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Environmental tastes as predictors of environmental opinions and behaviors

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Environmental tastes as predictors of environmental opinions and behaviors

Highlights

- Environmental tastes can be identified by querying individuals about their preferences regarding various environmental characteristics.
- Environmental tastes are shown to have consistently high explanatory power regarding environmental behaviors and opinions.
- Tastes may be stronger predictors of environmental behaviors and opinions than socio-demographic variables.

Environmental tastes as predictors of environmental opinions and behaviors

ABSTRACT

We develop a novel way to assess how individuals perceive and utilize their local environment. Specifically, we query local residents in Scotland's Cairngorms National Park regarding their preferences for different characteristics of their environment and examine how these preferences correlate with environmental behaviors and opinions. We identify groupings of preferred characteristics as distinct environmental tastes that, drawing upon Bourdieu's theory of taste, represent general dispositions, preferences, or orientations regarding the environment. We then test whether these tastes are useful for explaining environmental behaviors and opinions.

We introduced this idea previously using survey data drawn from residents of a hyper-arid ecosystem. Here, we seek to establish whether our framework has potentially universal applications generalizable to other socio-ecological settings. We analyze survey data collected from inhabitants of the Cairngorms and, using data reduction methods, identify four distinct environmental tastes. We demonstrate how tastes constitute significant correlates of private sphere environmental behavior, engagement in outdoor activities, opinions about development, perceived economic benefit from the environment, and environmental concerns.

Environmental tastes defined for the Cairngorms are similar to those drawn from previous research and we find several parallels between the two different settings in the associations between tastes and opinions and behavior. There are similarities in the way individuals with certain profiles of environmental tastes are more inclined to have certain opinions and to engage in certain activities. We suggest that tastes can be elucidating for understanding diverse

preferences for environmental characteristics and their broader implications for how humans interact with the landscape.

1. INTRODUCTION

Sociological and psychological literature has proposed various theories to explain behaviors that impact the environment. These theories articulate associations between various constructs such as values, attitudes, concerns, awareness, and socio-demographic characteristics, which shape pro-environmental behavior (Barr, 2007; Olli et al., 2001; Steg & Vlek, 2009). Although we see differences between these theories in the dimensions they emphasize and in their depictions of the processes that lead to engagement in pro-environmental behaviors, the general picture that emerges is that socio-psychological factors, such as values and beliefs, have been more successful than socio-demographic factors in predicting pro-environmental behaviors (Boldero, 1995; de Groot & Steg, 2008; Guagnano et al., 1995). For example, the value-belief-norm theory (Stern, 2000) has shown how environmental behaviors stem from holding particular personal values emphasizing certain perceptions of altruism and care for other humans, plants, and animals. While values cannot and should not be completely separated from socio-demographic factors (which may underlie values systems, as noted above), they are often shown to be more closely associated to behaviors and opinions.

In this research we continue this line of inquiry by deriving and testing a new construct that measures the way individuals perceive the environment, which we call "environmental tastes".

We explore whether this construct can shed new light on the factors that influence environmentally significant behavior and opinions. We developed this concept in previous research, and apply it here to an entirely new socio-ecological setting. We reason that if analogous relationships are established elsewhere, then environmental tastes may have universal applicability.

1.1. Environmental tastes and landscape preferences

We identify **environmental tastes** as clusters of orientations toward the environment. We define environmental tastes by querying people regarding their preferences for a specific set of biological, physical and climatic components of the landscape (e.g. mountains, rain, trees, birds; details provided in methods section). In developing this notion, we rely on Bourdieu's theory of taste (Bourdieu, 1984) to claim that environmental tastes are embedded in lifestyle and consumption preferences that would have an impact on environmental behavior. Bourdieu's (1984) theory of taste posits that tastes (e.g. cultural, ethical, or environmental preferences) are socially constructed, cultivated through socialization, and used to demarcate social groups in a hierarchical way that distinguishes "legitimate" from "illegitimate" norms, values, and preferences. Because tastes are cultivated through socialization, they are often taken for granted or interpreted as innate, individualistic choices of the human intellect. However, Bourdieu argues that in fact tastes are acquired dispositions that individuals use to evaluate and differentiate things in the social world (Lizardo, 2013). These dispositions produce tastes, which are embedded in lifestyles and in turn shape behavior.

The link between tastes, lifestyles and behavior has been applied in diverse ways to environmental research (Bourdieu & Wacquant, 1992; Horton, 2003). In the environmental context, tastes have been shown to reflect dispositions toward nature, sustainability, preservation,

landscapes, daily consumption practices, etc. Further, environmental tastes have been posited to form a set of dispositions that generate perceptions and practices (Crossley, 2003; Haluza-DeLay, 2008; Sela-Sheffy, 2011). These practices are embedded in individuals' lifestyles and are therefore conditioned by particular social contexts. For example, Carfagna et al. (2014) report a class of ethical consumers characterized by a high cultural capital who exhibit an eco-habitus (i.e. environmental orientation) that encourages environmental awareness and sustainability principles. To summarize, in the environmental field, tastes may shape attitudes and behavior in realms such as reflexivity about daily practices, seeking time in nature, or conscious effort to live environmentally.

In this research, we identify and measure environmental taste variables and analyze their relationship to environmental behaviors and opinions. As such, we suggest our research is similar in several ways to the study of landscape preferences because preferences for the landscape are among the taste indicators that we employ and because landscape preferences are often studied with regard to their interaction with environmental opinions and behaviors (e.g. DeLucio & Múgica, 1994; Larsen & Harlan, 2006; Múgica & De Lucio, 1996; Sevenant & Antrop, 2010). One difference between this literature and the research presented here, however, is that most, if not all, of the landscape preference literature focuses on the determinants of landscape preferences and not the reverse relationship, as we examine in this work, whether landscape preferences (or, in our case, environmental tastes) can be used as possible predictors of environmental behaviors and opinions (e.g. Oreg & Katz-Gerro, 2006; Takahashi & Selfa, 2015).

