Politics and Ecology: Maybe the Twain do Meet. A Hybrid Model of WTP for Local Environmental Projects

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Abstract

Many environmental enhancements are small projects funded from local sources. These projects are often on or near agricultural and and/or have impacts on nearby agricultural land. Several jurisdictions in British Columbia have adopted or are considering local conservation funds. We use the concept of such a fund as a payment vehicle in a choice experiment examining three environmental attributes: extreme weather impacts, pressures on rare and endangered species, and the local distribution of natural habitat. We pivot our choice experiment relative to a personal forecast of future conditions. We estimate a hybrid model, including two latent variables representing political leaning and environmental leaning. Results show that the latent variables are important predictors of choice behavior. That there are two dimensions highlights the fact that individuals can be left leaning and view the environment as existing purely to serve human instrumental purposes, and can be right leaning while seeing the environment having intrinsic value independent of human use. Consequently, efforts to encourage pro-environmental choices should not assume that environmental and political attitudes are tightly correlated. Results also suggest that the benefits from small environmental projects are greatest when they are located near residential areas.

1 Introduction

Our most common interaction with the environment is right where we live, work, and play. In the Okanagan valley of British Columbia, climate change and pressures from development are rapidly changing that environment (Pinna Sustainability, 2020; Lea, 2008; OCCP, 2014). The region is home to the highest concentration of red and blue listed species in Canada. Population growth in the valley is among the fastest in Canada, driving land use change that is destroying the habitat that area species need to survive. Precipitation is forecast to be less in summer and more autumn, winter and spring, and precipitation events are expected to be more extreme, increasing the risk of widespread spring flooding

and localized summer flooding. Temperatures will be warmer overall, extending the growing season, increasing the number of very hot days in the summer, increasing crop water demands, and increasing the risk of wildfire. Habitat zones suitable to the species that inhabit the valley will shift northward, with corridors for species movement essential if a number of these red and blue listed species are to continue to inhabit the Okanagan.

We conducted a choice experiment with three attributes that capture broad aspects of the effects changes in the Okanagan are having. These are increasing damages from extreme weather, continuing local extirpation of rare and endangered species, and the loss of natural habitat near where people live. Our alternative future scenarios for these attributes are set against a property levy, based on a 'Conservation Fund' that has been established elsewhere in British Columbia, including a part of the Okanagan not included in our sample. We include an endogenous status quo, to capture the fact that people have different perspectives on what the future environment will be.

The contribution of this work lies in three areas. First, and most applicable in the region, is an estimate of the relative importance residents place on the three attributes, and a measure of their willingness to pay for these. Second, by making one attribute specific to the respondents residential neighbourhood, we are contributing to the literature on the spatial distribution of willingness to pay. Finally, We estimate a hybrid model, including two latent variables representing attitude towards political leaning and environmental leaning. Results also show that the latent variables are important predictors of choice behavior.

The remainder of the paper is organized as follows. Section 2 discusses relevant literature related to the choice experiment (CE) and environmental valuation. Sections 3 discusses survey methods and data. Sections 4 provides a theoretical background and explains empirical methods applied to analyze the data. Section 5 discusses the results. Section 6 concludes with some policy implications and suggestions for future research.

2 Literature

In a choice experiment (CE), individuals are asked to perform one or more choice tasks, where each task typically involves comparing one or more hypothetical scenarios to a status quo or opt out option. The scenarios are described by means of levels for a set of attributes. Most of the attributes typically represent improvements, while at least one captures a cost. Participants are therefore comparing the alternatives to the status quo, and expected to choose (one of) the alternative(s) if the perceived value of the benefit exceeds the cost. If the cost attribute is expressed in currency units, then the estimated marginal utility of changes in the attribute level can be compared to the marginal utility of income determined by the cost attribute, to arrive at an estimate of the willingness to pay for changes in the

attribute levels Hoyos (2010).

There has been a considerable body of work using choice experiments for non-market valuation (Adamowicz et al., 1994, 1998; Boxall et al., 1996; Bergland, 1997; Layton and Brown, 2000; Price et al., 2016, to name a very few). The central objective of non-market valuation studies is to estimate the willingness to pay (WTP) for changes in the levels of the non-market goods and/or services being valued. The body of work continues to expand with novel attributes and sources of heterogeneity among respondents. Herein we contribute to these research trends in two areas. The importance of the spatial distribution of environmental goods and services is receiving growing attention, and we contribute to this by including an attribute that measures the amount of natural habitat near the respondents residence. Given that individuals may have different perspectives about how the future will unfold, and that an online choice experiment provides limited capacity to ensure that all participants are evaluating their choices relative to the same status quo, we ask participants to indicate their expected future, and pivot the choices they make against this anchor. This allows us to examine whether participants are responding to the actual level of the alternative, or the number of steps that the alternative is removed from the status quo. In what follows we briefly discuss some research that sets the stage for the contributions we are making.

A number of studies have considered the spatial distribution of environmental benefits. The simplest approach is considering the distance to a recreational site as an attribute. Adamowicz et al. (1994) use a CE of recreationists in Alberta, Canada to demonstrate that in addition to water quality and fishing catch, the distance to the site is an important predictor of WTP. Similarly, Boxall et al. (1996) find that distance to a hunting site reduces visits, while environmental quality increases it.

More recently, the spatial distribution of environmental improvements has become a subject of interest. Lanz and Provins (2013) find that respondents prefer spatially focused improvements to local environmental amenities relative to improvements spread over the wider areas. Badura et al. (2020) consider changes in land use quality in Great Britain, finding that the majority of individuals prefer the interventions that improve land use quality that are closer to their place of residence as well as the site being in the country they reside in. Brouwer et al. (2010) examine whether residents of sub-basins in a watershed prefer improvements in water quality in their sub-basin of residence relative to improvements in other sub-basins, and find that this is indeed the case. They point out that this spatial heterogeneity needs to be accounted for in WTP calculations for water quality improvements in the watershed. Campbell et al. (2009) measure the spatial variation in WTP for landscape improvements across different landscapes in Ireland. They find that the WTP for improvements is larger where the environmental features they are investigating are less common. Czajkowski et al. (2017a) consider forest improvements in Poland, finding that CE participants are willing to pay more for forest protection if there is forest near where they live and if in the area where they live forest is more scarce. These

and related recent work has demonstrated the existence of spatial variation in WTP for environmental goods and services, with many authors pointing out that this variation should be incorporated into benefit transfer. In our case, the proposed local environmental fund would have limited funds to invest in environmental improvement projects across a region. These results suggest that the distribution of those projects is important to the WTP and overall benefit generated. We have therefore included an attribute reflecting the spatial distribution of the projects, to assess how important this distribution is for people in the study area.

Climate change projections for the Okanagan suggest that the area will experience more hot summer days, drier summers with more severe storms, and more precipitation, more likely to be rain, during the other seasons. This will likely be accompanied by more flooding events and more summer wildfires. A number of studies have used choice experiments and related methods to measure the willingness to pay to reduce impacts like those climate change is expected to bring to the Okanagan. For a watershed in Japan, Zhai et al. (2007) found significant WTP to reduce the frequency, depth and environmental impact of floods. Preferences for investing in managing flood risk, protecting biodiversity and enhancing recreation in the Bobrek wetland in Poland was investigated by Birol et al. (2009), a region where these attributes were not complements. Two identified classes both valued reducing flood risk, and recreation access, but had opposite preferences for biodiversity protection. Veronesi et al. (2014) asked a sample of Swiss households in a choice experiment to express their WTP for investments that would reduce the risk of combined sewer overflows brought on by extreme precipitation events. Swiss households strongly value the protection of water quality, with those who have a stronger perception of climate change impacts having a higher WTP. Brouwer et al. (2016) look at the WTP for flood risk reduction and water quality improvement through habitat restoration on the Danube, finding that water quality improvements are valued more highly than flood risk reductions. SimilarlyHe et al. (2017) use a CE and CV to assess the WTP of Quebec residents for protecting wetland services including flood protection, climate regulation, biodiversity and water quality. Water quality and biodiversity protection received the highest values, but the lower WTP for flood control and climate regulation are positive and statistically significant. The attributes chosen by He et al. were inspired by a CV study by Pattison et al. (2011) that carefully described environmental services provided by wetland protection, including carbon storage, flood control, and biodiversity preservation. Rulleau et al. (2017) use similar attributes in a CE measuring the WTP for wetland services from a polder in north east France, finding that the WTP for flood control and biodiversity differ substantially between two classes in a latent class model. Layton and Brown (2000) use a CE to measure the WTP of Denver, Colorado residents to reduce climate change caused forest loss, finding higher WTP the larger the expected forest loss.Haider et al. (2019) used the results from a CE conduced in the lower Fraser Valley of British Columbia to identify a significant WTP to reduce air quality advisories and reduced visibility from wildfire smoke. The WTP to eliminate summer haze in

Singapore was estimated by Lin et al. (2017) to be about one percent of income, using a dichotomous choice contingent valuation survey. These results establish that people are willing to pay to reduce the adverse effects of climate change. Most of these studies focus on larger scale impacts, in contrast to the study reported here that considers small, local projects that may have some ability to mitigate climate change - particularly extreme weather - impacts.

