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Early Exposure to Nature and Willingness-To-Pay for Grassland Restoration

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Abstract

People, including children, spend less time in nature than in decades past (Pergams and Zaradic, 2008; Larson et al., 2011). Will such change in interaction with nature reduce how much today's children will be willing to pay to support environmental conservation and restoration when they are adults? Non-market valuation research commonly finds large heterogeneity in people's preferences for environmental goods, but little of that work explores the connection between childhood exposure to the environment and adult preferences over environmental goods. This paper examines the relationship between adults' early-life experiences with nature and the values they currently have for features of grassland restoration using a choice experiment survey in Illinois, Iowa, and Minnesota. This paper finds that the average value of grassland restoration with extensive recreational attributes can be large, a finding that can help restoration agents to plan how best to use funds for grassland restoration. The results also show that people who had extensive exposure to grasslands and some outdoor activities in childhood can value grassland restoration projects as much as five times more than those who did not. These patterns lend credence to concerns that reduced human engagement with nature may undermine future motivation to protect nature and create a negative feedback loop for stewarding nature.

Keywords: early-life experience; grassland restoration; willingness to pay

1 Introduction

Urbanization leads to rapid decline in open spaces – an estimated 6,000 acres of open space are lost each day in the U.S., at a rate of 4 acres per minute (USDA Forest Service, 2018), which causes a decline in people's interaction with nature (Cox et al., 2018). People, including children, spend less time in nature than in decades past (Pergams and Zaradic, 2008; Larson et al., 2011). Will such change in interaction with nature affect today's children's willingness to pay to support environmental conservation and restoration when they are adults? In neoclassical economics, the marginal value of nature theoretically increases with its scarcity. In other words, when people have fewer chances to visit nature because of limited supply, they may value nature more. However, if individual preferences are affected by their early-life experiences with nature, then the value of nature may not actually increase under scarcity. People who had fewer chances in their childhood to interact with nature may not consider nature relevant to their lives (Miller, 2005; Soga et al., 2016). A decrease in the value people place on nature may result in public marginal willingness to pay (MWTP) for nature staying the same or even decreasing as nature becomes scarce. This paper examines the relationship between individuals' early-life experiences with nature and their willingness to pay (WTP) for habitat restoration using a discrete choice experiment.

Research on environmental valuation has found that many factors, such as gender, income, and spatial proximity, can affect people's willingness to pay for environmental amenities (Jacobsen et al., 2013; Jacobsen and Hanley, 2009; Tait et al., 2012; Abildtrup et al., 2013; Kline and Wichelns, 1998). But are preferences present at birth, discovered with time, or shaped with experience? Economists and psychologist have found some general support for "preference discovery" – the hypothesis that people learn about their preferences over goods through experience and experimentation (Delaney et al., 2019). Studies find that recent experience with specific environmental goods can reduce an individual's uncertainty about their preference for that good (Tu and Abildtrup, 2016; Czajkowski et al., 2014; Whitehead et al., 1995; Mccollum and Boyle, 2005).

Limited economic research suggests that an individual's childhood experience may

have long-term effects on their preferences and behaviors (Severen and Van Benthem, 2019). Environmental psychologists suggest that experience with nature during childhood may affect their preferences over natural amenities preferences in two ways: affinity for nature and human capital accumulation. A person's childhood experiences influence how they think and feel about natural areas in their later life stages (Ewert et al., 2005; Thompson et al., 2008). For instance, people who played in a wilderness environment in their childhood have more positive perceptions of natural environments and show a greater affinity for nature (Kals et al., 1999; Bixler et al., 2002). In addition, experience may help children build up nature-related human capital in the form of skills and knowledge specific to nature appreciation and recreation. Such "amenity capital" (Krupka, 2009) might help them enjoy nature more as adults.

Would, for example, people who camped out when they were young actually have higher WTP for a natural area that allows camping later in life? Only Sato et al. (2017) has explored this kind of question. They focus on a specific preserved area, Mt. Rokko, in Kobe, Japan, and use a contingent valuation (CV) study to examine the effect of respondents' personal history and beliefs on the value they place on this preserved area. However, results generated from a study that focuses on a single protected area may not be generalized to other land conservation types. In addition, the CV method cannot provide multi-dimensional evidence to show how peoples' childhood experience affects their values for different attributes of a nature area. More empirical evidence is needed to explore the relationship between childhood experience and the valuation of environmental goods.

We carry out a choice experiment survey in three-state region comprised of Illinois, Iowa, and Minnesota to examine people's WTP for grassland restoration and its relationship with their early-life experience with nature. Respondents' early-life experiences are measured in two dimensions: active experience and passive experience. First, we measure an individual's active childhood experience as the frequency with which they visited nature, spent time outdoors, engaged in specific nature-related recreational activities, or received environmental education. Second, we measure an individual's passive childhood experiences with nature by proximity of nature and grasslands to their childhood home(s).

A mixed multinomial logit (MMNL) model in WTP-space is applied to estimate an individual's MWTP for different attributes of a hypothetically restored grassland. We use two methods to analyze the relationship between childhood experiences with nature and MWTP for grassland restoration. First, we regress the individual-specific means of MWTP on their childhood experiences with nature and socioeconomic characteristic control variables. Second, we use a latent class model to quantify the differences in MWTP for grassland restoration between groups of people that are classified by their childhood experiences with nature and current demographics.

We conduct this study in the context of grassland restoration because large fractions of grassland habitat in the U.S. have been lost, but little research exists to shed light on the potential value of reversing those losses. Grasslands are open land areas dominated by grass and flower plant species and with little tree or shrub cover. Native grassland loss is a serious issue in North America. The loss of grassland has contributed to a widespread and ongoing decline of bird and other animal populations that have affinities for grassland habitats (With et al., 2008). Ecologists and conservation biologists are trying to address this growing concern through grassland restoration. However, current restoration decisions are made under limited information about public preferences on grassland restoration. Only Dissanayake and Ando (2014) estimate the social value of grassland ecosystems. However, they only focus on grassland restoration in Illinois, and do not estimate MWTP for recreational activities in potential restored grassland areas.