Landscape is often defined as the product of the interaction between a biophysical space and the human activity occurring within that space (Council of Europe, 2000; Naveh, 2000, 2001; Naveh & Lieberman, 1994). Landscape is perceived and interpreted by the observer within particular

contexts, defined by culture, expectations, needs and other variables (Arriaza et al., 2004; Barroso et al., 2012; Egoz et al., 2001; Gobster et al., 2007). Landscape preferences have been assessed using two paradigms, one which considers landscape beauty to be inherent in its physical properties (i.e. the objectivist paradigm), and the other focusing on the subject observing the landscape (i.e. the subjectivist paradigm; Daniel, 2001; Dramstad et al., 2006; Lothian, 1999). Research extending from these approaches addresses the question of whether there is a general consensus regarding what constitutes aesthetic beauty (Kalivoda et al., 2014; Stamps III, 1997; Ulrich, 1986), or whether landscape aesthetics differ widely according to cultural, social and demographic variables, including nationality, age, residential profile, religion and other characteristics (Buijs et al., 2009; Duncan, 1973; Gee & Burkhard, 2010; Natori & Chenoweth, 2008; Zube & Pitt, 1981). Still other work identifies diversity in landscape preferences, but finds factors other than socio-demographic variables to be stronger correlates with landscape preferences, such as knowledge of the landscape and on-site experiences (Brush et al., 2000; Múgica & De Lucio, 1996) or educational background (subject matter, not necessarily years of study; Dramstad et al., 2006; Zheng et al., 2011). On the other hand, Sevenant and Antrop (2010), who defined the latent characteristics of landscapes that are preferred or not preferred, and then tested whether there were distinct preferences to these latent characteristics based on socio-demographic variables, found that latent characteristics were correlated with both socio-demographic variables (including age and education level) and behaviors and attitudes.

Several researchers have studied whether environmental values, activities and/or opinions might explain landscape preferences. For instance, DeLucio and Múgica (1994) and Múgica and De Lucio (1996) investigated whether activities and opinions of visitors to national parks in Spain

113 can be used to determine their landscape preferences. In their first study, they found that
114 landscape preferences were based on the activities in which visitors intended to engage and on
115 the decisions they had made regarding which parks to visit (e.g. they preferred the landscapes for
116 which the parks were known; DeLucio & Múgica, 1994). In their second study, they investigated
117 the determinants of landscape preferences of park visitors to the Doñana National Park, and
118 found that visitors who had acquired knowledge about the park and those with stronger
119 environmental opinions more strongly preferred park landscapes than those with less knowledge
120 or more moderate environmental opinions.

121 Larsen and Harlan (2006), in their study of private yards in a suburban landscape, investigated
122 the relationship between landscape preferences and behaviors, as expressed by how residents
123 maintain their front and back yards. They concluded that the way residents maintained their
124 yards (i.e. behavior) reflected their landscape preferences, although, recalling earlier work by
125 Duncan (1973), they also showed that both behavior and preference are at least partially
126 determined by social class. On the other hand, they also found that demographic variables did
127 not correlate significantly with landscape preferences. Larson and colleagues (2010) were able to
128 explain residential landscaping decisions through interactions among environmental values, land
129 cover and neighborhood effects.

130 While the directionality of the relationship between tastes (among them landscape preferences)
131 and behavior could be further tested in various domains, there is general agreement in social
132 psychological research on environmental issues that attitudes antecede behavior (e.g. Oreg &
133 Katz-Gerro, 2006; Takahashi & Selfa, 2015).

1.3. Environmental tastes as predictors of environmental opinions and behavior

In this work, we first define environmental tastes based on preferences for various biological and physical features of the environment and then test whether these environmental tastes can explain variation in environmental behaviors and opinions more strongly than socio-demographic variables. This path of inquiry is somewhat analogous to landscape preference research that explores the underlying relationship between landscape preferences, on the one hand, and environmental behaviors and opinions, on the other.

We introduced our hypothesis regarding the importance of environmental tastes as possible determinants of environmental opinions and behaviors in previous research (XXX, 2015; masked for blind review). In that work, we measured preferences of local environmental characteristics in a hyper-arid region of Israel, used these characteristics to define a set of environmental tastes and found that these tastes provided explanatory power with regard to frequency of engagement in outdoor activities and to opinions regarding various environmental issues.

In the present research we seek to examine whether the connections between our environmental taste construct and their connection to environmental behaviors and opinions are robust enough to apply to an entirely different ecosystem. We once again aim to identify distinct dimensions of environmental tastes that represent affinities for specific characteristics of the environment. Our first research question is whether such distinct tastes can be identified in a setting of a northern boreal ecosystem in Scotland's Cairngorms National Park, and whether these tastes are at all similar to the ones identified in the hyper-arid ecosystem. If the answer to the latter question is affirmative, this provides an indication that environmental tastes as we measure them are more widely applicable than only in the specific case study. Second, to give further credence to this new concept, we ask whether these environmental tastes provide potential explanatory power

157 regarding environmental behaviors and opinions, and whether the pattern and direction of
158 relationship is similar to that of previous studies. Aside from its theoretical contribution,
159 identification of clusters of environmental tastes and understanding their relationship with
160 environmental behaviors and opinions could be consequential for research on strategies to
161 change behaviors in the environmental sphere.

162

163 ## 2. METHODS

164 ### 2.1. Research site

165 Our research area is the Cairngorms National Park (CNP) in Scotland (Fig. 1), which has also
166 been a long-term social and ecological research (LTSER) platform since 2013. The ethos of the
167 LTSER platforms in Europe (under the auspices of the LTER Europe network) is to encourage
168 use of the data and infrastructure provided by long-term ecological research (LTER) sites and to
169 marry this knowledge with social and economic research in a place-based approach to facilitate
170 sustainable management of an area (Haberl et al., 2006; Singh et al., 2013).

171 The Cairngorms are a mountain range in the eastern highlands of Scotland, and the national park
172 is 4,500 km^2, or approximately 6% of the Scottish land area (Cairngorms National Park
173 Association, 2012). The park has boreal and sub-arctic mountain landscapes and provides habitat
174 for a quarter of the threatened animal and plant species of the UK (CNPA, 2012). This makes it
175 an important area for nature conservation. The population of the park is 18,000 people
176 (Cairngorms National Park, 2015) with approximately 1.4 million tourists visiting per year. The
177 economy is based on tourism, farming, forestry and wild game hunting (CNPA, 2012), though
178 tourism remains the most significant component (Cogent Strategies International Ltd, 2013) and

179 the relative contribution of this industry to the Cairngorms economy is higher than elsewhere in
180 Scotland. Part of the strategic plan of the area is tourism growth throughout the year, especially
181 during late autumn and spring, to increase the length of time tourists stay in the CNP and
182 increasing the amount of money tourists spend during their visits (CNPA, 2012). Other
183 cornerstones of long-term development policy are diversification of economic opportunities,
184 provision of land for residential development, development of clean energy sources, and
185 encouragement of local higher and further education opportunities (CNPA, 2012; Cogent
186 Strategies International Ltd, 2013).