The protection of endangered species has received considerable attention in valuation research. Bell et al. (2003) showed a positive WTP for local coho salmon enhancement for five rural coastal communities in Oregon and Washington, with WTP positively related to confidence in program management. Boxall et al. (2012) finds that the recovery of three marine mammal species found in the St Lawrence Estuary has a positive WTP among Canadians, with evidence that the marginal value of additional enhancement decreases. Wallmo and Lew (2011) show that WTP values for US Endangered Species Act species protection depends on the species and shows a decreasing marginal benefit. Wallmo and Lew (2012) reinforce their earlier work, measuring a higher WTP for marine mammals than for fish species.

Choice experiments can only offer a limited number of levels for each attribute. While the levels may correspond to quantifiable physical realities, it isn't clear that respondents pay attention to the actual level, or to relative changes. It might also be expected that the marginal value of changes will decline as the level increases. In an Australian watershed management caseKragt (2013) compared low cost and high cost ranges for the payment vehicle in a CE, finding that participants are more sensitive to relative over absolute changes, but that WTP estimates are not significantly different. Focusing on water quality improvement in an northern England river, Hanley et al. (2005) also compared pricing vector ranges, and again found no significant difference in WTP. Martinsson and Carlsson (2006) scale the cost vector in a CE examining the WTP to reduce power outages among Swedish households. In contrast to the other cited studies, they find that the higher price vector results in a higher WTP estimate.For a wetland creation project, Luisetti et al. (2011) compared respondent WTP derived through a choice experiment between those near the site and those distant from the site. They reject the hypothesis of no range bias, suggesting that respondents are valuing the relative changes in attribute levels rather than absolute levels.

Many non-market valuation studies ask respondents to express a WTP for some policy or project that will provide an improved future, relative to what would happen without that policy or project. The value of the proposal depends on what the respondent believes the future will be without an intervention, a belief that may not be the same for everyone. An alternative would be to have the respondent provide an expectation of the future, and then in a CE pivot the choice set off of that. A number of authors have adapted CEs to pivot of the current situation of the respondent. Barton and Bergland (2010) found that estimates of the WTP for irrigation improvements in Karnataka State, India was more precise when calculated relative to the irrigators own situation. For water quality improvements in an intensive

agricultural area, Marsh et al. (2011) divided respondents to a CE for watershed improvements into a group that could describe a perceived status quo and those who could not. For the group that could describe the status quo, WTP for improvements was estimated relative to their perceptions. This group had both a higher average WTP for watershed improvements and a higher likelihood of remaining at the status quo. Ahtiainen et al. (2015) adapted their estimation of Finland second home purchasers WTP for water quality improvements for the respondents perception of current and future water quality in their nearby water body. In Price et al. (2016), Nepali farmers were asked for their assessment of the frequency of water supply challenges before indicating their willingness to pay for improvements in their village water storage, with the WTP for improvements found to depend on the size of the improvement relative to the farmers initial situation. Similarly, in Rwanda, Uwera and Stage (2016) find that using an individualized status quo improves the precision of the WTP estimates and increases the estimated aggregate benefit of improving drinking water access and irrigation supply. Dissanayake and Meyer (2021) establish that participants beliefs about future land use is a significant predictor of WTP for protection for a possible national park in Maine. This work was inspired by Domínguez-Torreiro and Soliño (2011), who compared results for CE participants provided a future scenario by the researchers with participants who provided their own perception of the future levels of the CE attributes. When participants provided their own status quo, estimated WTP was almost always more precise, and generally the WTP was larger.

Demographic factors, particularly income and education, have long been included as explanatory variables in choice models. In general, environmental goods and services are found to have a positive income elasticity of demand - higher income respondents are willing to pay more - with education shifting out the demand - higher education associated with higher willingness to pay. As noted above, individual specific variables like location of residence have also been included and found to affect willingness to pay. Research work has also sought to include measures of attitude and belief. Lupia (1994) demonstrated that uninformed voters rely on information shortcuts to emulate informed voters. Schläpfer and Schmitt (2007) showed that Swiss participants in a choice experiment were strongly affected by endorsements from political parties and interest groups. This lead Schläpfer (2008) to argue that people use simple heuristics when unfamiliar with the valuation context, and that stated preference results can be improved by providing relevant contextual information, particularly perspectives of important contributors to public discourse, such as political parties. Sagoff (1988) argues that people have citizen preferences reflecting concern for aspects of society beyond their individual interest, which Keat (2007) counters that individual preferences are shaped by social and cultural norms. Yao et al. (2014) find a strongly negative impact on WTP for CE respondents who agree that the New Zealand government should pay for biodiversity conservation. Ideas about shared and social values developed in Kenter et al. (2015) are consistent with political leaning being associated with a particular set of shared and social values.

We contend that measures of political leaning should reflect shared social values for political groupings, groupings that may predict variations in willingness to pay.

There has been a considerable body of research linking pro environmental behavior and environmental attitudes. Perhaps the most widely used measure of environmental attitudes is the New Ecological Paradigm (NEP) of Dunlap et al. (Dunlap, 2008; Dunlap et al., 2000). The offered scale uses fifteen questions organized around five themes that broadly span a range from a strongly instrumental perspective on the relationship between humans and the environment to a strongly ecological perspective that attributes important instrumental value to the environment which is unrelated to the service the environment provides to humans. Using a contingent valuation survey, Kotchen and Reiling (2000) find that the NEP is an important predictor of support for peregrine falcon and shortnose sturgeon protection. Using the NEP and two additional attitude scales, Cooper et al. (2004) conclude that decision motives in contingent valuation studies may be driven in part by attitudes other than private utility maximization. However, it isn't clear that this adversely impacts the WTP measures generated. Liebe et al. (2011) incorporate scales representing six different theories of contribution to public goods into a contingent valuation study of forest enhancement in Germany. Both the decision to contribute and the offered amount were explained by factors from several different theories. Manoli et al. (2019) find evidence that pro-environmental behavioral intentions may be driven by more complex attitudes than those captured by the NEP. This work suggests that WTP may be driven by more complex motivators than simple utility maximizing formulations generally assume. In most of this and similar work, attitude measures have been included directly in estimated models. However, these variables may be codetermined with the choice being studied through a unobservable attitude variables, and/or be affected by measurement error, creating an endogeneity problem if indicators correlated with this unobserved or latent variable are treated as exogenous (Ben-Akiva et al., 1999; Guevara and Ben-Akiva, 2010; Bolduc and Alvarez-Daziano, 2010).