Our choice experiment yields two major findings. First, people place economically significant value on having a restored grassland nearby, and that value is increased by recreational attributes. For example, people are willing to pay an average of at least $12 per household per year to have a 100-acre grassland restored nearby with no particular recreational amenities, but the value of the project increases to $108 per household per year, if the project has the experience of birdwatching enhanced by 30 additional bird species, 3 mile of trails, and both unrestricted fishing and campgrounds available onsite. Second, people who had early-life experiences with nature, either active or passive, tend to have higher MWTP for associated attributes in a restored grassland. The impacts

of immersive or especially relevant experiences like camping, environmental education, and living within walking distance of a grassland as a child are especially strong. These results directly inform government policies and private efforts aimed at restoring tallgrass prairie habitat itself. The work also helps us understand how future demand for nature conservation and restoration can be shaped by how much current children experience and learn about nature and outdoor recreation.

2 Choice Experiment Survey Design

We carry out a choice experiment survey in three states in the U.S. tallgrass ecosystem region - Illinois, Iowa, and Minnesota - to estimate individual's MWTP for different features, including recreational activities, of a hypothetical restored grassland.[1] We design the choice questions to estimate the values people have for grassland restoration itself, and for the kinds of nature-based recreation that can be made available in a restored grassland.

We survey people in all three states as the study area to enhance our research's external validity. This area has lost most of its original tallgrass prairies, where vegetation can grow 4 to 6 feet. In Minnesota and Iowa, there are only about 300,000 acres of the original tallgrass prairies remaining, while the historical range of tallgrass prairies was about 25 million acres (Fish et al., 1998). Illinois has lost 99 percent of its original prairies since the early 1800s.[2] Restoring and conserving native tallgrass prairies are essential for these states.

The survey instrument includes background information, descriptions of choice-scenario attributes, a set of discrete-choice questions, and a set of questions that collect respondents' demographic information and early-life experiences with nature. A full sample survey is available in the Appendix. By gathering data on respondents' childhood experiences, we can estimate the correlations between their present-day responses to the choice questions

[1]Three main types of grasslands ecosystems are available in the U.S., which are the short-grass ecosystem, the mid-grass ecosystem, and the tallgrass ecosystem. Figure A1 shows the grassland ecosystems in the U.S.

[2]https://www.fs.usda.gov/main/midewin/learning/nature-science

and how they experienced nature as children.

2.1 Background information and choice question attributes

The survey begins with background information about grasslands, outlining the ecosystem services such areas provide and showing representative photographs to help respondents envision what they are being asked to evaluate. The survey frames the choice questions by explaining that the state has proposed restoring a new grassland area near them, but such a restoration project could have different outcomes depending on how it is designed; the purpose of the survey is to learn how much the respondent would support such a project as a function of its features.[3]

The survey describes the fixed attributes of the hypothetical restoration scenarios the respondent will choose between to ensure all respondents have the same features in mind when making choices. In all cases, the state government would use marginal farmland or abandoned public land to restore a 100-acre grassland that is 40 miles away from the respondent's home, and the project would be paid for by an annual property tax paid by homeowners or passed on to renters. Other fixed attributes of the hypothetical restored grasslands include the presence of wildflowers, deer, and butterflies. All grasslands would have picnic tables, informational signage, and a pond with some fish but no visitor center.

Next, the survey describes the variable attributes of the choice scenarios. We chose attributes related to recreational activities that are commonly available in existing restored grasslands so the results can usefully inform actual agents making choices about how to design a restoration project. The variable attributes are the annual payment the household would have to make if that project were chosen, and a set of amenities: bird species richness (which enriches birdwatching), length of biking and hiking trails, availability of fishing, and availability of camping. Table 1 describes each attribute and its levels, specifying the status quo level that prevails when there is no grassland restoration. The attribute levels of each attribute are chosen based on relevant literature and advice from biologists to ensure attribute levels are reasonable in the survey. The exact list of

[3]Our hypothetical scenario is similar to that in Dissanayake and Ando (2014).

grassland attributes was refined after analyzing the results from the focus groups (see section2.5).

2.2 Choice cards and experimental design

A single choice question is posted on a "card" that includes a set of scenarios. Respondents are asked to choose the scenario they prefer among the options of that choice card. In our survey, choice questions are generated based on the five attributes and varying levels mentioned above using the D-efficient experimental design in Stata. The D-efficient design is the most commonly used efficiency measure, which minimizes the generalized variance of the parameter estimates (Zwerina et al., 1996). All attributes are coded as categorical variables in the experimental design, but the attribute "bird species richness", "length of biking and hiking trails," and the payment vehicle are treated as continuous variables in the data analysis.[4] To limit respondents' cognitive burden while maintaining statistical power for WTP estimation(Caussade et al., 2005), we produce 18 unique choice questions and divide them into three blocks of choice profiles to generate three unique versions of the survey. We also ensure that no dominated strategy exists within each choice card.

Respondents are randomly assigned to answer one of three versions of six choice questions. Each question offers three options: two different options of a restored grassland and a status quo option. The status quo option indicates that there will be no restoration project, which means there will be no new grassland, and what would have been the restoration site will have minimal bird species and no multi-use trails, fishing, or camping. The variation of attributes in each question is designed to generate maximum estimation efficiency of the preferences underlying respondents' choices. An example of a choice question is shown in Figure 1.

[4]An advantage of coding attributes as categorical variables is that they allow researchers to test and examine a variety of continuous specifications after data have been collectedJohnson et al. (2013).

2.3 Information on childhood experience with nature

The final part of the survey collects standard demographic characteristics such as gender, income, education, and age. In order to estimate the relationships between an individual's childhood experiences and the values they place on grasslands and recreational amenities, we also collect data on respondents' childhood experiences with nature. Following research in psychology, we define childhood experience as an individual's life experience before thirteen years old (Collado and Corraliza, 2015). Features of respondents' childhood hometown locations are certainly exogenous to their WTP for grassland restoration as adults because children do not choose where they live. The extent of a person's childhood activities in nature is also likely to be heavily influenced by their parents' exogenous decisions to do (or not do) things like sign them up for nature classes and take them fishing or camping.

Specifically, the survey asks respondents how much they did the following things before they were 13 years old: visited nature, spent time outdoors, received environmental education, and engaged in hiking or biking, bird watching, fishing, and camping Respondents are also asked questions about whether they lived as children near any grassland or other nature areas.

