	1.62
Where do you live? (London) (yes/no)	1.83	1.73
Do you rent your home from a housing association? (yes/no)	1.73	1.58
How did you vote in the 2024 general election? (Liberal democrat)		
(yes/no)	1.55	1.40
How did you vote in the 2024 general election? (Green party)		
(yes/no)	1.13	1.18
What is your ethnicity? (black) (yes/no)	1.12	1.08
What is your ethnicity? (Asian) (yes/no)	0.98	0.84

For the random forest model without the recycler class, 1500 trees were built, with 10 variables selected at random at each branch split and a minimum node size of 2. These parameters were selected using the same process as for the main analysis, and all other parameters remained the same. Overall accuracy was 0.49 (95% CI: 0.44 - 0.55), compared to the null model rate of 0.33, p<0.001, Kappa = 0.25). The sensitivity, specificity and other related variables for each group are shown in Table A3.3. The relationship between the 6 groups and the variables not included in the main text are shown in Table A3.4.

Table A3.3 Sensitivity, specificity and other related statistics for each of the five classes, based on the 20% test data not used to train the model.

	High action	Wildlife gardeners	Diverse action	Low action	Communication averse
Sensitivity	0.71	0.50	0.53	0.63	0.37
Specificity	0.86	0.88	0.87	0.88	0.88
Pos Pred Value	0.27	0.49	0.66	0.33	0.60
Neg Pred Value	0.98	0.88	0.79	0.96	0.74
Prevalence	0.07	0.19	0.33	0.08	0.33
Detection Rate Detection	0.05	0.10	0.17	0.05	0.12
Prevalence	0.17	0.20	0.26	0.16	0.20
Balanced Accuracy	0.79	0.69	0.70	0.76	0.63

Table A3.4. Additional demographic and attitudinal variables used in a random forest model to test whether they could be used to distinguish between individuals in the 6 groups. Relationships with the top 15 variables are included in the main text. Cells in each row are coloured from blue (highest values) through green and yellow to white (lowest values).

	High action	Wildlife gardeners	Recyclers	Diverse action	Communicati on averse	Low action	Overall
	(N=160)	(N=391)	(N=528)	(N=896)	(N=754)	(N=183)	(N=2912)
Region							
Greater London	20 (12 %)	21 (5 %)	41 (8 %)	152 (17 %)	55 (7 %)	21 (11 %)	310 (11 %)
South East England	23 (14 %)	58 (15 %)	60 (11 %)	99 (11 %)	101 (13 %)	27 (15 %)	368 (13 %)
South West England	13 (8 %)	33 (8 %)	48 (9 %)	60 (7 %)	70 (9 %)	11 (6 %)	235 (8 %)
East of England	20 (12 %)	45 (12 %)	45 (9 %)	69 (8 %)	74 (10 %)	12 (7 %)	265 (9 %)
Midlands	24 (15 %)	70 (18 %)	73 (14 %)	131 (15 %)	92 (12 %)	31 (17 %)	421 (14 %)
Yorkshire and the Humber	11 (7 %)	32 (8 %)	44 (8 %)	60 (7 %)	51 (7 %)	18 (10 %)	216 (7 %)
North East England	1 (1 %)	8 (2 %)	15 (3 %)	34 (4 %)	27 (4 %)	12 (7 %)	97 (3 %)
North West England	10 (6 %)	28 (7 %)	57 (11 %)	103 (11 %)	70 (9 %)	13 (7 %)	281 (10 %)
Scotland	17 (11 %)	42 (11 %)	58 (11 %)	82 (9 %)	111 (15 %)	14 (8 %)	324 (11 %)
Wales	11 (7 %)	38 (10 %)	54 (10 %)	50 (6 %)	69 (9 %)	12 (7 %)	234 (8 %)
Northern Ireland	10 (6 %)	16 (4 %)	33 (6 %)	56 (6 %)	34 (5 %)	12 (7 %)	161 (6 %)
Employment							
Working full time - working 30 hours per week or more	80 (50 %)	126 (32 %)	200 (38 %)	533 (59 %)	273 (36 %)	67 (37 %)	1279 (44 %)
Working part time - working less than 30 hours per week	24 (15 %)	64 (16 %)	82 (16 %)	138 (15 %)	114 (15 %)	21 (11 %)	443 (15 %)
Not currently working	20 (13 %)	57 (15 %)	116 (22 %)	111 (12 %)	109 (14 %)	47 (26 %)	460 (16 %)
Retired	31 (19 %)	141 (36 %)	110 (21 %)	76 (8 %)	239 (32 %)	38 (21 %)	635 (22 %)
Other	5 (3 %)	3 (1 %)	20 (4 %)	38 (4 %)	19 (3 %)	10 (5 %)	95 (3 %)
What is your ethnicity?							
Asian/Asian British	9 (6 %)	1 (0 %)	23 (4 %)	89 (10 %)	24 (3 %)	9 (5 %)	155 (5 %)
Black/Black British	12 (7 %)	3 (1 %)	17 (3 %)	116 (13 %)	24 (3 %)	9 (5 %)	181 (6 %)
White (British/Irish/Other)	136 (85 %)	380 (97 %)	477 (90 %)	652 (73 %)	691 (92 %)	160 (87 %)	2496 (86 %)
Other	3 (2 %)	7 (2 %)	11 (2 %)	39 (4 %)	15 (2 %)	4 (2 %)	80 (3 %)
Gender							
Female	82 (51 %)	222 (57 %)	265 (50 %)	402 (45 %)	347 (46 %)	82 (45 %)	1400 (48 %)
Male	78 (49 %)	169 (43 %)	263 (50 %)	494 (55 %)	407 (54 %)	101 (55 %)	1512 (52 %)