Hybrid choice models have emerged to include latent variables in choice models. Hybrid models jointly estimate the influence of latent variables on the choice of interest and on one or more indicator variables (Kim et al., 2014), permitting an examination of the role these latent variables play in explaining behavior Vij and Walker (2016). Following are some examples of hybrid models applied to environmental valuation problems. Hess and Beharry-Borg (2012) include a latent preference for fee funded intervention when estimating WTP for interventions affecting beach quality in Tobago. The latent variable was interacted with beach attribute levels to capture heterogeneity in WTP across attributes. Czajkowski et al. (2017b) identify three latent variables, interpretable as social pressure, moral duty and effort aversion, that contribute to explaining at home recycling effort in two Polish cities. The most important predictor of at home recycling preference is moral duty. Taye et al. (2018) find two latent variables within the NEP responses to a Danish forest conservation CE, both of which signif-

icantly affect the WTP of the respondents. Boyce et al. (2019) introduce indicators used in the five factor personality model of McCrae and Costa Jr (2008) into three choice experiments in Latvia and Estonia focusing on riparian environmental protection. All five factors, included as latent variables, have predictive power, with those for which theoretical expectations exist being largely verified. Faccioli et al. (2020) examine the impact of a general environmental attitude, as measured by the NEP and a sense of place attachment on the WTP of Scottish residents for restoring peat bogs. Both are important explanatory variables, with environmental attitude significantly reducing sensitivity to the size of the fee. We contribute to this literature by examining two dimensions, environmental and political leaning.

These previous investigations has demonstrated how choice experiments have been used to measure the willingness to pay to reduce flooding impacts and to protect endangered species. Increasing flood risk and adverse effects on endangered species are expected climate change impacts in the Okanagan. The previous work has also highlighted that the WTP for environmental improvements is often a function of where these improvements occur relative to the respondents residence. The validity of the status quo has also been investigated, with participant provided status quo information suggested and verified as an approach to improve estimator precision. And some of the highlighted previous work has also raised the possibility that participants are stating a willingness to pay for relative changes in the attributes rather than absolute changes. Our contributions build on this previous work. We consider small, local environmental improvements that could mitigate some of the impacts of climate change, particularly flooding and endangered species loss. We investigate the role that location of the project has on participants WTP. Given that climate change is a contentious issue in some quarters, we ask respondents to choose status quo levels for the CE attributes in the future if there is no policy intervention, and offer choices that are improvements relative to this participant provided status quo.

3 Survey Methods and Data

3.1 Study Site

The choice experiment was conducted within the Regional District of Central Okanagan and the Regional District of North Okanagan, in the southern interior of British Columbia. Figure 1 presents a digital elevation model of the study region. Much of the study area is at an elevation of at least 1,000 meters above sea level. Much of this higher elevation area has long winters and rugged terrain that is not particularly suitable for human settlement or agricultural activities. Human settlement therefore is largely located on the valley floors.

The elevation map also shows how the lower elevation areas form something of an interconnected

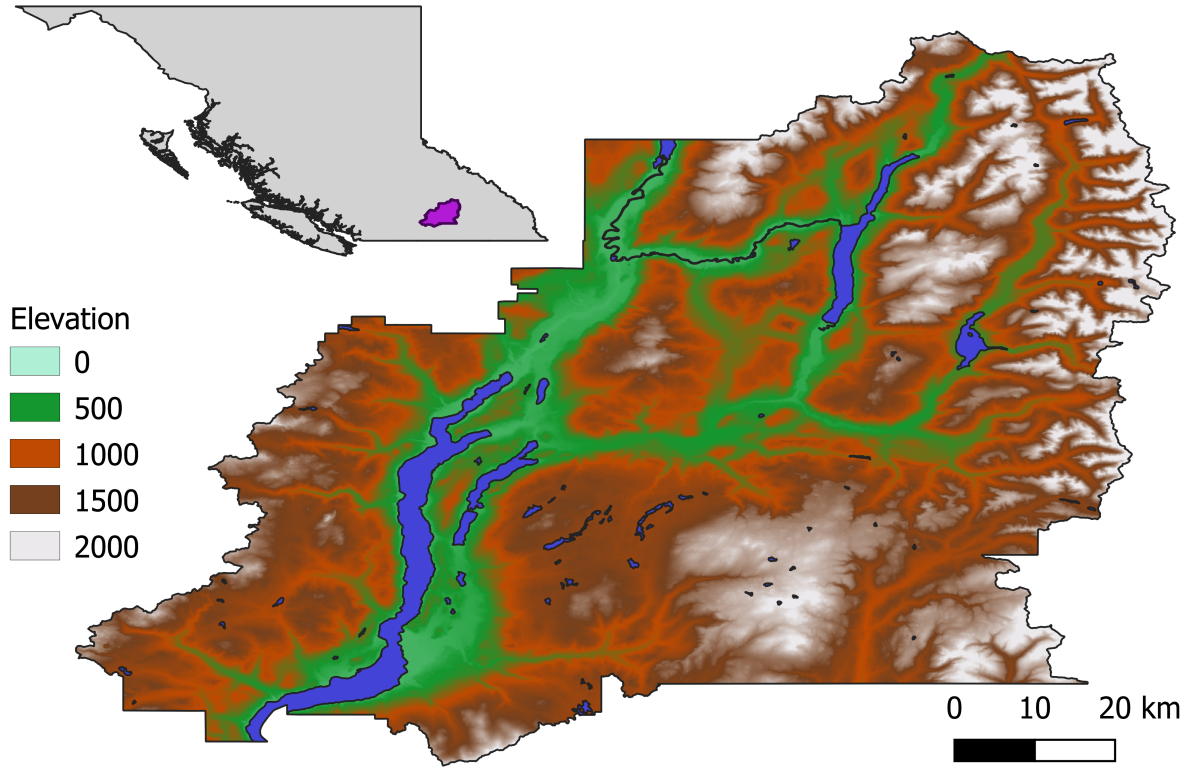

Figure 1: Digital elevation map of the Regional District of Central Okanagan and the Regional District of North Okanagan. Inset map shows location of these regional districts within the province of British Columbia.

network. This network of lower elevation habitats offers the potential for connectivity from the northern part of the study area to the southern part that could enable species who are unable to cross over high elevation terrain to migrate north as the climate warms. Protecting these corridors is one important method of reducing the extinction risk for locally rare and endangered species, one subject of the choice experiment.

The high elevation terrain has historically accumulated snow for about half the year. This snow has then melted in a way that sustained stream flows through the most important part of the growing season. The warming climate is resulting in an earlier and more rapid spring melt, more extreme precipitation events during the summer, and more frequent rain on snow events in the winter. This increases the potential for flooding damage, damage that can be partly mitigated by protecting natural stream channels. The warmer temperatures also increase evapotranspiration potential, which in the absence of summer rains can more rapidly result in drought conditions, impacting agricultural activities at lower elevations, and the risk of forest fire at higher elevations.

Within the study area there are two main urban centers, Kelowna in the southwest and Vernon in the center. The location of these communities is clear in Figure 2, where the major land cover categories are mapped. Most of the landscape is covered by forest, and much of this is used for forestry. The lower elevation areas that are not used for urban purposes are mostly either grasslands or open forest used as cattle range, or used for more intensive agricultural purposes. Absent human activities, the lower elevation areas of the valley would have been grasslands and open forests, the habitat types that enable species to use the valleys as movement corridors. Agriculture and urban development have become important barriers to this movement.

Most of the human population is concentrated in or near the urban centers. People's exposure to different land covers may impact on their willingness to pay for environmental protection projects. Figure 2 also shows a breakdown of the postal code delivery zones into urban and rural, a breakdown that was used to stratify the sample. The postal code based classification is not perfectly consistent with the urban concentrations. The stratification was based on Forward Sortation Areas (FSAs), the first three characters of the six character postal code system used by Canada Post. Postal codes serve to increase the efficiency of the postal sorting and delivery system, with no necessarily consistent connection with housing density in the area to which a postal code is attached. With stratification limited to FSAs, the urban strata covers all of the main urban centers and some nearby rural areas, with the rural strata covering most of the remaining area and capturing several smaller urban clusters.