2.4 Hypothetical bias

One common concern in stated preference valuation is hypothetical bias, which arises when respondents report a WTP that exceeds what they would actually pay using their own money. We apply three survey features that are widely applied in the literature to mitigate such bias. First, we include a modified cheap talk script based on Tonsor and Shupp (2011) and Aadland and Caplan (2006) in the survey instruction section to notify our respondents of the possibility of overstating their WTP in the survey (Cummings and Taylor, 1999).[5] Second, we include an opt-out reminder on each choice card to reduce

[5]Our cheap talk script is shown in the survey as: "Researchers find that people sometimes say in surveys that they are willing to pay more for something than they actually are. For this reason, please imagine your household actually paying the money for grassland restoration projects when you make each of your choices. Remember that paying for grassland restoration means that you have less money available for other purchases."

hypothetical bias (Ladenburg and Olsen, 2014). Third, we include a certainty follow-up question after each choice card to ask how sure the respondent was that they would choose the option they indicated with a 1 to 10 point scale from "very uncertain" to "very certain."- a method used to mitigate the influence of hypothetical bias on value estimates (Ready et al., 2010).

2.5 Focus group and survey administration

We held four focus groups in Illinois from the general population, with the participation of 9-10 people per group and a total duration of 60 minutes each. The participants replied to advertisements posted on a campus-wide email list and Craigslist and were rewarded with $20 cash. In each focus group, participants were given 15-20 minutes to answer a completed survey. Then they were asked to discuss aspects of the survey such as different attribute levels, and salience of the payment vehicle. In general, participants reported that the survey was easy to understand and answer, the survey language was not biased or too technical, and the payment vehicle used in the survey was believable. Participants also reported that it was easy for them to recall and answer questions about their childhood experiences with nature.

We made several adjustments based on the suggestions from the focus group participants. First, we added more pictures in the background information section to help them better understand the hypothetical scenarios. Second, we stated the distance between the restored grassland and respondents' home more precisely. Third, we added two fixed attributes to the description of the hypothetical restored grasslands, making clear that some birds, butterflies, and deer would always be present in a restored area and any features like trails would always be accessible to people with disabilities.

We launched a pilot version of the survey in mid-September through Qualtics and obtained 90 complete and usable surveys. We then distributed the survey online through a Qualtics panel in October 2019. An online survey can prevent respondents from reading ahead or going back and changing responses. It is also valuable to randomize the order of the presentation of choice sets to avoid learning and ordering effects. Data from all

choices are used in the analyses. We obtained 1018 usable surveys in total (330 in Illinois, 338 in Iowa, and 350 in Minnesota), which generated 6108 choice question observations.

3 Econometric Framework

3.1 Estimating Values

This paper applies the choice experiment method (Hanley et al., 1998) to estimate an individual's WTP for different attributes of a hypothetically restored grassland and examines the relationship between individuals' early-life experiences with nature and WTP for restoration. We analyze the responses collected by the choice experiment survey based on the random utility maximization (RUM) model (Louviere et al., 2000). Individuals choose from a set of grassland restoration scenarios with varying attributes to maximize their utility. The utility of individual n choosing alternative i in choice card t can be written as:

$$U_{nit} = -\alpha_n p_{it} + \beta'_{\mathbf{n}} \mathbf{X_{nit}} + \epsilon_{nit} \tag{1}$$

where $\mathbf{X}$ is a vector of variable attributes, p is the price (cost) of the choice scenario, and ϵ_{nit} is an unobserved random component that captures an individual's idiosyncratic tastes and is i.i.d extreme value type-one distributed (Louviere et al., 2000). The vector β represents a vector of individual-specific random coefficients, and α is the individual-specific coefficient on cost in the random parameter logit model.

We define k_n as the scale parameter for an respondent n as the variance of the error term can vary across respondents.[6] Dividing Equation 1 by the scale parameter to achieve a specification that has the same variance across all respondents:

$$\begin{aligned} U_{nit} = -(\frac{\alpha_n}{k_n}) p_{it} + (\frac{\beta'_n}{k_n}) X_{nit} + \epsilon_{nit} \rightarrow \\ U_{nit} = -\lambda_n p_{it} + c'_n X_{nit} + \epsilon_{nit} \end{aligned} \tag{2}$$

[6] $(Var(\epsilon_{nit} = k_n^2(\frac{\pi^2}{6}))$

The specification in Equation 2 is a mixed multinomial logit (MMNL) model in preference space (Train and Weeks, 2005). To take the advantage of directly specifying the distribution of WTP instead of deriving WTP indirectly based on the distribution of coefficients in the utility space, we estimate our model in the WTP space directly (Carson and Czajkowski, 2019). Since the WTP for an attribute is calculated as $wtp_n = \frac{c_n}{\lambda_n}$, we re-parameterize Equation 2 to get the model estimated in WTP-space (Train and Weeks, 2005):

$$U_{nit} = -\lambda_n p_{it} + \lambda_n \mathbf{wtp}' \mathbf{X_{nit}} + \epsilon_{nit} \tag{3}$$

We use the MMNL model estimated in WTP-space with fully correlated distributions of the random parameters to estimate individual's WTP for each attribute of a restored grassland. We assume the coefficient for the attribute cost p to be log-normally distributed, while the $\boldsymbol{wtp}$ for all each attribute is specified to be normally distributed. The model is estimated using maximum simulated likelihood (Scarpa et al., 2008; Train and Weeks, 2005).[7]

We also check the presence of attribute non-attendance (ANA) behavior in our survey. ANA in stated preference choice experiments occurs when respondents ignore one or more attributes in a choice experiment question. Estimated MWTP can be biased if the ANA issue exists but is not addressed. The stated and inferred ANA approaches are the two common methods to identify and address the presence of ANA behavior in a choice experiment. The stated ANA approach requires respondents to report the attributes they have ignored or given less than full attention in a survey. As we do not ask for such information in our survey questions, we use inferred ANA approach to examine and account for the existence of ANA behavior in our survey.

To account for inferred ANA, we follow Scarpa et al. (2009) and use an equality-constrained latent class (ECLC) model with ANA. Instead of using latent classes for accounting for respondents' heterogeneous preferences, the ECLC model with ANA classifies respondents into latent classes based on ANA behavior. We impose two constraints on the class coefficients so that each latent class represents an attribute attendance

[7]All specifications and analyses are estimated in Stata using the *mixlogitwtp* package (Hole, 2016).

pattern: (1) The coefficients of attributes that are assigned zero if the attributes are unattended. (2) All coefficients for attended attributes are constrained to be equal across classes. We categorize the attributes in the survey into two types (price and grassland) and follow Petrolia and Hwang (2020) to classify respondents into four classes: all attributes attended, price non-attended, grassland attributes non-attended, and none attributed attended. The grassland attributes include bird species, the length of trails, and options for fishing and camping, while the price attribute is the annual cost for grassland restoration each household needs to pay.