187 There are a large number of stakeholders involved in the management of land and tourism in the
188 Cairngorms: local residents, land owners, tourists, farmers, housing developers, the tourism
189 industry, environmental organizations/conservation groups, and the national park authorities. In
190 recent years, the CNP has seen an in-migration of 18 to 25 year-old residents (Cogent Strategies
191 International Ltd, 2010). Many of them are moving to the CNP to work in the hospitality sector.
192 -- Figure 1 Map of area --

193 **2.2. Survey**

194 We prepared and distributed a 'self-completion' questionnaire in the Spring/Summer of 2012 on
195 people's relationship with their natural environment in the CNP. The questionnaires were
196 originally designed to reveal whether local residents were aware of the services they receive
197 from their ecosystem, and thus batteries of questions dealt with respondents' appreciation of
198 various ecological, climatic and geological characteristics of the local environment (cultural ES),
199 their recreational activities (also cultural ES), and their perceived economic dependence on these
200 characteristics (provisioning, cultural or regulating ES). To measure behaviors and opinions we
201 used sets of questions that frequently feature in research on these issues (e.g. de Groot & Steg,

2008; Guagnano et al., 1995; Stern, 2000). A pilot version of the questionnaire was distributed in the spring of 2012 and, based on 29 completed surveys, the questionnaire was modified for greater clarity and more geographic and environmental specificity based on respondents' comments.

The final version of the questionnaire was publicly distributed by the research team over a period of four days in August, 2012, in the western portion of the Cairngorms National Park. Using a "quota sampling approach" (Fogelman & Comber, 2007) we aimed to collect 250 completed surveys that would provide a representative sample of Cairngorm residents, as determined by demographic profiles of the region (e.g. gender, age, occupation, income; Cogent Strategies International Ltd, 2010). Questionnaires were distributed in person by research staff in the business districts of two of the larger towns – Aviemore and Granton on Spey – as well as in numerous smaller towns – in a broad variety of venues, including shops, bus stations, city parks, camp grounds, and tourist sites. Following a preliminary analysis of the demographic profile of respondents, we identified a gap in representation from the agricultural sector and subsequently hired a research assistant to visit farmers in the area and distribute the questionnaire among them; this yielded an additional 17 completed surveys from farmers. Altogether, we received 331 completed questionnaires, of which 251 were completed by residents and 80 by tourists or individuals who did not specify whether they were residents or tourists. We conducted our analysis on the 251 questionnaires completed by residents.

The questionnaire was divided into three sections. In Section 1, participants were requested to mark on a map an area that they engage with. This focus area refers to where the respondent interacts with the environment or experiences it in some way. The goal of this request was to both provide data to the researchers regarding where the respondents located themselves within

the region and to provide the respondent with the opportunity to focus on a geographic region for the remaining survey questions. Section 2 consisted of a series of questions applied to the 'focus area' marked in Section 1, but also general questions relating to the Cairngorms National Park. These questions are outlined according to variable type, i.e. series of questions, below. Section 3 consisted of questions regarding the socio-demographic profile of the respondent.

2.3. Survey questions to determine environmental tastes, opinions and behaviors

Environmental tastes. Respondents were asked to rank characteristics of their environment with regard to how much they appreciate them on a scale from 1 (strongly dislike) to 5 (love/strongly enjoy). The 18 qualities included summer climate, winter climate, precipitation, openness, quality and variety of light, topography, quiet, snow storms, wind/gales, mountains, landscape, animals (birds, mammals), biting insects, non-biting insects, wild flowers, wild trees, day length – summer, and day length – winter. This series of questions assisted in determining which physical and biological components of the landscape are valued by respondents. We interpret preferences of such characteristics as indicating certain inclinations or dispositions that pertain to aesthetic, climatic, and visual qualities, considered together as 'environmental tastes'.

Level of engagement in outdoor activities was measured by asking respondents to indicate the frequency of engaging in a list of 16 activities, ranging from 1 (never) to 5 (almost every day). The activities included walking/running outside, road biking, mountain/trail biking, horseback riding, driving off-road vehicles in the countryside, swimming in river, recreational fishing, recreational shooting, having campfires, bird watching, kayaking and other water sports, camping, collecting biological material (e.g. mushrooms and blueberries), art-related activities, skiing/snowboarding, and golfing.

Private-sphere environmental behavior refers to frequency of engagement in six particular environmental activities, including: turning off appliances and lights when not in use, recycling, walking or riding a bike in lieu of using a motor vehicle (for environmental reasons), saving water, using energy-efficient light bulbs and re-using bags or using cloth bags for shopping. Ranking was from 1 (never) to 4 (always).

Perceived economic benefit from the environment measures the extent to which listed natural resources provide economic benefits to them or their communities on a scale from 1 (no benefit) to 4 (my economic wellbeing is dependent on this resource). The list of 13 resources included water, soil, sun/heat, insects, fish, birds, game or wild animals, domesticated animals, plants/trees, minerals/rocks, snow/ice, open land, and wind. These questions lend insight into whether the respondent *perceives* an economic reliance on ecosystem services, regardless of whether or not it is true in economic terms.

Environmental concern refers to respondents' level of concern regarding eight local to global-scale environmental challenges, including climate change, water availability and quality, stream pollution, toxic waste storage and disposal, preservation of open space, protection of biodiversity, public access to roam, and level of recycling in place of residence. Respondents ranked their opinions from 1 (not concerned) to 5 (very concerned).

Opinions on development issues. Respondents were asked to indicate the extent to which they agreed or disagreed with 16 statements regarding local and regional development issues, on a scale from 1 (strongly disagree with the statement) to 5 (strongly agree with the statement). We chose topics based on our a priori knowledge of local and regional issues. Full text for this battery of questions in included in Appendix 1.

Socio-economic and demographic variables included gender (male or female), age (in years), resident or tourist (our analysis pertains only to residents), tenure (years lived in the region), marital status (married/cohabiting or single/living with a housemate who is not a partner), and formal educational achievement (high school or less, undergraduate degree, graduate degree). Response categories and descriptive statistics of these variables are presented in Table 1. The age distribution of our sample was representative of the population, though women were slightly oversampled relative to their proportion of the general population (Cogent Strategies International Ltd, 2010).