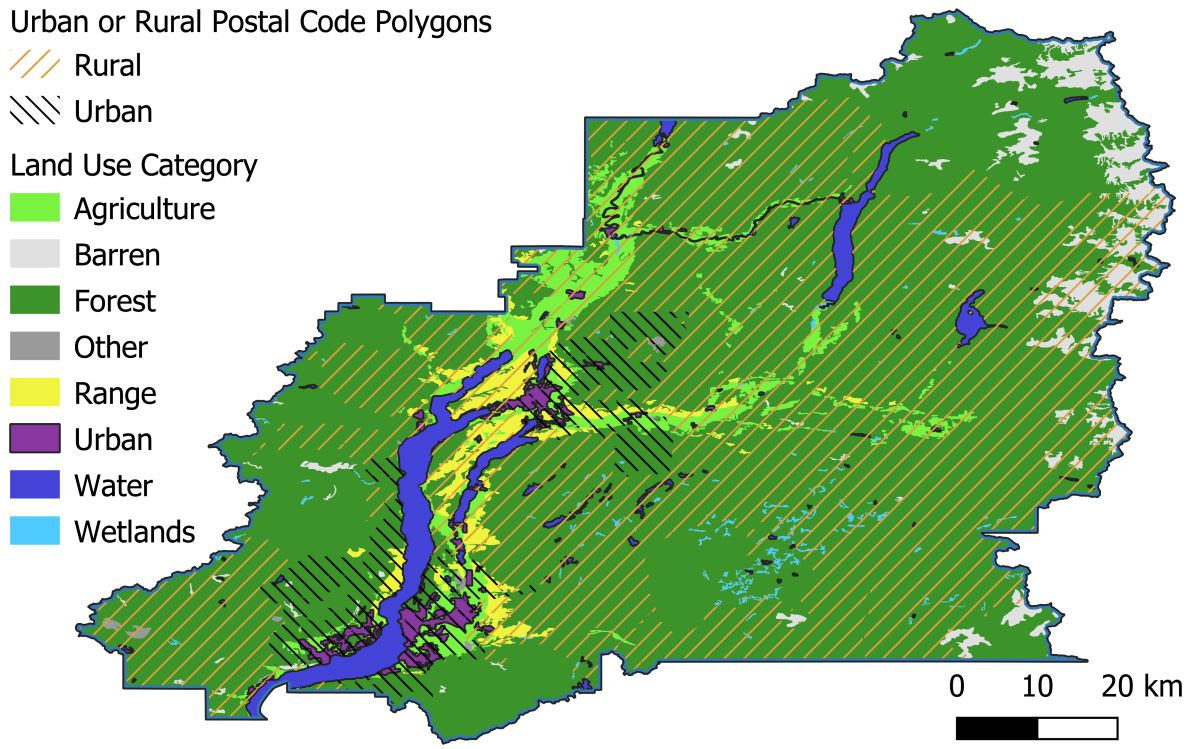

Figure 2: Land cover categories across the study area.

3.2 Survey

The survey containing the choice experiment included seven sections: background, an example, expected futures, referendum questions, behaviors and attitudes, close network attitudes, and demographics. The background section began by describing recent initiatives in nearby jurisdictions that implemented a parcel levy to raise money for a local conservation fund. This was followed by a series of pages that explored perceptions of extreme weather impacts and the potential role of natural waterways, threats to endangered species and the need for natural habitats, the importance of the location of conservation projects, and the impacts of a parcel levy.

The example section described a small conservation project, the rehabilitation of a short stream reach in the North Okanagan. Following this example, participants were asked to choose from a menu the maximum one time payment they would make towards a similar project.

The expected futures section established the pivot point for the participant, based on their perception of how things will change over the next two decades. Participants were presented with the three principle attributes that would be the basis of the choice experiment: change in the impacts caused by extreme weather, changes in the loss of rare and endangered species, and changes in the amount of natural habitat near the residence of the respondent. For all three cases, participants were provided with referenced

Aspect	Existing Policy	Conservation Fund
Extreme Weather Impacts	 $\left(1+\frac{1}{2}\right) \times$ now.	 Like now.
Rare and Endangered Species	 2 × already lost.	 1 × already lost.
Nearby Natural Habitats	 $\frac{1}{2}$ area lost.	 $\frac{1}{4}$ area lost.
Parcel Levy	$0.00	 $50.00
Your Vote	☐	☐

Figure 3: Referendum question example.

information describing how these attributes had changed over the previous two decades. Participants chose from a menu with four or five levels, where one level was an improvement relative to the current situation, while the remainder were a deterioration relative to the current situation. These choices established the individual status quo. Participants were also able to indicate if they expected some other change outside of the offered range.

In the next section participants were offered three binary referendum questions, with an example shown in Figure 3. In each question, the status quo was the pivot point provided by the participant, labeled as the consequences of the Existing Policy. The alternative, labeled Conservation Fund, offered improvements in one or more of the attributes, if the status quo was such that improvements were available. The offered alternatives were based on a D-efficient design specific to the participant's chosen status quo. The D-efficient designs for each possible status quo were generated prior to administration of the survey using the package AlgDesign (Wheeler, 2019) in R (R Core Team, 2020) and stored in a database. Each design was a subset of the possible attribute combinations with up to 30 choice sets of three choice cards for each possible personal status quo. The choice sets were delivered in a sequence that reset after all the sets were delivered. The order of the choice cards was randomized within each delivered choice set. In this way, the most common choice set was delivered at most one more time than the least common choice set for every person who chose the same status quo. Management of the design for the online implementation of the survey was through a survey system developed by one of the authors, with details available on request.

The payment vehicle was a parcel levy, similar to that used in nearby jurisdictions to raise money for local conservation funds. This charge would be levied on all parcels, independent of the assessed value of the parcel. The range of the values for the parcel levy were $5.00, $10.00, $20.00, $50.00 and $100.00, chosen to span the range of the existing conservation fund parcel levies, which are in the $10.00 to $25.00 range. The background material provided the values for the conservation parcel levies in nearby jurisdictions, so that all participants had the same information about these nearby policies.

The behaviors and attitudes section first provided participants with a list of outdoor activities and asked them to indicate the frequency that they participated in these activities. Following this participants were offered the New Ecological Paradigm (NEP) scale (Dunlap et al., 2000). Finally, in this section, participants were asked to indicate their views on the role of government and their relationship with the environment. For the role of government, participants were asked to indicate their leanings, left or right, where left leaning individuals supported an active government promoting redistribution, while right leaning individuals favour private property rights and limited government. Environmental leaning ranged from instrumental, where the value of protecting the environment stems from the value of the services provided by the environment, to ecological, where the environment has value in itself, independent of how humans may value it.

The network section asked participants to consider two people that they are closest with, with whom they would share personal information and who they could count on for help. The beliefs of these people on the same scales for the role of government and relationship with the environment were also collected.

The final section collected demographic information, with the last demographic question asking people to select from an income range, where the intervals matched those used by Statistics Canada.

3.3 Survey Administration

The overall survey information was developed in consultation with local content experts including UBC faculty and community members. A focus group assembled from clerical staff at UBC was lead through the survey to assess the clarity of the wording and the potential sensitivity of the topics. Students and volunteer community members were invited to pretest the survey, where the pretest setting of the survey system enabled testers to provide comments on each page of the survey. These were reviewed and further changes made to clarify confusing aspects of the survey.

Letter mail invitations were used to provide initial contact. An address list of 10,000 randomly sampled named addresses was purchased from Canada Post ™, with budget limits leading to only 9,000 invitations being sent. The address population was defined by postal codes over the Regional District of Central Okanagan and the Regional District of North Okanagan, stratified into two equal sized samples, drawn from the lower population density postal code regions and the higher population density postal

code regions. These were more rural and more urban strata that could be used to examine differences in responses between rural and urban participants, and ensures that more rural regions are well represented in the sample.

Canada Post's privacy policy dictated that we not have direct access to the address list. Rather, we provided a form letter to a contractor, who received the list from Canada post, merged the list with our form letter, and mailed out the letters. We are therefore unable to geolocate the residences of the survey participants. The most accurate spatial information we have is the postal code, if the participants provided a postal code. Therefore, while the sample was stratified to enhance representation from lower population density portions of the study area, we do not know which strata the participants are from unless they provided us with their postal code.