3.2 Values and Early-childhood Experience

Two methods are applied in the paper to quantify how people's WTP for grassland restoration is related to their childhood experiences. In the first method, we recover the conditional individual-specific means of MWTP for every respondent in our sample (Greene et al., 2005). We then regress an individual's MWTP for each attribute on their childhood experiences with nature and other current socioeconomic characteristics in an Ordinary Least Squares (OLS) model. The estimated results can be interpreted as the differences in WTPs for attributes between people with and without childhood experiences.

In the second method, we use a latent class model to examine how heterogeneity in people's MWTP for grassland restoration is associated with their childhood experiences with nature. The latent class model models unobserved preference heterogeneity across respondents as a discrete distribution (Boxall and Adamowicz, 2002; Greene and Hensher, 2003). The respondents are divided into **C** preference classes. People within a class have relatively homogeneous preferences, while respondents' preferences vary between classes. The probability of observing a particular sequence of choices for an individual n is:

$$P_n = \sum_{c=1}^{C} \pi_{cn}(\theta) \prod_{t=1}^{T} \prod_{i=1}^{I} [\frac{exp(x'_{nit}\beta_c)}{\sum_{i=1}^{I} exp(x'_{nit}\beta_c)}]^{y_{nit}} \tag{4}$$

where x_{nit} represents is a vector of alternative-specific attributes and y_{nit} is a binary variable that equals 1 if respondent n chooses alternative i in card t and equals 0 otherwise.

$\pi_{cn}(\theta)$ in Equation 4 represents the population share of class c and is given as:

$$\pi_{cn}(\theta) = \frac{exp((\theta_c z_n)}{1 + \sum_{c=1}^{C} \theta_c z_n} \tag{5}$$

where θ represents class membership model parameters and z_n is a constant.[8] The log-likelihood of the model is given as:

$$lnL(\beta, \theta) = \sum_{n=1}^{N} P_n(\beta_c) \tag{6}$$

We estimate β and θ by indirectly maximizing the expression above via the expectation-maximization algorithm (Train, 2008).[9] We calculate the MWTP for an attribute in each class by taking the ratio of the attribute's class-specific coefficient to the price coefficient.

In our primary latent class regressions, we allow respondents to map into two classes in order to simplify the discussion of the results. The optimal number of classes for the latent class model can be determined endogenously by data. Information criteria commonly applied to selecting the number of classes include the Bayesian information criterion (BIC) and the corrected-Akaike's information criterion (CAIC). To check our results' robustness to the number of classes, we present the CAIC and BIC associated with models run with different numbers of classes in Table A1 in the Appendix. Based on the information criterion, the optimal number of classes would be four classes. However, variation in CAIC and BIC is small across the different numbers of classes. The a latent class model with two classes fits the data well and provides reasonable estimations.

4 Results

Table 2 compares the mean of respondents' demographic characteristics to each state's average demographic characteristics based on data from the 2010 US Census, with standard deviations (where available) indicated within parenthesis. All of the state averages fall within one standard deviation of the sample means, showing our sample can be considered

[8] θ_c is normalized to 0 for identification purpose.

[9] The latent class model is estimated in Stata using *lclogit2*

as reasonable representative of adults in each state.[10] Figure 2 shows respondents' early-life experience in terms of nature-related activities (hiking, fishing, bird watching, and camping) and childhood location proximity. Sufficient variations exist in respondents' childhood experiences with nature. For instance, 53%, 12%, 26%, and 25% of respondents frequently hiked, watched birds, went fishing, and camped out in their childhood, while 13%, 53%, 27%, and 32% of respondents never did these four activities in their childhood, respectively.[11] Moreover, 45% and 34% of respondents lived near a grassland that they could visit on a day trip and within a 20 minutes walking distance respectively.

We might expect strong correlations between these measures of experience would limit our ability to separately explore the roles played by different kinds of activities. Figure 3 does show that there are some moderate positive correlations; for example, people who "visited nature" often are understandably likely to have camped, fished, and hiked often, and we see that people who visited grasslands often tended to live near them. However, the correlations among many of the elements of individual experience are very small, so multicollinearity should not be a serious issue in our analyses that explore the relationship between MWTP and childhood experiences.

4.1 MWTP for grassland restoration

Table 3 Column (1) presents the main regression results, estimating equation 3 (WTP-space) for the original data without certainty adjustment All mean MWTP coefficients in Column (1) are statistically significant at the 1% level. The coefficient on the status quo (no grassland restoration) option is large and negative, suggesting respondents would be willing on average to pay over $60 to have a restored grassland instead of the status quo even with none of the variable attributes in the choice scenarios present. The coefficients on all amenity attributes are positive and significant, which suggests that people would gain positive value from having recreational opportunities in a restored grassland.

[10] More detailed information of summary statistics for respondents characteristics can be found in Table A5 in Appendix.

[11] In the survey, respondents choose "Frequently" if they did an activity frequently in a specific season, every week, or every month before 13 years old. Respondents choose "occasionally if they did an activity once or twice a year or at least once ever before 13 years old.

We use certainty follow-up questions after each choice card to mitigate hypothetical bias and show the robustness of our results. We compare the MWTP with and without certainty adjustments and present the results in Table 3. Column (2) makes a certainty adjustment that recodes any follow-up questions with a certainty level less than 6 to the status quo option (Light adjustment). Column (3) makes a certainty adjustment that recodes any follow-up questions with a certainty level less than 7 to the status quo option (Heavy adjustment). The results in the table can be interpreted as moving from less restrictive (Column (1)) to more restrictive (Column (3)). MWTP values are still significant for all attributes with slightly smaller magnitudes. The adjustment used in Column (3) is a fairly strict certainty threshold (7 or higher on a scale of 10) (Ready et al., 2010), which may actually over-correct (Penn and Hu, 2020).