-- Insert Table 1 about here --

2.4. Analysis

Survey results were analyzed in three phases. First, we present descriptive statistics for results of each question, including mean scores and standard deviations. Next, using SPSS software, we conduct a principal component factor analysis with varimax rotation on the first three batteries of questions – environmental tastes, outdoor activities, and perceived economic dependence on environmental characteristics. Factor analysis is used to identify underlying latent variables (called factors) that represent common worlds of content shared by groups of questions, and has been used in research linking environmental attitudes, values, behaviors and other related variables (e.g. Groot & van den Born, 2003; Marques et al., 2017). For the first series of questions, for example, we identify and conceptualize the factors that emerged as different types of environmental tastes (XXX, 2015; masked for blind review). Each factor is in fact an index that summarizes responses to several questions and in addition attributes different weights to the components of the index, according to the degree to which each question loads on each factor. After reducing a series of questions that addressed a specific topic to several factors, we use

these factors as independent variables in subsequent multivariate analyses. Specifically, we estimate Ordinary Least Squares (OLS) regressions to gauge the effect of environmental tastes (opinions regarding environmental characteristics) and socio-demographic variables (gender, tenure, marital status, education, age) on measures of environmental behavior (engagement in outdoor activities, private sphere environmental behavior) and measures of environmental opinion (perceived economic dependency, level of concern, development opinions).

3. RESULTS

3.1. Descriptive statistics

Environmental tastes. Mean preference scores and standard deviations for each of the environmental characteristics are displayed in Figure 2 and Table 2 (right column). They reflect a general affinity with most of the characteristics of the region. Landscape, mountains, animals, and summer day length are the most appreciated characteristics of the environment, while biting insects, precipitation, wind, and winter day length ranked as the least liked.

-- Insert Table 2 and Figure 2 about here --

The factor analysis yielded four unique factors. Rotated factor loadings on the four factors that emerged are described in Table 2. Each factor clustered a group of related variables that revealed particular affinities, or "tastes" for particular components of the environment. The first dimension, which we term "landscape + biota," includes characteristics associated with the visual and sensory landscape, including mountains, quiet, openness, and light, and also biotic items such as animals and flowers. The next dimension, which we label "climate extreme," included those climatic characteristics that define the extreme environment of the Cairngorms –

314 snow storms, wind, winter climate, and winter day length. The third dimension included the
315 biting and non-biting insects, therefore we label it "insects." Finally, the fourth dimension
316 "dreary summer" included two items which we suspect were biased by summer conditions in the
317 specific survey year, summer climate and precipitation.[1] Corroborating this suspicion is the
318 results of an open question in the survey, "If you could change one thing about the natural
319 environment in the Cairngorms, what would it be?" Among the 251 completed surveys, 198
320 responded to this open question; of those, 37% commented using some variation of desiring drier
321 summers, less rain, more predictable and less extreme weather and more sun and fewer clouds
322 (other common comments included reducing the amount of wind and midges and having colder,
323 snowier winters). We thus consider the "dreary summer" taste to be an artifact of the particular
324 survey year expressing the discontent of respondents with the weather.

325 *Level of engagement in outdoor recreational activities.* Responses regarding engagement in
326 outdoor recreational activities are presented in Appendix 2 (Table A). Walking/running is by far
327 the most prevalent activity (mean score 3.97, equivalent to "1-2 times a week") and next comes
328 outdoor art, bird watching and road biking. Horseback riding is the activity with the fewest
329 adherents, followed by shooting and fishing.

330 The attempt via data reduction (factor analysis) to identify latent factors that capture the list of
331 outdoor activities resulted in five dimensions. The first dimension is "active – on the ground",
332 which includes physical activities that require minimal equipment (walking, running and
333 swimming) or camping related activities. The second factor is "active – on equipment" and it
334 includes physical activities requiring equipment, such as biking, boating, or skiing. The third
335 factor, "pensive" includes the slower, more reflective activities, including bird watching, outdoor

[1] The week in which the survey was conducted was rainy, and the summer of 2012 was characterized by 15% more rainfall than the long-term average (http://www.gov.scot/Publications/2013/08/1634/15)

art activities, and collecting from nature. The fourth factor, "macho", includes ORV driving, fishing, and shooting (and, as we will show below, is significantly correlated to gender). Finally, the fifth factor combines horseback riding and golf; we call this factor "highbrow activities", as they are often (though not exclusively) associated to higher economic strata of society and require significant economic investment and leisure time to partake in the activity.

Perceived level of economic benefit received from environmental resources. Sun / heat are the resources that received the highest score (i.e. highest perceived dependency) followed closely by water and plants. Wind and insects received the lowest scores (see Appendix 2, Table B).

For perceived level of economic dependency, factor analysis distinguished between two dimensions, which we termed "agricultural" and "tourist-dependent". The first factor reveals perceived dependency on soil, sun/heat, water, domestic animals, plants, open land, and insects – all components of an agricultural system. The second factor concentrates a seemingly disparate group of characteristics, although they are highly correlated with each other. These include fish, snow / ice, wild animals, wind, minerals, and birds. We note that all of the elements in the second factor received low rankings with regard to perceived economic dependence, and they are related to a variety of potential tourist-dependent economic endeavors including fishing and hunting, skiing and winter sports, bird and animal watching and (perhaps) wind power production.

Private sphere environmental behavior. Respondents reported a high frequency of activity in all of the questions on pro-environmental behavior, with the exception of walking/bike riding in lieu of using motor vehicles (Appendix 2, Table C, top). The most popular behavior is recycling. We treat the question regarding 'private sphere environmental behavior' as a summed scale because it produced only one dimension in factor analysis. Additional evidence that the various indicators

of private sphere environmental behavior can be summed in one index is provided by a reliability score, demonstrating that all indicators are significantly correlated and can be interpreted as part of the same construct (Cronbach's alpha = 0.689).

Level of concern regarding regional and global environmental issues. Overall, there was a high level of concern for environmental challenges across all categories (Appendix 2, Table C, middle). Biodiversity protection, toxic waste storage, open space preservation, and water quality and quantity rank highest, while the level of recycling in the region and public access to roam ranked lowest from among the choices. We treat the questions regarding 'level of concern' as a summed scale because they produced only one dimension in factor analysis. The reliability score of all questions indicates that they are part of the same construct (Cronbach's alpha = 0.827).

Opinion on development. The items measuring opinions regarding development issues did not form a scale, nor did we expect them to represent distinct underlying dimensions, therefore we treat them as separate questions. Means and standard deviations are presented in Appendix 2 (Table C, bottom). Residents disagreed the most with the statements that there are not enough people living in the area, that economic development should always take precedent over environmental protection, that the economic benefits of building outweigh the environmental costs, and that wind farming is an important activity and should be expanded in the Cairngorms National Park. Residents agreed the most with the statement that they personally enjoy nature, that it is important to improve A9 road to dual lanes, that economic development and environmental protection can occur together, that developing tourism infrastructure in the area is important for the future of the region, that most tourists come to the Cairngorms for the nature, and that their economic wellbeing depends on a clean environment.