	High action	Wildlife gardeners	Recyclers	Diverse action	Communicati on averse	Low action	Overall
	(N=160)	(N=391)	(N=528)	(N=896)	(N=754)	(N=183)	(N=2912)
low did you vote in the 2024 eneral election?							
abour	64 (40 %)	131 (34 %)	152 (29 %)	428 (48 %)	261 (35 %)	63 (34 %)	1099 (38 %)
Conservative	21 (13 %)	83 (21 %)	99 (19 %)	116 (13 %)	165 (22 %)	30 (16 %)	514 (18 %)
leform UK	15 (9 %)	75 (19 %)	85 (16 %)	54 (6 %)	94 (12 %)	21 (11 %)	344 (12 %)
did not vote	7 (4 %)	32 (8 %)	96 (18 %)	69 (8 %)	82 (11 %)	41 (22 %)	327 (11 %)
iberal Democrat	19 (12 %)	32 (8 %)	35 (7 %)	62 (7 %)	56 (7 %)	11 (6 %)	215 (7 %)
he Green Party	15 (9 %)	13 (3 %)	8 (2 %)	70 (8 %)	25 (3 %)	1 (1 %)	132 (5 %)
Other	19 (12%)	25 (6%)	53 (10%)	97 (11%)	71 (9%)	16 (9%)	281 (10%)
Vhich best describes where you ve?							
Irban /City Centre	35 (22 %)	31 (8 %)	75 (14 %)	258 (29 %)	90 (12 %)	41 (22 %)	530 (18 %)
arge Town	15 (9 %)	56 (14 %)	97 (18 %)	174 (19 %)	132 (18 %)	32 (17 %)	506 (17 %)
Suburbs	29 (18 %)	71 (18 %)	127 (24 %)	143 (16 %)	158 (21 %)	37 (20 %)	565 (19 %)
mall Town	42 (26 %)	117 (30 %)	138 (26 %)	166 (19 %)	199 (26 %)	46 (25 %)	708 (24 %)
llage	21 (13 %)	79 (20 %)	55 (10 %)	80 (9 %)	103 (14 %)	13 (7 %)	351 (12 %)
Rural Area	18 (11 %)	37 (9 %)	36 (7 %)	75 (8 %)	72 (10 %)	14 (8 %)	252 (9 %)
lousing tenure							
Owned outright	62 (39 %)	199 (51 %)	172 (33 %)	246 (27 %)	318 (42 %)	55 (30 %)	1052 (36 %)
wned with a mortgage or loan	35 (22 %)	79 (20 %)	105 (20 %)	203 (23 %)	149 (20 %)	33 (18 %)	604 (21 %)
rivately rented	33 (21 %)	51 (13 %)	109 (21 %)	216 (24 %)	120 (16 %)	34 (19 %)	563 (19 %)
ented from the housing association	8 (5 %)	23 (6 %)	52 (10 %)	102 (11 %)	64 (8 %)	26 (14 %)	275 (9 %)
ented from the council	15 (9 %)	29 (7 %)	63 (12 %)	78 (9 %)	76 (10 %)	24 (13 %)	285 (10 %)
refer not to say	7 (4 %)	10 (3 %)	27 (5 %)	51 (6 %)	27 (4 %)	11 (6 %)	133 (5 %)
o you have access to any garden ncluding shared etc.)?							
lo	3 (2 %)	0 (0 %)	75 (14 %)	50 (6 %)	45 (6 %)	35 (19 %)	208 (7 %)
/es	157 (98 %)	391 (100%)	453 (86 %)	846 (94 %)	709 (94 %)	148 (81 %)	2704 (93 %)
o you have a private garden?							
lo	28 (18 %)	26 (7 %)	155 (29 %)	320 (36 %)	143 (19 %)	66 (36 %)	738 (25 %)
² ec	132 (82 %)	365 (93 %)	373 (71 %)	576 (64 %)	611 (81 %)	117 (64 %)	2174 (75 %)