To explore the impact of ANA on our results, we followed Glenk et al. (2015) to compare the MWTP estimates from the MMNL model in WTP-space and the ECLC model estimates that infer ANA. The results are presented in Table 4. Column (1) shows the MWTP for each grassland restoration attribute with 95% confidence intervals estimated in the MMNL model in WTP-space using the data without certainty adjustment (these are the results from Table 3 Column (1)). The Column (2) and (3) show the estimated coefficients and MWTP for each attribute using the ECLC ANA model on the same unadjusted data. Model fit does not change much in the ECLC ANA model. AIC favors the MMNL model slightly, while BIC favors the latent class model slightly. The "price non-attended" class has the largest class share (45%), though the "all attendance" class is estimated to include 32% of the population. All in all, the probability of ANA is considerable but within the range of ANA probabilities reported in the literature (e.g., Scarpa et al. (2009), Glenk et al. (2015)). Since the MWTP is the ratio of the marginal utility of a grassland attribute and the marginal utility of cost attribute, price non-attendance can bias estimates of MWTP upward; such bias is apparent in the comparison of Columns (1) and (3). The MWTP for any restoration instead of the status quo falls from \$62 to \$53, and while the MWTP for bird species is stable, the average MWTP values for the recreational attributes fall by 38-49% after accounting for ANA behavior. We also

estimate the ECLC ANA model with light and heavy levels of certainty adjustments; those results are in Table 4 Columns (4) to (7). The impact of certainty adjustment on estimated MWTP values is similar to that found in the regular MMNL regressions, and certainty adjustment has little impact on the nature of the findings of ANA.

Policy-relevant valuation must control for sources of hypothetical bias; thus, we discuss the actual average values of these environmental goods focusing on the estimates from Table 4 Column (5) that account for ANA and do a light certainty adjustment. Even with those controls, the marginal values of grassland restoration and its recreational amenities are considerable. People would be willing to pay about $1 per year to have just one additional species of birds in the restored grassland.[12] People would gain utility from having recreational amenities in the grassland, with an average annual MWTP of about $9 for an additional mile of trails, $22 for camping, and $14 and $20 for having catch-and-release or unlimited fishing, respectively.[13] The magnitudes of these values are not unreasonably high in the context of similar recreational use values documented in the Non-market Valuation Database (NVD). For instance, the NVD suggets that the average value for camping is $20 per day per person and the average value for fishing is $50 per day per person.[14]

For further context, Table 5 Panel A provides an individual's total WTP (per year per household) for the attributes of a grassland restoration under two different hypothetical scenarios without including the value of the ASC. Focusing on the calculations in Column (4) that account for ANA and use a light certainty adjustment, a simple restoration that attracts 10 additional bird species, 1 mile of trail, and the option of catch-and-release fishing could be worth $32 per year per household. A more extensive restoration with 30 additional bird species, 3 miles of trails, the option of unlimited fishing, and campgrounds for camping could be worth $95 per year per household. If we add the non-use value of the

[12]The magnitude of MWTP for bird species is consistent with findings in Dissanayake and Ando (2014).

[13]The baseline attribute level for the fishing attribute is "no fishing," and for the camping attribute is "no camping."

[14]Non-market Valuation Databases is provided by the USGS Benefit transfer toolkit (https://sciencebase.usgs.gov/benefit-transfer/). It contains roughly 2900 value estimates and compiles economic values estimates and other information on resources not priced in conventional markets for natural resource planners, socioeconomic analysts, field staff, and public land managers.

restored grassland without any additional attributes as captured by the ASC, respondents are willing to pay $47 per year per household for the simple grassland restoration project and $108 per year per household for the extensive restoration.

4.2 Heterogeneity in MWTP by early life experience

Do the average values reported above vary among people with different childhood experiences with grasslands and outdoor recreation? Here we report the results of two types of analyses outlined in Section 3 that shed light on the answer to that question.

4.2.1 Individual-specific MWTP and OLS estimates

In the first method, we regress the conditional individual-specific means of MWTP for each attribute on individuals' childhood experiences with and exposure to nature and socioeconomic characteristics. One group of explanatory variables is a set of dummies for activities (camping, hiking, bird-watching, fishing, visiting nature, visiting grasslands, spending time outdoors, receiving environmental education) coded as one if an individual did an activity frequently in childhood and zero if an individual never did such activity or did it only occasionally. A second group of variables captures other features of their childhood. We measure whether they lived near any grassland that could be visited on a day trip or was within a 20 minute walk of their home, and include dummies for whether they had negative childhood experiences with nature and learned how to ride a bike. Finally, a third group of variables controls for demographic features of the respondents: age, gender, income, race, and the number of children currently in the household.

Table 6 presents the estimation results when the conditional individual-specific MWTP for each of the attributes including the status quo variable is recovered using the MMNL results from Table 3 Column (1) to create the dependent variables of the regressions in Columns (1) through (6). We find strong evidence of links between features of people's childhoods and the preferences they have today.

Some direct experiences seem influential. People who camped out frequently as children have higher MWTP for all attributes of a restored grassland; for example, they would be willing to pay over $6 more for having catch-and-release fishing, and nearly

$10 more to be able to set up camp. Additionally, respondents who received frequent environmental education have higher MWTP for bird species, hiking trails, and catch-and-release fishing. People who grew up fishing don't have broadly different preferences than other people, but they are willing to pay over $4 more for a restored grassland to have unlimited fishing available.

People's childhood location itself seems related to their current MWTP for grassland restoration. Respondents have higher MWTP for grassland restoration if they lived a short walk to a grassland, though the magnitudes of the MWTP differences are smaller than those associated with frequent camping. In contrast, living within day-trip distance of a grassland is not associated with any increased MWTP for a new grassland project.

People's childhood experience with nature appears related to the non-use value they place on restoring new grasslands. Respondents are willing to pay more to avoid the no-restoration status quo in the absence of the other amenity attributes if they grew up with a lot of camping and environmental education or if they simply lived near a grassland.

We evaluate whether these quantitative results are robust to the two different certainty adjustments. Respondents' MWTP for each attribute is recovered using the certainty adjustment 1 and 2 specifications in our analysis (Table 3 Column (2) and (3)). We regress those on respondents' childhood experiences and demographics and plot the estimations with 95% confidence interval in Figure 4. Many of the findings in Table 6 are robust, and while a few coefficients for camping lose significance with heavy certainty adjustment, some coefficients on environmental education and living close to a grassland become newly significant after adjustment. In general, the relationships between childhood experiences and their adult preferences for restoration are reasonably stable to certainty adjustment.

We also explore whether the results change if we alter how we define the dichotomous representation of whether someone had an experience. In this treatment, we code someone as having had an experience if they did it frequently or occasionally instead of never. To simplify the explanation, we call this experience coding scheme "broadly defined of experience" and the previous version the in the main specification as "narrowly defined experience". Correlation between childhood experiences with nature using the broad

definition of experience coding scheme is presented in Figure A2 in Appendix.