3.2. Multivariate analysis of environmental tastes, behaviors, and opinions

382 The statistically significant standardized effects from regressions of perceived economic
383 dependency, environmental concern, private sphere environmental behavior, and outdoor
384 activities are displayed in Table 3. In Table 3a, we see that the environmental taste constructs are
385 all strongly associated to one or more of the outdoor activities. Among the socio-demographic
386 variables only gender and age have significant effects on some of these factors. Males are
387 positively associated with active – on equipment and macho activities. Age is negatively
388 associated with active – on the ground activities, and positively associated with pensive
389 activities. The taste variables show relatively high standardized effects with all of the dependent
390 variables, with all of them significantly influencing the pensive activities factor. The climate
391 extreme taste has a significant effect on four out of the five activity factors (three of which are
392 positive, while one – highbrow – is negative). This means that respondents who appreciate the
393 extreme climate (or have more tolerance for it) tend to engage in active, pensive, and macho
394 outdoor activities, but not in highbrow activities. Overall, the models are quite predictive of some
395 of the activity factors as indicated by relatively high explained variance (Adjusted R^2),
396 particularly for pensive (R^2 = 0.291) and active (both on the ground (R^2 = 0.198) and on
397 equipment (R^2 = 0.138)).

398 Turning now to panel b in Table 3, we see that the tourist-dependent economic factor is not
399 associated with any of the variables in the model. Recall that the tourist-dependent factor was an
400 amalgam of seemingly disparate items that were nonetheless highly correlated with one another.
401 Agricultural dependency is positively associated with dreary summer taste and with tenure, and
402 has a negative association with the climate extreme taste. These relations suggest that the dreary
403 summer taste may be associated with farmers who are especially dependent on predictable
404 weather patterns and averse to climate extremes. Likewise, those who are not averse to climate

405 extremes (reflected in the climate extreme taste factor) are also negatively associated with
406 agricultural dependence. The only socio-demographic variable associated with the economic
407 dependency factors is tenure, with those living for longer in the region reporting more economic
408 dependency on the agriculture factor.

409 Environmental concern is positively associated with the landscape + biota taste and with the
410 insects taste, as well as having a negative correlation with gender and marital status, meaning
411 that men are less concerned than women and married are less concerned than non-married.
412 Further, age is positively associated to environmental concern. Private sphere behavior correlates
413 with landscape + biota and insect tastes as well, in addition to having a negative correlation with
414 gender, indicating that women adopt environmentally friendly private sphere behaviors more
415 than men.

416 -- Insert Table 3 about here –

417 Table 4 shows the associations between various opinions on development in the region and
418 environmental tastes and socio-demographics. Explained variance is generally modest across all
419 of the opinion questions (with the exception of "I enjoy nature"), but the landscape + biota taste
420 has a significant positive effect on nine of the 16 items and climate extreme and insects tastes
421 each have a significant effect on four opinion items. Respondents who have a taste for the
422 landscape + biota characteristics think that most tourists come to the region because of nature,
423 they self-identify as environmental, think that environmental and economic development can go
424 together, that more tourism infrastructure is needed, and they also favor a clean environment,
425 protection of the area, and valuing biodiversity. They disagree that wind farming should be
426 developed in the region or that the economic development should come before environmental
427 considerations. Respondents who appreciate the extreme climatic features of the region tend to

be against wind farming and expanding the tourism infrastructure, and they support biodiversity and enjoy nature. Respondents who scored high on the insects taste also consider their community to be environmental, express that they need a clean environment and biodiversity, and state that they enjoy nature. Finally, those associated with the dreary summer factor tend to consider themselves environmental, they enjoy nature, and they tend to oppose fish farming.

While the environmental taste factors show multiple and strong correlations to various environmental opinions, socio-demographic variables also show some significant associations. Relative to females, males show stronger support for development, as reflected in two questions. Likewise, those who have spent more time in the region (tenure) also showed stronger development tendencies that those with less time in the region (although tenure is also positively associated to needing a clean environment). Married respondents were less environmental than non-married respondents, as defined by three questions. Respondents with more formal education disagreed that environmentalists were extreme, less likely to desire to prioritize the economy over the environment, and less likely to consider fish farming a desired economic activity. On the other hand, those with more formal education were less likely to want to protect the core area from development. Finally, age is negatively associated to support for wind farming, negatively associated to believing that economic development and environmental protection can go hand-in-hand, and less likely to consider a clean environment as vital to their economic wellbeing. Thus, while environmental taste constructs show a high degree of explanatory power, socio-demographic variables are also significant explanatory factors for environmental opinions.

In sum, our findings suggest that taste factors are significantly correlated with environmental opinions and behaviors and that these associations persist when controlling for an array of socio-

demographic variables. Residents of Cairngorms who have a taste that we depicted as landscape + biota show strong environmental concern, adopt environmental private sphere behaviors, and report strong environmental opinions on various environment and development issues. Residents who hold a taste that we named climate extreme are engaged in a variety of activities, with the exception of highbrow activities. They also express relatively strong environmental opinions, but do not report strong environmental concerns or private sphere environmental behaviors. The insect taste is associated with environmental concern, environmental private sphere behavior, pensive outdoor activities, and it exhibits some pro-environmental opinions. Finally, those with a taste we classify as dreary summer correlate positively with agricultural economic dependency and tend to consider themselves as environmental, but don't express strong environmental opinions and don't correlate with strong environmental concerns or behaviors. Socio-demographic variables also provided significant correlates (especially with regard to questions about environmental opinions), and thus cannot be disregarded.

-- Insert Table 4 about here –

4. DISCUSSION

In this study, we generate statistically significant environmental taste constructs through the analysis of survey data reflecting preferences of environmental characteristics. We find that environmental tastes constitute statistically significant explanatory variables for environmental behaviors and opinions. The results strengthen our earlier findings that environmental tastes can explain environmental behaviors and opinions, often better than traditional socio-economic and demographic variables. As such, our results reinforce the assertion that socio-psychological factors can be stronger predictors of environmental opinions and behaviors than socio-

demographic variables (Boldero, 1995; Olli et al., 2001). The landscape preference literature, as reported above, is not singular in this regard, with some research finding significant correlates between socio-demographic variables and landscape preference, while in other studies, demographic factors are often found to be weak predictors of preferences.