Invitation letters were mailed on February 15, 2019. A reminder postcard was mailed two weeks after the initial invitation letter, with a second reminder postcard mailed three weeks after that. A participation incentive, in the form of a $250 prize awarded to one of every 200 people who reached the end of the survey was clearly described on all contact information. Participation in the prize draw was voluntary and unconnected to any answers provided in the survey, as per provincial gambling regulations. Participation information related to the prize draw was stored in a separate database, with no key or time stamp linkage to the survey data. Since we did not have access to the mailing list itself, the system was set up to provide each participant with a unique identification number which they could subsequently use to return to the same version of the survey that they were originally provided.

3.4 Sample Characteristics

The 9000 mailed invitations resulted in 643 completed surveys. After cleaning the data for missing values, 592 usable completed surveys remained. With each observation including three choice tasks, there are 1776 observations for econometric model estimations (592×3). Table 3.1 provides a comparison of several sample demographic variables with 2016 census results for the central and north Okanagan regional districts. The sample is somewhat over representative of males, of people in the 50 - 64 years age group, of people with at least one university degree, and the $50,000 to $99,999 household income group. These over representations are matched by an under representation of people in the 20 - 39 years age group, people with high school or less education, and with people in the less than $50,000 income group. While results need to be interpreted with this context in mind, the bias towards higher income, more educated older members of the population as survey respondents is not uncommon.

Table 3.1: Demographic Comparison

Variable	Sample	Census	Variable	Sample	Census
Gender (% share male)	60.1	51.4	Education (% share)		
Household size (members)	2.3	2.3	High school or less	18.3	37.0
Age (% share)			Post-secondary, not university	46.0	41.8
20-39	5.3	28.3	One or more university degrees	35.7	21.2
40-49	13.8	14.7	Income (% share)		
50-64	51.9	29.3	Below $50,000	28.0	33.8
65+	29.0	27.7	$50,000 - $99,999	42.3	33.9
			$100,000 and above	29.7	32.3

4 Theoretical Background and Econometric Model

CEs have theoretical foundations in the Lancaster (1966) approach to consumer and welfare theory, in which individuals derive utility from the characteristics of the goods rather than directly from the goods themselves. Econometric applications developed with the random utility theory (Luce, 1959; McFadden, 1974). Hanemann (1984) provides the formal framework of CE by linking the econometric method with the consumer theory, separating consumer decisions into discrete or continuous choices. Following McFadden (1974), the indirect utility function can be decomposed into a utility that depends on observable factors V and an unobserved utility contribution ε.

Participants choose an expected future, and then choose among alternatives relative to this expected future. Let the utility from the expected future be

$$U_{i0} = V_{i0} + \epsilon_{i0} \tag{1}$$

where V_{i0} are the observable components of the agent $i's$ utility and ϵ_{i0} is an unobserved variation in utility. Participants are then offered a set of choice situations where their offered future is set against an alternative. Let the choice situations be indexed by $k \in K$, with the alternative itself identified by the subscript '1'. The utility of alternative in choice situation k is

$$U_{i1k} = V_{i1k} + \epsilon_{i1k} \tag{2}$$

In each choice situation, the individual will choose the alternative if

$$U_{i1k} > U_{i0}$$

$$V_{i1k} + \epsilon_{i1k} > V_{i0} + \epsilon_{i0}$$

where we assume that U_{i0} is independent of the composition of the offered alternative.

Stated preference off revealed preference (SP off RP) studies use an observed choice to construct

a set of choices that the participant is asked to evaluate [(Train and Wilson, 2008);Louviere et al. (2000)]. With simulations, Train and Wilson (2009) show that such studies can increase the efficiency of estimators, provided that the endogeneity is accounted for in the estimation. Hess and Rose (2009) describe six issues with SP pivot designs: 1) correlation between alternatives, 2) correlation across replications, 3) heteroskedasticity across alternatives, 4) different response to reference and alternatives, 5) attribute zero values treated differently, and 6) asymmetric preferences for increases and reductions in attribute levels. With binary choices, a single direction of change for all attributes, and all reference values having zero for the payment vehicle and nonzero for the alternative, (1), (5) and (6) are not relevant in the current experiment. The unobserved utility contribution of the RP choice carries through to the SP choice situation, introducing endogeneity into the model. In the present context, the expected future predicted by the respondent is not the result of a utility maximizing choice. Therefore, an RP choice does not need to be modeled.

We follow the usual assumption that the utility function is linear

$$V_{i0} = \boldsymbol{x}'_{i0}\boldsymbol{\beta} + \epsilon_{i0} \tag{3}$$

$$V_{i1k} = \beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta} + \epsilon_{i1k} \tag{4}$$

where the vectors $\boldsymbol{x}_{i1k}$ and $\boldsymbol{x}'_{i0}$ are the levels of the attributes for the alternative and the status quo respectively, and $\boldsymbol{\beta}$ captures the influence of these attribute levels on the participant's utility. The scalar parameter β_1 is a constant particular to the alternative (the alternative specific constant), and the corresponding constant for the status quo is assumed to be zero. With these assumptions, we have

$$P_{i1k|i0} = \Pr\left[\beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta} + \epsilon_{i1k} > \boldsymbol{x}'_{i0}\boldsymbol{\beta} + \epsilon_{i0}\right]$$

In the SP off RP development, the unobserved variation ϵ_{i0} is part of an RP discrete choice, and assumed to follow an extreme value distribution. While not strictly necessary here, we will maintain that assumption and proceed in the same way Train and Wilson (2008) does, assuming that ϵ_{i1k} follows an extreme value distribution with scale parameter $1/\alpha$. Using this and rearranging yields

$$P_{i1k|i0} = \Pr\left[\alpha(\beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta}) + \epsilon_{i1k} > \alpha(\boldsymbol{x}'_{i0}\boldsymbol{\beta} + \epsilon_{i0})\right]$$

In the SP off RP setup described by Train and Wilson, the distribution of ϵ_{i1k} is conditional on the probability that the RP option was chosen. As an extreme value distribution, the distribution is shifted by $-\ln(P_0)$, where P_0 is the probability that the RP option was chosen. In the current case, the participant's forecast of the future levels of the attributes is not the result of a utility maximizing

choice among alternatives, and as such we assume that $P_0 = 1$. While this does eliminate the need to consider the conditional distribution of ϵ_{i1k}, the choice between the alternative and the status quo remains dependent on the unobserved value ϵ_{i0}.

To arrive at the probability, the influence of ϵ_{i0} is integrated out as

$$P_{i1k|i0} = \int \frac{\exp[\alpha(\beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta})]}{\exp[\alpha(\beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta})] + \exp[\alpha(\boldsymbol{x}'_{i0}\boldsymbol{\beta} + \epsilon)]} f(\epsilon) d\epsilon \tag{5}$$

which amounts to adding a new variable, draws from an extreme value distribution with unit scale, and a scale parameter that captures the relative impact of the unobserved utility contribution to the choice between the status quo and the alternative. Accommodating the possibility of endogeneity therefore converts the multinomial logit into a mixed multinomial logit necessitating simulation.

That the distribution of the unobserved variation in the participant's utility is independent of the participant's chosen forecast makes it simple to allow heterogeneity in the other model parameters. With the appropriate integration, the likelihood above becomes

$$P_{i1k|i0} = \iiint \frac{\exp[\alpha(\beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta})]}{\exp[\alpha(\beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta})] + \exp[\alpha(\boldsymbol{x}'_{i0}\boldsymbol{\beta} + \epsilon)]} f(\epsilon) g(\beta_1, \boldsymbol{\beta}) d\epsilon d\beta_1 d\boldsymbol{\beta} \tag{6}$$

The fact that the distribution of ϵ is not conditional on parameter values renders the order of integration irrelevant and allows this system to be estimated as a regular mixed logit model.