		Wildlife		Diverse	Communicati		
	High action	gardeners	Recyclers	action	on averse	Low action	Overall
	(N=160)	(N=391)	(N=528)	(N=896)	(N=754)	(N=183)	(N=2912)
Are you in good health?							
Yes	78 (49 %)	227 (58 %)	308 (58 %)	528 (59 %)	407 (54 %)	96 (52 %)	1644 (56 %)
No	82 (51 %)	164 (42 %)	220 (42 %)	368 (41 %)	347 (46 %)	87 (48 %)	1268 (44 %)
Do you have any mental health conditions?							
Yes	37 (23 %)	52 (13 %)	79 (15 %)	151 (17 %)	119 (16 %)	27 (15 %)	465 (16 %)
No	123 (77 %)	339 (87 %)	449 (85 %)	745 (83 %)	635 (84 %)	156 (85 %)	2447 (84 %)
How financially comfortable are you?							
I am very comfortable financially	19 (12 %)	21 (5 %)	31 (6 %)	138 (15 %)	36 (5 %)	9 (5 %)	254 (9 %)
I am relatively comfortable financially	54 (34 %)	133 (34 %)	147 (28 %)	258 (29 %)	244 (32 %)	55 (30 %)	891 (31 %)
I do not have money for luxuries but can normally comfortably cover the essentials	55 (34 %)	138 (35 %)	205 (39 %)	297 (33 %)	295 (39 %)	55 (30 %)	1045 (36 %)
I can only just afford my costs and often struggle to make ends meet	26 (16 %)	78 (20 %)	110 (21 %)	157 (18 %)	133 (18 %)	44 (24 %)	548 (19 %)
I cannot afford my costs and often have to go without essentials like food and heating	6 (4 %)	21 (5 %)	35 (7 %)	46 (5 %)	46 (6 %)	20 (11 %)	174 (6 %)
How much do you know about nature?							
I don't know much about nature	4 (2 %)	9 (2 %)	119 (23 %)	56 (6 %)	105 (14 %)	70 (38 %)	363 (12 %)
I know a moderate amount about nature	77 (48 %)	268 (69 %)	361 (68 %)	604 (67 %)	558 (74 %)	100 (55 %)	1968 (68 %)
I know a lot about nature	79 (49 %)	114 (29 %)	48 (9 %)	236 (26 %)	91 (12 %)	13 (7 %)	581 (20 %)
Do you support TWT?							
No	103 (64 %)	355 (91 %)	523 (99 %)	778 (87 %)	735 (97 %)	177 (97 %)	2671 (92 %)
Yes	57 (36 %)	36 (9 %)	5 (1 %)	118 (13 %)	19 (3 %)	6 (3 %)	241 (8 %)
Is lack of time a barrier to accessing greenspace?							
Yes	34 (21 %)	45 (12 %)	51 (10 %)	162 (18 %)	98 (13 %)	14 (8 %)	404 (14 %)
No	126 (79 %)	346 (88 %)	477 (90 %)	734 (82 %)	656 (87 %)	169 (92 %)	2508 (86 %)
Do you work in conservation?							
Yes	12 (8 %)	11 (3 %)	2 (0 %)	126 (14 %)	15 (2 %)	3 (2 %)	169 (6 %)
	4 40 (00 0()	200 (07.0)	$E_{2}C(1000/)$	770 (96 9/)	720 (00 0/)	100 (00 0/)	2742(040/)

	High action	Wildlife gardeners	Recyclers	Diverse action	Communicati on averse	Low action	Overall
	(N=160)	(N=391)	(N=528)	(N=896)	(N=754)	(N=183)	(N=2912)
I consider climate change to be an important issue							
Yes	75 (47 %)	87 (22 %)	53 (10 %)	175 (20 %)	96 (13 %)	10 (5 %)	496 (17 %)
No	85 (53 %)	304 (78 %)	475 (90 %)	721 (80 %)	658 (87 %)	173 (95 %)	2416 (83 %)
I consider the NHS to be an important issue							
Yes	88 (55 %)	235 (60 %)	285 (54 %)	364 (41 %)	420 (56 %)	79 (43 %)	1471 (51 %)
No	72 (45 %)	156 (40 %)	243 (46 %)	532 (59 %)	334 (44 %)	104 (57 %)	1441 (49 %)
I consider the cost of living to be an important issue							
Yes	87 (54%)	242 (62%)	366 (69%)	574 (64%)	479 (64%)	122 (67%)	1870 (64%)
No	73 (46%)	149 (38%)	162 (31%)	322 (36%)	275 (36%)	61 (33%)	1042 (36%)
I consider immigration to be an important issue							
Yes	34 (21%)	122 (31%)	184 (35%)	183 (20%)	223 (30%)	55 (30%)	801 (28%)
No	126 (79%)	269 (69%)	344 (65%)	713 (80%)	531 (70%)	128 (70%)	2111 (72%)