We regress the conditional individual-specific MWTP for each attribute recovered from the primary specification in our analysis (Table 3 Column (1)) on the same variables but with experience broadly defined. Results shown in Table 7 are similar to the results presented in Table 6 above in that people did camping and environmental education and lived close to a grassland have larger MWTP for many attributes of a grassland restoration (including avoiding the no-restoration status quo). Furthermore, we find that if one defines experience more broadly, fishing and bird-watching experience emerge to have significant positive associations with the values people place on many of the attributes. This finding may suggest that even a one-time experience with nature might positively affect the values people have for outdoor recreation and nature restoration.

4.2.2 Latent class model

In the second method, we use a latent class model to examine the links between childhood experiences and adult preference through a different lens. As explained more formally in Section 3, this model has two components: a regression that identifies the likelihood that a respondent is in each class, and a regression that estimates preferences over scenario attributes for each class from which average class-specific MWTP values are derived. The results described below use the narrow definition of childhood experience.

Table 8 shows how individual characteristics affect which group a respondent is most likely to be in. Looking at the results in Column (1) from unadjusted data, we see that respondents in class 1 are less likely than those in class 2 to have extensively camped, received environmental education, or visited nature, and they are less likely to have lived in walking distance to a grassland. To evaluate robustness, we conduct certainty adjustment and re-perform the latent class model analysis. The class membership results under certainty adjustments (Table 8 Columns (2) and (3)) are broadly consistent with the findings using the original sample, though the camping variable loses significance.

Figure 5 shows the MWTP for each attribute from both class 1 (less experience) and class 2 (more experience) with 95% confidence interval. Significant differences in MWTP exist between respondents in class 1 and class 2. More specifically, respondents

in class 1 would be willing to pay \$7.9 for having the option of camping in a restored grassland, while the class 2 respondents would be willing to pay \$51. Moreover, instead of restoring a grassland without any fishing option, the class 1 respondents would be willing to pay \$5 and \$6.5 for having the C&R fishing and the unlimited fishing, while people in class 2 would be willing to pay \$35 and \$49 for these two fishing options. In addition, the differences in MWTP between the class 1 and class 2 respondents are \$18 for an additional mile of trails and \$2 for an additional bird species in a restored grassland. Overall, the results suggest that the MWTP of grassland attributes for people who interacted with nature in their childhood are around five times higher than those who do not have such experiences. Figure 5 also shows the MWTP for both classes under certainty adjustments. Results with two levels of certainty adjustments are both rousted to the findings using the original data.

Figure 5 shows the MWTP for each attribute for both class 1 (less experience with nature) and class 2 (more experience with nature) with 95% confidence intervals. The figure reveals very striking differences in MWTP between people in the two groups. Respondents in the low-experience class would be willing to pay only \$8 for having the option of camping, while the respondents with more childhood nature experience would be willing to pay \$51. Likewise, low-experience respondents would be willing to pay only \$5 and \$6 to have C&R or unlimited fishing (respectively), while people in the high-experience group would be willing to pay \$35 and \$49 for these two fishing options. The differences in MWTP between the class 1 and 2 respondents are \$18 for an additional mile of trails and \$2 for an additional bird species in a restored grassland. Overall, the results in Figure 5 suggest that the MWTP of grassland attributes for people who interacted extensively with nature in their childhood are around five times higher than for those who do not have such experiences, and these results are robust to both level of certainty adjustment.

Results from both methods discussed above illustrate that people's MWTP for grassland restoration is affected by their childhood experiences. Specific childhood experiences that can positively affect an individual's WTP include whether people went camping, received

environmental education, and lived near a grassland within walking distance in their childhood. The differences in MWTP for grassland restoration between people with and without childhood nature experience can be large. People who experienced nature more in childhood (class 2) would be willing to pay over $60 per year per household to restore a grassland with 10 bird species, 1 mile of trail, and the option of C&R fishing, while other respondents in class 1 would only be willing to pay about $10 per household per year for such grassland (Table 5 Panel B - Scenario A). The difference in WTP between these two types of respondents is even larger if a restored grassland is equipped with better recreational attributes (Table 5 Panel B - Scenario B).

5 Conclusion and Discussion

We carried out a choice experiment survey in Illinois, Iowa, and Minnesota to analyze the relationship between individuals' childhood experiences with nature and their WTP for habitat restoration in the context of grasslands. This paper yields several findings that can have broad implications for conservation planning.

Our research helps government agencies and conservation groups plan efforts at grassland restoration by estimating grassland restoration values and how those values are affected by the recreational amenities included in restoration efforts. We find that the value of grassland restoration with extensive recreational attributes can be large. The average individual in the tallgrass prairie region of Illinois, Minnesota, and Iowa places positive annual values on bird diversity, trails for recreation, ponds with unrestricted fishing, and campgrounds for camping in a restored grassland. Agencies and non-profits involved in grassland restoration can use these results in conjunction with their knowledge of the costs of different features of grassland projects to shape plans for recreational activities in restored grassland to maximize the net benefits such areas produce.

Our results also suggest that people's demand for environmental goods is related to their childhood experiences. People are willing to pay more for grassland restoration if they grew up near grasslands, had actual experience in nature, or received environmental

education. Accumulated nature-related amenity capital seems to play an important role in affecting people's valuation for nature. Individuals can have higher MWTP for grassland restoration even they only occasionally did nature-related activities such as fishing. Moreover, the differences in MWTP between people with and without childhood experiences with nature can be large. People who did more with nature and lived near grasslands in childhood value a hypothetically restored grassland about five times more than those who do not have such experiences.

This result has several implications, if these patterns are causal. First, trends that limit how much children interact with nature may indeed undermine future public demand for conservation. It also seems, thought, that programs promoting nature education and activities for children may mitigate the decline in public demand for conservation.

Second, climate change may result in a spatial mismatch between species and ecosystems and those who value them. Ecologists have already documented shifts in growth zones (Kelly and Goulden, 2008) and predict large-scale changes in species ranges spurred by climate change (Walther et al., 2002; Forister et al., 2010). If a location changes to host a different set of species and type of natural landscape, people there may have limited appetite for protecting the species that now share their space.