Extending the model in equation 6 to include characteristics of individual i requires accounting for the fact that these characteristics do not vary over the choice tasks. If we continue the linear formulation assumed above, then we cannot include the individual specific variables directly, as they are perfectly co-linear with the individual specific parameter (fixed or random) included with panel data. These effects can be included as interactions with the variables in 6. We also consider individual specific characteristics that are not directly observable - are latent - but may be associated with observable indicators. Let $\boldsymbol{w}_i^*$ be a vector of latent variables describing unobservable characteristics of i and let $\boldsymbol{z}_i$ describe observable characteristics. The linear utility specification of equations 3 and 4 then become

$$\begin{aligned} V_{i0} &= (\mathbf{1} + \boldsymbol{w}_i^{*\prime}\boldsymbol{\gamma}^w + \boldsymbol{z}_i'\boldsymbol{\gamma}^z)\boldsymbol{x}'_{i0}\boldsymbol{\beta} + \epsilon_{i0} \qquad (7) \\ &= \boldsymbol{x}'_{i0}\boldsymbol{\beta} + \boldsymbol{x}'_{i0}(\boldsymbol{\beta}\boldsymbol{\gamma}^{w\prime})\boldsymbol{w}_i^* + \boldsymbol{x}'_{i0}(\boldsymbol{\beta}\boldsymbol{\gamma}^{z\prime})\boldsymbol{z}_i + \epsilon_{i0} \\ V_{i1k} &= (\mathbf{1} + \boldsymbol{w}_i^{*\prime}\boldsymbol{\gamma}^w + \boldsymbol{z}_i'\boldsymbol{\gamma}^z)(\beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta}) + \epsilon_{i1k} \qquad (8) \\ &= \beta_1 + \boldsymbol{x}'_{i1k}\boldsymbol{\beta} + \boldsymbol{x}'_{i0}(\beta_1\boldsymbol{\gamma}^{w\prime})\boldsymbol{w}_i^* + \boldsymbol{x}'_{i0}(\beta_1\boldsymbol{\gamma}^{z\prime})\boldsymbol{z}_i + \boldsymbol{x}'_{i0}(\boldsymbol{\beta}\boldsymbol{\gamma}^{w\prime})\boldsymbol{w}_i^* + \boldsymbol{x}'_{i0}(\boldsymbol{\beta}\boldsymbol{\gamma}^{z\prime})\boldsymbol{z}_i + \epsilon_{i1k} \end{aligned}$$

where the interaction effects are captured by the parameter vectors and matrices $\beta_1\boldsymbol{\gamma}^{y\prime}$, $\beta_1\boldsymbol{\gamma}^{z\prime}$, $\boldsymbol{\beta}\boldsymbol{\gamma}^{y\prime}$ and $\boldsymbol{\beta}\boldsymbol{\gamma}^{z\prime}$. Implementing this formulation requires accounting for the unobservable characteristics $\boldsymbol{w}_i^*$.

Equation 6 must be appropriately adapted to include the interaction terms in equations 7 and 8 to incorporate the effect of the observed and latent individual characteristics. For each individual we observe the choice vector $\boldsymbol{y}_i = \{y_{ik} : \forall k \in K\}$. The probability of realizing the vector $\boldsymbol{y}_i$ is

$$L_{\boldsymbol{y}_i} = L_{\boldsymbol{y}}(\boldsymbol{y}_i|\boldsymbol{x}_{i0}, \boldsymbol{x}_{i1k}, \boldsymbol{w}_i^*, \boldsymbol{z}_i) = \prod_{k \in K} (P_{i1k|i0})^{y_{ik}} (1 - P_{i1k|i0})^{(1-y_{ik})} \tag{9}$$

Operationalizing an estimation for the choice model requires accounting for the latent variables. To do so, assume the latent variables are predictive of one or more observable variables beyond the choices made, as

$$\boldsymbol{v}_i = g(\boldsymbol{w}_i^*, \boldsymbol{\zeta}_i)$$

where $\boldsymbol{\zeta}_i$ is an error term. The relationship between the indicator variables and the latent variables will depend on the type of observations embodied in $\boldsymbol{v}_i$. Attitude variables are typically measured using an ordered Likert scale, and for such indicators, with the appropriate assumptions on the error distribution $\boldsymbol{\zeta}_i$, an ordered logit regression is the predictor. Implementing these assumptions, we have a likelihood of the form $L_{\boldsymbol{v}_i} = L_{\boldsymbol{v}}(\boldsymbol{w}_i^*|\boldsymbol{\Lambda})$ where $\boldsymbol{\Lambda}$ is a matrix of parameters.

It is also assumed that the latent variables themselves can be predicted by a set of observed variables, often the very individual specific characteristics used in combination with the latent variables described above. If we assume this relationship is linear, it has the form

$$\boldsymbol{w}_i^* = h(\boldsymbol{z}_i, \boldsymbol{\eta}_i) = \boldsymbol{\delta}_0 + \boldsymbol{\Delta}' \boldsymbol{z}_i + \boldsymbol{\eta}_i \tag{10}$$

By definition, the latent variable vector $\boldsymbol{w}_i^*$ is unobservable. Therefore, we cannot estimate a regression of this form. However, with the assumed structure of equation 10 and an assumed distribution for $\boldsymbol{\eta}_i$, we have a distribution for $\boldsymbol{w}_i^*$ conditional on individual characteristics $\boldsymbol{z}_i$ and the unknown parameters $\boldsymbol{\delta}_0$ and $\boldsymbol{\Delta}$. Assuming that $\boldsymbol{\eta}_i$ follows a standard normal, then

$$\boldsymbol{w}_i^* \sim \boldsymbol{\Phi}(\boldsymbol{\delta}_0 + \boldsymbol{\Delta}' \boldsymbol{z}_i)$$

where $\boldsymbol{\Phi}$ is a multivariate normal distribution with mean $\boldsymbol{\delta}_0 + \boldsymbol{\Delta}' \boldsymbol{z}_i$ and the identity covariance matrix suppressed for notational convenience.

Putting it together, the likelihood of observing the vectors $\boldsymbol{y}_i$ and $\boldsymbol{v}_i$ is

$$L_{\boldsymbol{y}_i \boldsymbol{v}_i} = \int L_{\boldsymbol{y}}(\boldsymbol{y}_i|\boldsymbol{x}_{i0}, \boldsymbol{x}_{i1k}, \boldsymbol{\delta}_0 + \boldsymbol{\Delta}' \boldsymbol{z}_i + \boldsymbol{\eta}, \boldsymbol{z}_i|\boldsymbol{\beta}, \boldsymbol{\gamma}) L_{\boldsymbol{v}}(\boldsymbol{\delta}_0 + \boldsymbol{\Delta}' \boldsymbol{z}_i + \boldsymbol{\eta}|\boldsymbol{\Lambda}) \boldsymbol{\Phi}(\boldsymbol{\eta}) d\boldsymbol{\eta}$$

and the likelihood of the complete set of observations is

$$L(\boldsymbol{y}, \boldsymbol{v}|\boldsymbol{\beta}, \boldsymbol{\lambda}, \boldsymbol{\Delta}, \boldsymbol{\Lambda}) = \prod_{i \in I} L_{\boldsymbol{y}_i \boldsymbol{v}_i}$$

with estimation consisting of identifying the values for the parameters $(\boldsymbol{\beta}, \boldsymbol{\lambda}, \boldsymbol{\Delta}, \boldsymbol{\Lambda})$ that maximizes this likelihood. The presence of the nested integrals results in this system lacking a closed form solution. Therefore, maximum simulated likelihood is employed to arrive at parameter estimates. Typically, estimation challenges and/or data limitations lead the researcher to impose zero restrictions on a subset of the parameters in the model.

Figure 4 shows the structure of the hybrid model. For each individual, there is a set of observable characteristics and a set of unobservable latent characteristics. These latent characteristics are assumed to determine the values taken on by a set of observable indicators. For each choice situation k, the individual is offered an alternative with attributes x_{i1k}. These attribute levels, together with the observed and latent characteristics of the individual, and a choice task specific error term ϵ_{i1k} determine the utility offered by the alternative. The individual chose the future that they considered the most likely from a set of alternative, a future with attribute levels $\boldsymbol{x}_{i0}$. These attribute levels, together with the same observed and latent characteristics, and an error specific to this status quo, determine the utility the individual expects to receive from the status quo future. These utilities are not observable. What is observable is the choice that the individual makes, voting for the status quo or the alternative.