We have found that the consolidation and explanatory power of environmental tastes recurs in two seemingly unrelated socio-ecological contexts. This suggests that the environmental taste construct is rather robust and warrants further examination. Further, we found many similarities between the Cairngorms (Scotland) data set and the [MASKED] data set (citation MASKED for blind review). Respondents of both regions/climatic areas ranked environmental characteristics similarly, and similar physical activities were prominent in both regions, albeit with some differences due to climate related specifics. More importantly, environmental characteristics clustered in remarkably similar groupings across the two regions, suggesting that our indicators could be appropriate for tapping environmental tastes.

Unlike our previous research, some socio-economic and demographic variables, including gender, tenure in the region, marital status, and age were each correlated with some of the behaviors and opinions. In particular, men were positively associated to active (on equipment) and macho activities, and negatively associated with pensive activities. Likewise, and similar to other research findings (e.g. Olli et al., 2001; Takahashi & Selfa, 2015), women were found to be more positively associated to both environmental concerns and behaviors. Age was positively associated to environmental concern, while, as elsewhere, education level was not found to be a significantly correlated with either environmental opinions or behavior (Olli et al., 2001; Takahashi & Selfa, 2015).

Based on this and our previous study, we strongly recommend further investigation into the use of generating factors reflecting environmental tastes for investigating determinants of environmental behaviors and opinions. We note that there has been enough accumulated evidence to suggest that analyzing opinions and behaviors based on underlying values and preferences (in our case, as expressed in environmental tastes) is not only accurate (e.g. strong and consistent correlations), but that this can also free us somewhat from our tendency to categorize individuals according to narrowly-defined (and sometimes stereotypical) social groups (e.g. gender, age, religion or nationality). Of course, there are also correlations between socio-demographic groups and values and preferences that are valuable to understand. There may also be interactions and correlations between socio-demographic variables on the one hand, and values, on the other, but – as this research demonstrates – characteristics that cut across socio-demographic divides may be more accurate in defining behaviors and opinions.

The environmental tastes we identify, and their relationship to behaviors and opinions, may contribute to the landscape preference literature in two ways. First, defining environmental taste categories offers a novel alternative approach to defining preferences for elements within the landscape (e.g. biota or views). We identified clear typologies (e.g. tastes) for groups of people who are attracted to specific packages of landscape elements, and these tastes are somewhat robust across two socio-ecological systems. There is at least one precedent from the landscape preference literature that use similar statistical methods to the ones we apply here (factor analysis) for the identification of tastes. Groot and van den Born (2003) investigated how landscape preferences relate to people's images of nature and their definition of the appropriate relationship between humans and nature. They generated four unique factors from survey results that they defined as typologies of respondents' "images of nature" and, while they did not

519 investigate these images as explanatory variables for landscape preferences or activities, they do
520 find strong associations between respondents' image of nature and their preferences. Their
521 "images of nature" are somewhat analogous to our "environmental tastes" and individual images
522 show some similarity to our tastes. For instance, their category "elementary nature" emphasizes
523 the climate extremities as does our "climate" taste, and their "penetrative nature" features pesky
524 biota (rats, weeds, mosquitoes), similar to our taste based solely on biting and non-biting insects.

525 Second, since our "biota/landscape" taste is strongly associated to positive environmental
526 behaviors and strong environmental opinions (Tables 3b and 4), and our previous results suggest
527 stronger connection between "biota" and environmental behaviors, our findings suggest that
528 strengthening one's positive association towards biota can have broader implications regarding
529 their environmental behaviors and opinions. The results support the contention that developing
530 empathy and preference for biotic elements of the landscape, or what Kals et al (1999) call
531 "emotional affinity towards nature" may have positive cascading effects on environmental
532 opinions and behaviors, as has been suggested elsewhere in the large body of literature on the
533 impact of nature experience on environmental opinions and behaviors (e.g. Curtin & Kragh,
534 2014; Kals et al., 1999; Wells & Lekies, 2006).

535 This research did not deal with the underlying determinants of environmental tastes, nor did we
536 try to separate and isolate the potentially interacting variables of environmental tastes and other
537 socio-demographic variables, some of which were also correlated with certain environmental
538 behaviors and opinions. These next steps will greatly assist in building the foundation of
539 understanding how environmental behaviors and opinions, via environmental tastes, are
540 developed. Here, too, the relevant literature on landscape preferences, which has suggested
541 underlying paradigms for linking values and beliefs to tastes (Duncan, 1973; Egoz et al., 2001;

542 Larsen & Harlan, 2006; Larson et al., 2010; Nassauer, 1995; Sevenant & Antrop, 2010) will be
543 useful in further developing the theory of environmental tastes.

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Table 1: Demographic characteristics of survey sample

DEMOGRAPHICS OF SAMPLE (N=251)							
Gender (%)	**Female** 57.9%			**Male** 42.1%			
Age (%)	**15-19** 4.8%	**20-29** 16.4%	**30-39** 15. 6%	**40-49** 19.6%	**50-59** 19.6%	**60-69** 13.2%	**70+** 10.4%
Marital status (%)	**Single** 22.8%		**Married** 68.4%		**Cohabitating** 8.9%		
Years lived in region (%)	**≥ 10** 38.9%	**11-20** 21.0%	**21-30** 13.0%	**31-40** 10.5%	**40+** 16.6%		
Formal education (%)	**Elementary** 1.7%	**High school** 35.1%	**Undergraduate degree** 36.8%	**Graduate degree and higher** 26.4%			

Table 2: Means (standard deviations), and rotated factor loadings of environmental characteristics

Environmental characteristic	Mean (SD)	Environmental tastes (factors)			
		Landscape + Biota	Climate Extreme	Insects	Dreary Summer (artifact)
Topography	4.29 (0.798)	**.698**	-.006	.093	.080
Mountains	4.69 (0.588)	**.669**	.335	.194	-.153
Quiet	4.32 (0.750)	**.646**	.151	.009	-.081
Openness	4.35 (0.772)	**.631**	.154	-.037	.022
Landscape	4.758 (0.474)	**.630**	.286	.205	-.164
Light	4.27 (0.837)	**.626**	.087	-.078	.345
Flowers	4.30 (0.727)	**.613**	-.058	.474	.062
Summer day	4.54 (0.720)	**.604**	-.149	-.038	.148
Trees	4.34 (0.764)	**.602**	-.022	.455	.023
animals	4.59 (0.662)	**.588**	.092	.349	-.070
Snow storms	3.50 (1.234)	.230	**.786**	-.121	-.128
Wind	2.569 (1.110)	.035	**.745**	.133	-.059
Winter climate	3.55 (1.135)	.238	**.700**	-.069	.323
Winter day	2.60 (1.154)	-.103	**.617**	.129	.320
Biting insects	1.74 (0.850)	-.096	.082	**.817**	-.007
Non biting insects	3.22 (0.980)	.331	.031	**.589**	.052
Summer climate	3.45 (1.154)	.007	-.001	-.060	**.836**
Precipitation	2.54 (0.951)	.070	.416	.254	**.572**
Cumulative % of variance explained		23.5	37.4	47.3	55.5