Third, differential acquisition of childhood amenity capital could even be an element in the system dynamics that yield persistent patterns of environmental injustice in access to nature and green space. People choose where to live based at least in part on their budget constraint and WTP for environmental amenities (Tiebout, 1956; Banzhaf et al., 2019), and our findings imply that people's WTP for nature is affected by their childhood exposure. If people in poor and minority groups live in neighborhoods with fewer green spaces in their childhood because of budget constraints and structural racism in housing markets, they may have lower WTP for nature as adults and may be less willing to pay a premium to live near nature even if budget constraints and barriers to mobility are relaxed. Scholars of environmental justice could further explore whether this kind of feedback really does play a role in entrenching patterns of unjust access to nature in the U.S.

Future work could do more to unpack the mechanisms driving the relationships we have found between WTP for restoration and recreation and childhood exposure to and experience with nature. But this paper alone makes clear that investments in U.S. grassland habitat produce large benefits to the public, and there is a connection between the benefits current adults would gain from investments in nature and their exposure to natural areas in their youth.

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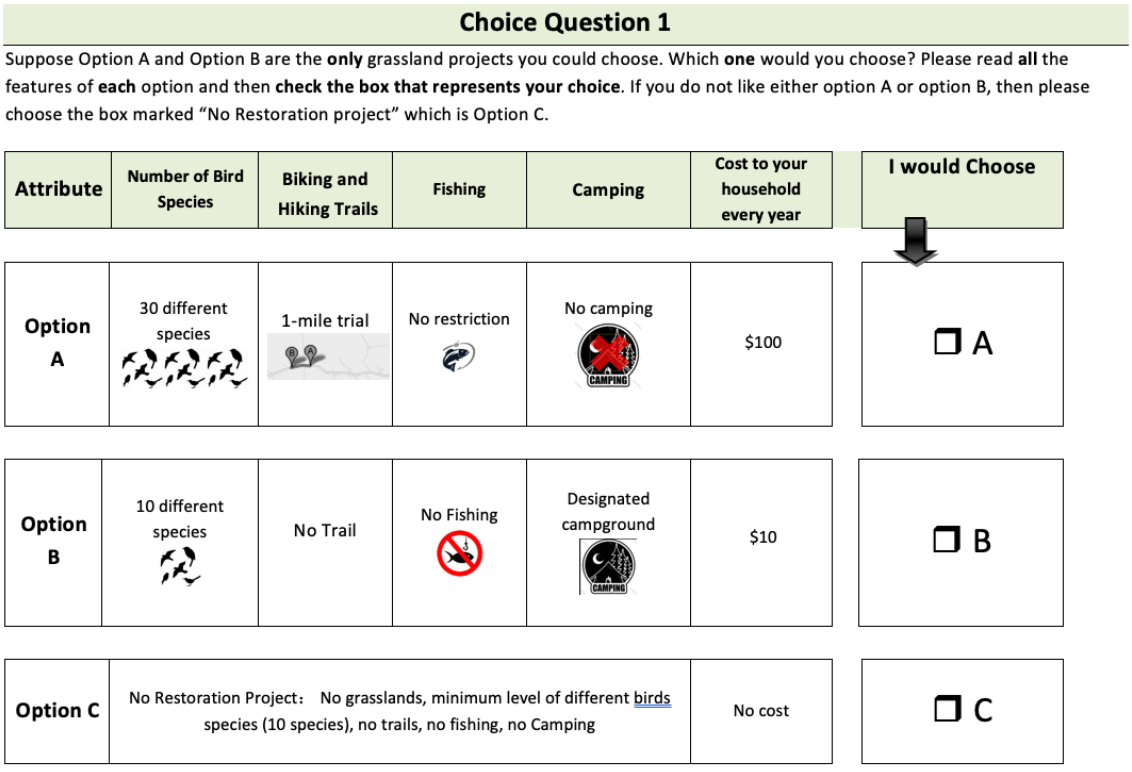
6 Figures and Tables

Figure 1: Sample Choice Question

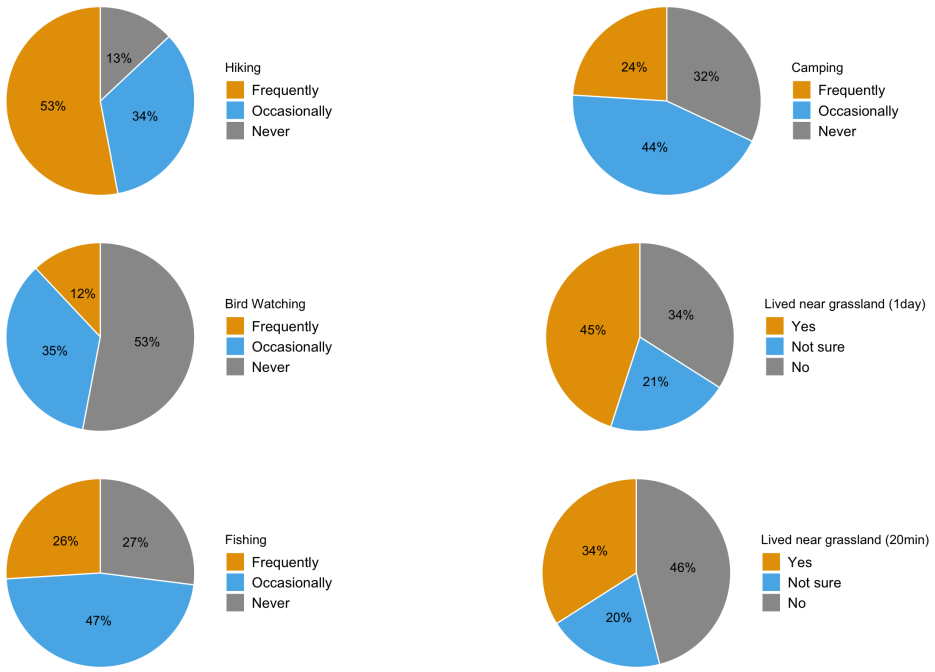


Choice Question 1

Suppose Option A and Option B are the **only** grassland projects you could choose. Which **one** would you choose? Please read **all** the features of **each** option and then **check the box that represents your choice**. If you do not like either option A or option B, then please choose the box marked "No Restoration project" which is Option C.