Finally, with an attribute expressed in currency units - the payment vehicle - the parameter estimate on this attribute measures the marginal utility of income. The marginal rate of substitution between changes in the level of other attributes and income is an estimate of the willingness to pay (WTP). If the model formulation is linear, then the WTP is calculated as

$$WTP_A = -\frac{\beta_A}{\beta_C} \tag{11}$$

where β_A is the parameter estimated for attribute A, and β_C is the parameter estimate on the payment vehicle (levy). As a ratio of random variables, the distribution of WTP_A may not be defined, and confidence intervals derived from the common distributional assumptions not valid. Parametric and nonparametric bootstrap methods (e.g. Krinsky and Robb, 1986) are offered as superior approaches to calculating confidence intervals for WTP measures. An alternative approach is to estimate the model directly in WTP space, as described by Train and Weeks (2005) and Sonnier et al. (2007). These issues are primarily a concern when the estimate of β_C has a high probability density at zero, which translates into a high probability density on undefined WTP values. Our estimates for β_C are strongly significant (see WTP results), suggesting that inferences based on Delta method calculated confidence intervals

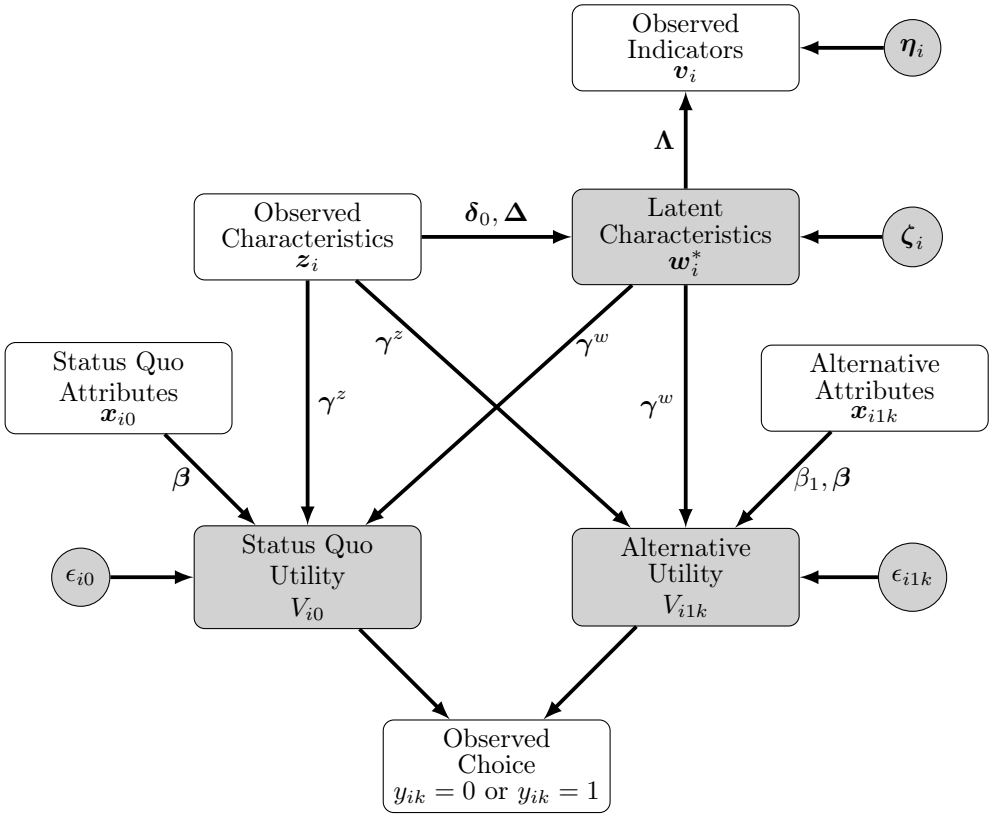

Figure 4: Hybrid model. Items gray filled represent unobserved model components. Arrows indicate direction of influence.

will not differ from those generated using other methods. As such, the results reported here are based on the Delta method.

Table 5.1: Indicators for latent variables.

Label	Description	Mean	Min	Max
Political Orientation				
Pol. Leaning	Political leaning (1, O, right = 7)	2.910	1	7
Property	Support for private property (2, C)	-0.990	-3	3
Resources	Support for resource extraction (2, C)	-1.201	-3	3
Environmental Orientation				
Env. Leaning	Environmental Leaning (1, O, ecological = 7)	5.322	1	7
Nature	Importance of time spent in nature (3, C)	1.878	-2	3
Duty	Strength of duty to protect nature (2, C)	2.190	-1.5	3
NEP	New Ecological Paradigm (15, C, anthro = 1)	0.278	0	0.68

5 Results and Discussion

5.1 Indicator Variables

An objective of our analysis is to examine if an environmental orientation measure provides additional explanatory power relative to political orientation. We have directly asked people to rate their environmental and political leanings. However, we include additional indicators in estimating the influence of the latent variables on the choices made.

The political orientation indicators are: (1) political leaning, a self rated position on a scale from strongly left to strongly right, included as an ordered discrete variable; (2) support for private property, scaled and centered sum of two Likert scale measures, included as a continuous variable; and (3) support for resource extraction, sum of two Likert scale measures. The average responses suggest that the sample is more inclined to lean left politically, is not a strong believer in prioritizing private property rights, and is not supportive of resource extraction. However, the range of these three indicators shows that there are respondents reporting the extremes on these measures.

The environmental orientation indicators are: (1) environmental leaning, a self rated position on a scale from an ecological perspective to an instrumental perspective, with higher values corresponding to the ecological perspective; (2) an indicator of how important time spent in nature is to the respondent, a sum of three Liker scale measures; (3) an indicator of the respondents sense of duty to protect nature, a sum of two Likert scale measures; and (4) an aggregation of the New Ecological Paradigm instrument, scaled to lie between zero and 1, with higher values corresponding to a more anthropocentric perspective. The mean values suggest that the average respondent is ecologically oriented, places a high value on time spent in nature, feels a strong duty to protect the environment, and leans quite strongly toward an ecocentric world view. For these indicators, the ranges do not span all the possible values. The sample does not include people choosing the extremes on these measures.

Table 5.2: Regression results for attributes and demographics estimated using MXL

Variables	estimate	S.E
ASC	-0.010	0.728
1/scale	2.311***	0.307
Attributes		
Weather	0.004	0.062
Species	0.047	0.064
Nearby nat.	0.102*	0.055
Levy	-0.010***	0.002
Individual Specific Characteristics		
Household size	-0.056	0.063
Male	0.030	0.164
Middle income	0.282	0.201
High income	0.460*	0.225
Middle age	-0.131	0.339
Senior age	-0.021	0.350
College educ.	0.189	0.189
University educ.	0.150	0.208
Attitude Measures		
Pol. leaning	-0.136*	0.049
Property	-0.104	0.069
Resources	-0.042	0.073
Env. leaning	0.101	0.069
Nature	0.278***	0.083
Duty	-0.016	0.083
NEP	-0.959	0.737
N	387×3	
Log-likelihood	-496.61	
AIC	1035.22	
BIC	1141.41	

Significance: $*** \equiv p < 0.001$; $** \equiv p < 0.01$; $* \equiv p < 0.05$

5.2 Regression Results

We report results estiamted using mixed multinomial logit model (Table 5.2) and hybrid model (Table 5.3) framework. We start our discussion with the results of mixed multinomial logit model. The results show that the nearby natural habitats is significant whereas weather and species attributes are not. Levy is found to be significant. Except for high income group, none of the demographic varibales are found to be significant.On attitude measures, except for political leaning and time spent in nature, none of the variables are significant. This is perhaps due to potentianl endogenoity in the measures of attitude. The statistical significance of the scale parameter indicates that there exist a possibility of endogeneity arising from the relative impact of the unobserved utility on the choice between the status quo and the alternative.

The hybrid model (Table 5.3) report the results of the hybrid model that are directly comparable with MXL model (Table 5.2) . Here nearby natural habitats and levy are statistically significant. Again,

only high income group is significant. Political and environmental orientation are both significant, which were not the case in MXL model. This indicates that hybrid model addresses potential endogeneity issues assoicated with the measures of political and environmental orientation.