Table 3: Standardized coefficients from OLS regressions of outdoor activity factors (3a, upper table), perceived economic dependency factors, environmental concern, and private sphere behavior (3b, lower table) on environmental tastes and socio-demographics

Explanatory variables	Outdoor activities				
	Active – on the ground	Active – on equipment	Pensive	Macho	Highbrow
Landscape + Biota		0.175*	0.253**		
Climate extreme	0.220**	0.289**	0.231**		-0.235**
Insects			0.212**		
Dreary summer	-0.154*		0.192**		
Male		0.152*	-0.177*	0.341**	
Tenure					
Married					
Degree					
Age	-0.358**		0.212*		
Adj. R^2	0.198	0.138	0.291	0.109	0.031
N	162	162	162	162	162

Explanatory Variables	Perceived economic dependency		Environmental Concern	Private sphere behavior
	Agricultural	Tourist-dependent		
Landscape+Biota			0.229**	0.263**
Climate extreme	-0.167*			
Insects			0.152*	0.187*
Dreary summer	0.197*			
Male			-0.225**	-0.302**
Tenure	0.330**			
Married			-0.173*	
Degree				
Age			0.238**	
Adj. R^2	0.105	Model insignificant	0.187	0.227
N	139	139	173	173

* $p < 0.05$, ** $p < 0.01$

Note: only statistically significant results are reported.

Table 4: Standardized coefficients from OLS regressions of opinion on development on environmental tastes and socio-demographics

	Not enough people	Tourism for nature	Building benefits	Improve roads	Extreme environmentalists	Wind farming important	I am environmental	Others are environmental	Economy first
Landscape + Biota		0.414**				-0.249**	0.231**		-0.365**
Climate extreme						-0.188*			
Insects								0.159*	
Dreary summer							0.203**		
Male			0.188*		0.177*				
Tenure					0.205*				
Married									
Degree					-0.301**				-0.163*
Age						-0.177*			
Adj. R^2	Not sig.	0.133	0.020	0.010	0.188	0.110	0.129	0.026	0.188
N		173	162	173	173	171	173	173	173

	Economy and environment go together	Tourism infrastructure needed	I need a clean environment	Protect area	Biodiversity first	I enjoy nature	Fish farming good
Landscape + Biota	0.268**	0.257**	0.352**	0.166*	0.222**		
Climate extreme		-0.155*		0.138~	0.204**	0.508**	
Insects			0.158*		0.163*	0.154*	
Dreary summer						0.168*	-0.170*
Male	0.153*						
Tenure	0.180*		0.213*		-0.175*		
Married			-0.157*	-0.350**	-0.239**		
Degree				-0.173*			-0.177*
Age	-0.202*		-0.194*				
Adj. R^2	0.057	0.060	0.130	0.152	0.125	0.223	0.064
N	173	173	173	173	173	173	162

~ p<0.10, * p < 0.05, ** p < 0.01; Note: only statistically significant results are reported

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Appendix 1: Opinion questions from Cairngorms survey

Regional development – please rank each statement by whether you agree or disagree, from 1 (strongly agree) to 5 (strongly disagree):

Statement	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Don't have an opinion / Don't know
There are not enough people living in focus area	1	2	3	4	5	DK
Most tourists come to the region because of the natural environment (geology, ecology, aesthetics)	1	2	3	4	5	DK
The economic benefits of building (e.g. An Camus Mor) outweigh the environmental costs	1	2	3	4	5	DK
It is important to improve A9 road to dual lanes	1	2	3	4	5	DK
"Environmentalists" are too extreme in their desire to prevent development in the focus area	1	2	3	4	5	DK
Wind farming is an important activity and should be expanded in the Cairngorms National Park	1	2	3	4	5	DK
I am very environmental in my behaviors	1	2	3	4	5	DK
In general, the people I associate with are very environmental in their behaviors	1	2	3	4	5	DK
Economic development should always take precedent over environmental protection	1	2	3	4	5	DK
Economic development and environmental protection can occur together	1	2	3	4	5	DK
Developing tourism infrastructure in the focus area is important for the future of the region	1	2	3	4	5	DK
My economic wellbeing depends on a clean, healthy environment	1	2	3	4	5	DK
It is important to protect focus area from development	1	2	3	4	5	DK
It is important to protect biodiversity in the focus area, even if it means foregoing economic opportunities	1	2	3	4	5	DK
I enjoy spending time in nature	1	2	3	4	5	DK
Fish farming is an environmentally sustainable economic activity, which would be good to expand in the Cairngorms.	1	2	3	4	5	DK

Appendix 2: Additional data tables.

Table A: Means (standard deviations) and rotated factor loadings of outdoor activities

Activity	Mean (SD)	Factors				
		Active – on equipment	Reflective	Macho	Active – on the ground	Highbrow
Mountain bike	2.21 (1.201)	**.804**	.105	.068	.017	.270
Ski	2.15 (1.287)	**.731**	-.050	.076	.126	-.070
Boat	1.80 (1.038)	**.726**	.188	.129	.235	-.061
Road bike	2.33 (1.259)	**.579**	.177	-.098	-.022	.464
Bird watch	2.48 (1.525)	.045	**.807**	.052	-.191	.029
Art	2.50 (1.255)	.040	**.767**	-.123	.238	.005
Collecting	2.15 (1.164)	.173	**.691**	.181	.147	.079
ORV	1.443 (1.046)	.040	.112	**.771**	.032	.035
Shoot	1.35 (0.779)	.008	-.072	**.734**	.112	.001
Fish	1.43 (0.902)	.167	.110	**.575**	.028	.417
Camp fires	2.19 (0.948)	.017	-.174	.331	**.739**	.096
Camp	1.83 (0.874)	.215	.186	.078	**.668**	.177
Walk / run	3.97 (1.250)	.071	.216	-.256	**.516**	-.037
Swim	1.77 (0.882)	**.436**	-.065	,190	**.470**	.041
Horse ride	1.28 (0.815)	-.013	.280	.060	.156	**.666**
Golf	1.53 (0.977)	.112	-.339	.144	.059	**.649**
Cumulative % Explained variance		**14.8**	**28.15**	**39.35**	**50.05**	**58.72**