Table 5.3: Regression results from Hybrid Choice Models

Variables	estimate	S.E
ASC	-0.694	0.510
1/scale	2.277***	0.312
Attributes		
Weather	0.004	0.064
Species	0.059	0.065
Nearby nat.	0.108*	0.056
Levy	-0.011***	0.002
Individual Specific Characteristics		
Household size	-0.075	0.073
Male	0.050	0.185
Middle income	0.257	0.210
High income	0.487*	0.245
Middle age	-0.523	0.404
Senior age	-0.430	0.401
College educ.	0.065	0.208
University educ.	-0.010	0.231
Latent Variables		
Pol. Orientation	0.596***	0.141
Env. Orientation	0.437***	0.136
N	387×3	
Log-likelihood	-4204.589	
AIC	8517.18	
BIC	8855.27	

Significance: $*** \equiv p < 0.001$; $** \equiv p < 0.01$; $* \equiv p < 0.05$

Table 5.4 reports the parameter estimates associated with the latent variables. Political leaning and environmental leaning are included as ordered variables, estimated with six breakpoints. To save space, we do not report these breakpoints. All other attitudinal indicator variables associations with the latent variables assume a standard normal disturbance. Estimates of the mean and standard deviation of these distributions are reported.

Table 5.4: Regression results of indicator variables from Hybrid Choice Models

Variables	estimate	SE
Political Orientation		
Household size	0.044	0.060
Male	-0.519***	0.127
Middle income	-0.044	0.146
High income	-0.120	0.183
Middle age	0.590**	0.191
Senior age	0.723***	0.190
College educ.	0.497**	0.182
University educ.	0.490**	0.203
Pol. leaning - mean	-1.290***	0.110
Property - mean	-1.008***	0.072
Property - st. dev	1.005***	0.048
Resources - mean	-1.208***	0.092
Resources - st. dev	0.965***	0.090
Environmental Orientation		
Household size	0.092	0.079
Male	-0.617***	0.128
Middle income	0.249	0.163
High income	0.104	0.196
Middle age	2.146***	0.373
Senior age	2.153***	0.345
College educ.	0.639***	0.180
University educ.	0.612**	0.209
Env. leaning - mean	0.437***	0.136
Nature - mean	0.669***	0.093
Nature - st. dev.	0.970***	0.059
Duty - mean	0.785***	0.104
Duty - st. dev.	0.689***	0.063
NEP - mean	0.090***	0.009
NEP - st. dev.	0.230***	0.018

Significance: $*** \equiv p < 0.001$; $** \equiv p < 0.01$; $* \equiv p < 0.05$

For political orientation, the indicators are all strongly significant and have a negative sign. This latent variable is therefore decreasing in value as the respondent is oriented more towards the right politically. One concern with asking people to state their political leaning on a survey about an environmental issue is the perception that people on the right of the spectrum are not supporters of environmental protection. As a result, people may be inclined to either protest - choose strongly right when their attitudes are not as strong - or soften - choose neutral rather than reporting a position they assume is unpopular with the researchers. Using an ordered regression allows the breakpoints to parse out some of this effect.

For environmental orientation, the indicators are all strongly significant and have a postive sign. This latent variable is therefore increasing in value as the respondent is oriented more towards the ecological. Where people are often presented with the left to right political axis, the environmental leaning axis is novel. Respondents may therefore have thought more carefully about their position along this axis, and

see less reason to not report truthfully.

The results on demographic variables indicate that a right political orientation is more likely among females and older respondents surprisingly with more education. The age is expected, while the education effect is opposite of what is normally seen when political attitudes are correlated with eudcation. The demographic influences on the environmental orientation latent variable are also a bit surprising in some ways. Gender and education have the expected effects. Females are more likely to be ecocentric in their orientation than males, and those with higher education similarly. Age enters strongly and positively. Older respondents are more likely to be ecocentric. This is again inconsistent with the usual observation about young people being more concerned about the environment. Using two dimensions allows for a richer representation of people's attitudes that impact on funding environmental activities. People can be in favor of protecting the environment, while at the same time not supporting government as a major player in regulating people's choices. Our results suggest that there are two dimensions.

We also examined our anaylsis by extending hybrid model in two ways. First, we explored the effects of interactions between the attribute levels and the latent variables on the choice varaible. Second, we allowed correlation betwen the two latent variables politcal and envrionemtnal oreintation in explaining our choice vairable. None of the results are found to be significant.

5.3 Willingness to Pay (WTP)

Table 5.5 shows the WTP estimates for the environmental attributes. Values are calculated as per equation 11, with standard deviations estimated using the Delta method. The results show a finding similar to other uses of hybrid models. WTP estimates are not that different between hybrid models and conventional mixed logit models.

Table 5.5: Willingness to Pay with respect to levy

	Mixed Logit		Hybrid	
Var.	WTP	SE	WTP	SE
Expected Weather	0.250	6.03	0.406	5.59
Endangered species	4.61	6.16	5.56	6.04
Nearby Habitats	9.89	5.19	10.15	5.14

The presence of a positive willingness to pay for protecting or enhancing natural areas near the respondents residence echos findings of other research on the importance of the spatial distribution of environmental services provision. The local conservation funds being established in British Columbia have sometimes expressly restricted proposal consideration to environmental enhancement, ruling out

the consideration of recreational or aesthetic considerations. The results of this research suggest that projects which provide both environmental benefits and other social benefits have overall greater value. It also suggests that public support for such funding projects may be greater when the investments made generate other social benefits in addition to the environmental improvements.

We do not have the spatial location of the survey participants, a consequence of the recruitment approach taken. The sample was stratified based on more or less urban postal code regions. However, this is only based on the average population density in the postal code zones, and does not capturing clustering within those areas. Therefore, it is not surprising that the designation of urban or rural did not have any explanatory power. A proxy may exist in the personal status quo, where people report the amount of natural space near their residence. We will explore further such variable interactions in future.

Our sample almost certainly suffers from some selection bias. The least represented in our sample are younger people, people with lower incomes, and people with lower levels of education. Our results do demonstrate that environmental leaning and political leaning both have explanatory power. Therefore, simple assumptions about how the missing population segments would have responded are somewhat dubious.

The strong predictive power of political and environmental leaning deserves further study. Empirically, is this an artificial result, a consequence of political and environmental leanings being a function of individual characteristics that we have only partially captured in our survey? Measuring additional individual characteristics may provide some additional insight. Practically, this result offers at least some potential for concern for the environment to overcome the left and right political chasm. People who see the environment as having intrinsic value are more willing to vote in favor of environmental improvements, even if they are right leaning in their political orientation. In jurisdictions where politics is highly polarized along the left to right dimension, environmental concerns are often seen as left. However, the results here suggest that this isn't a true reflection of people's attitudes. Perhaps there are ways that we can address environmental concerns outside of the left vs right debate, and make some progress on the global challenges that affect us all.

6 Conclusion

The Regional District of Central Okanagan is exploring the implementation of its first funds collected through its local conservation levy. Using a choice experiment consistent with the local conservation levy, we have found a positive willingness to pay for local investments that protect or enhances natural habitats that are near participants place of residence. However, many projects may contribute to more than one attribute, with potentially enhanced total benefits flowing from these complementary.

We encourage those charged with allocating the funds collected towards projects that provide such complementary benefits.

Political leaning was siginifacnt but environmental leaning was not when directly included in a mixed logit model. When the potential endogeneity issues with this approach are addressed with a hybrid model, environmental orientation latent variable has strong predictive power. We take these results to imply that political leaning in itself is not sufficient to explain people's environmental preferences. People can be strongly right leaning and also view the environment as having intrinsic value, and likewise people can be strongly left leaning and take a primarily instrumental view of the environment. This implies that for researchers it is unwise to ignore the differences between political and environmental leaning, and that we would benefit from a public discourse that doesn't presume that those who strongly favor small government and free markets are necessarily unwilling to pay for activities that protect the environment.

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