Table B: Means (standard deviations) and rotated factor loadings of economic dependency items

Environmental characteristic	Mean (SD)	Factors	
		Agricultural	Tourist-dependent
Soil	1.91 (1.096)	**.901**	.170
Sun / heat	2.15 (1.124)	**.763**	.276
Water	2.11 (1.203)	**.758**	.306
Domestic animals	1.82 (1.146)	**.728**	.264
Plants	2.07 (1.124)	**.645**	.505
Open land	2.00 (1.165)	**.623**	.441
Insects	1.51 (0.878)	**.598**	**.514**
Fish	1.58 (0.895)	.241	**.803**
Snow / ice	1.80 (1.069)	.193	**.734**
Wild animals	1.76 (0.998)	.439	**.708**
Wind	1.47 (0.845)	.193	**.703**
Minerals	1.58 (0.898)	.383	**.696**
Birds	1.73 (0.992)	**.481**	**.692**
Cumulative % explained variance		33.55	65.28

Table C. Means and standard deviations for answers to questions regarding private sphere behavior (top), environmental concern (middle), and opinions on various development/environment issues (bottom).

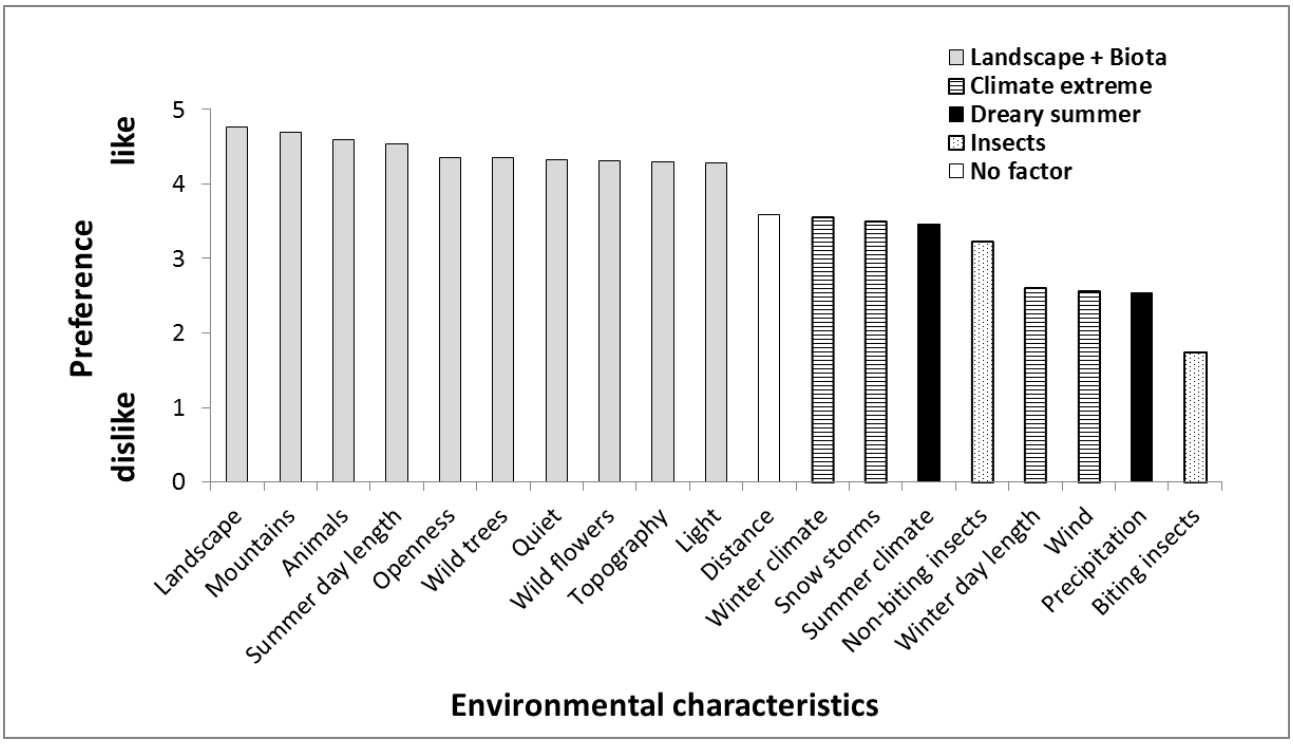
	Mean (SD)
Private sphere behavior (1 = not at all; 4 = always)	
Recycling	3.74 (0.53)
Turning off appliances	3.68 (0.50)
Energy efficient	3.60 (0.66)
Reusing bags	3.48 (0.78)
Saving water	3.30 (0.84)
Walking/biking in lieu of motor vehicles	2.80 (0.95)
Environmental concern (1 = not concerned; 5 = strong concern)	
Biodiversity protection	4.39 (0.76)
Toxic waste storage	4.37 (0.88)
Open space preservation	4.34 (0.80)
Water availability	4.12 (1.00)
Stream pollution	4.07 (0.92)
Climate change	4.03(0.90)
Public access to roam	3.98 (0.94)
Level of recycling	3.83 (1.03)
Opinion on development (1 = strongly disagree; 5 = strongly agree)	
I enjoy nature	4.47 (0.74)
Improve roads	4.24 (1.10)
Economy and environment together	4.03 (0.71)
Tourism infrastructure important	4.01 (0.80)
Tourists come for nature	4.00 (1.01)
Need clean environment	4.00 (0.89)
I am environmentalist?	3.68 (0.82)
Others are environmental – not clear	3.48 (0.87)
Biodiversity first	3.47 (0.98)
Protect area	3.46 (1.05)
Extreme environmentalists	3.29 (1.23)
Fish farming good	3.19 (1.00)
Wind farming important	2.76 (1.23)
Building benefits	2.59 (1.12)
Economy first	2.26 (1.01)
Not enough people	2.22 (1.04)

Figure

Figure 1. Map of research site (Reprinted with permission of the Cairngorms National Park Authority)

Figure

Figure 2. Preferences for environmental characteristics (shading denotes "taste" categories)



Environmental tastes as predictors of environmental opinions and behaviors

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