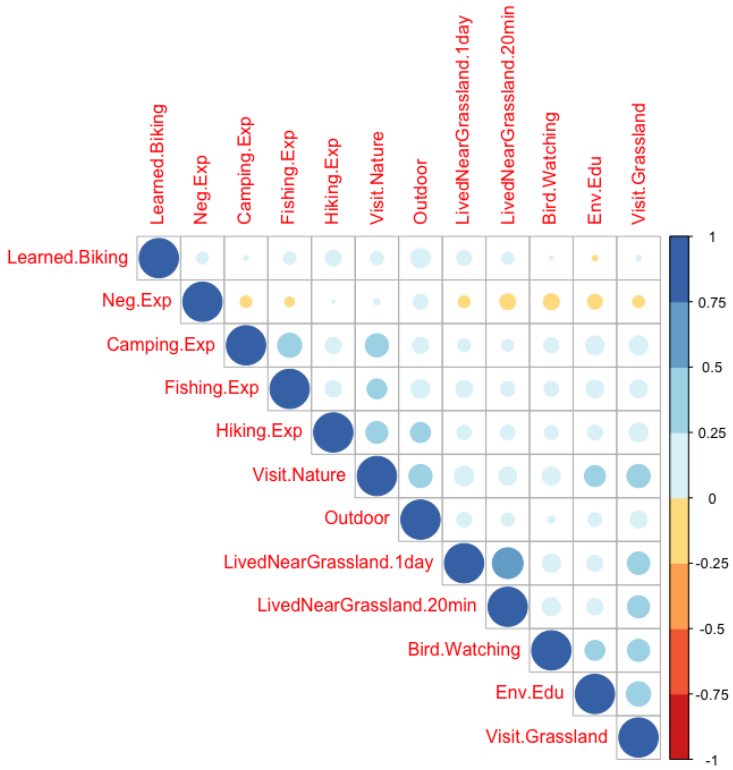
Attribute	Number of Bird Species	Biking and Hiking Trails	Fishing	Camping	Cost to your household every year	I would Choose
Option A	30 different species	1-mile trial	No restriction	No camping	$100	❒ A
Option B	10 different species	No Trail	No Fishing	Designated campground	$10	❒ B
Option C	No Restoration Project: No grasslands, minimum level of different birds species (10 species), no trails, no fishing, no Camping				No cost	❒ C

Figure 2: Respondents Early-life Experience with Nature Related Activities



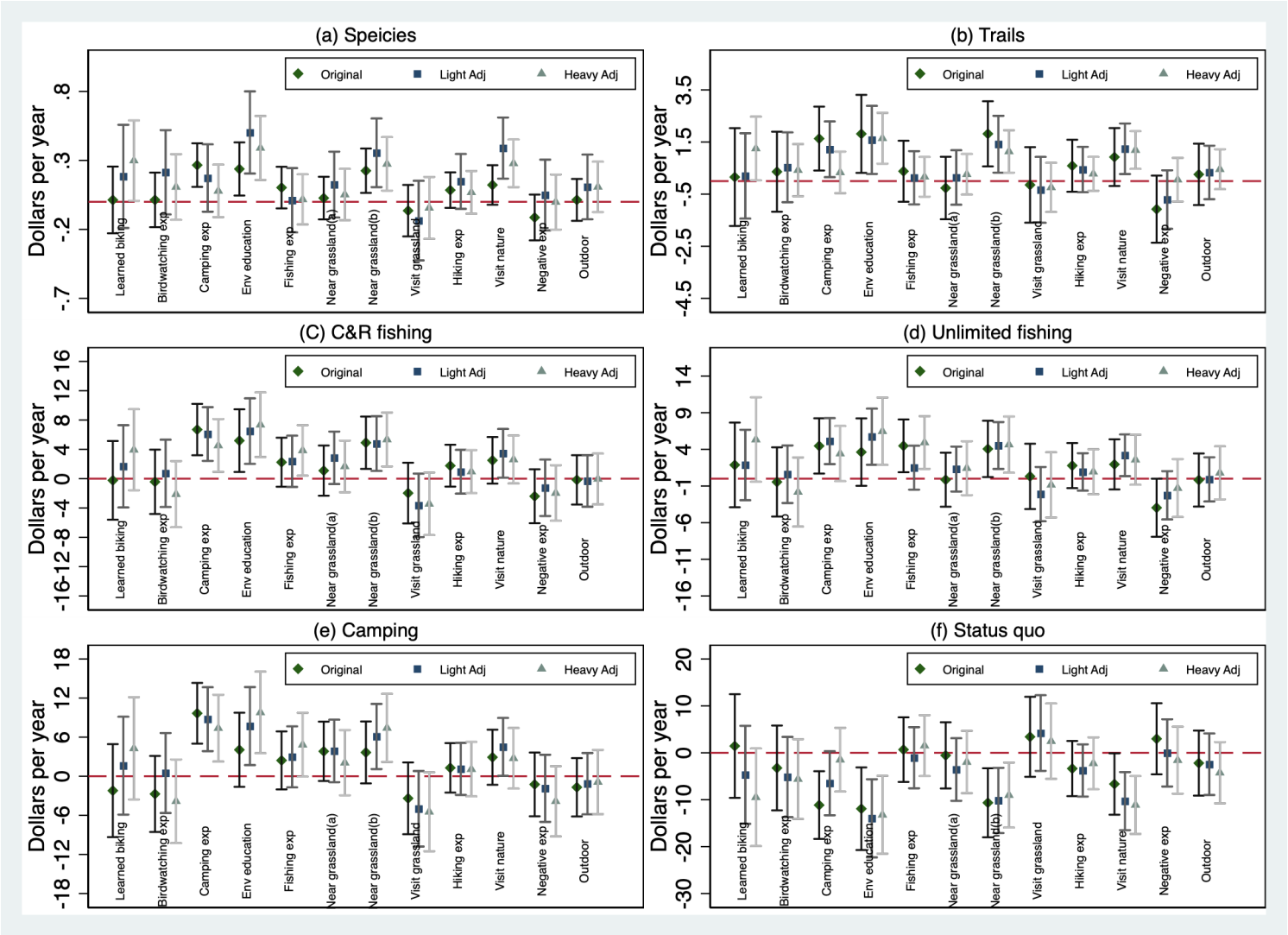
Note: This figure shows respondents' early-life experience (before 13 years old) in terms of nature-related activities (hiking, fishing, bird watching, and camping) and childhood location proximity. "Frequently" is defined as an individual did an activity every week, every month, or frequently in a specific season in their childhood. "Occasionally" is defined as an individual did an activity once or twice a year or at least once ever in their childhood. "Lived near grassland (1day)" means an respondent lived near any grassland that can be visited in a one-day trip in their childhood. "Lived near grassland (20 min)" means an respondent lived near any grassland that can be visited within a 20 minutes walking distance in their childhood.

Figure 3: Correlation between Childhood Experiences (Narrowly Defined Experience)



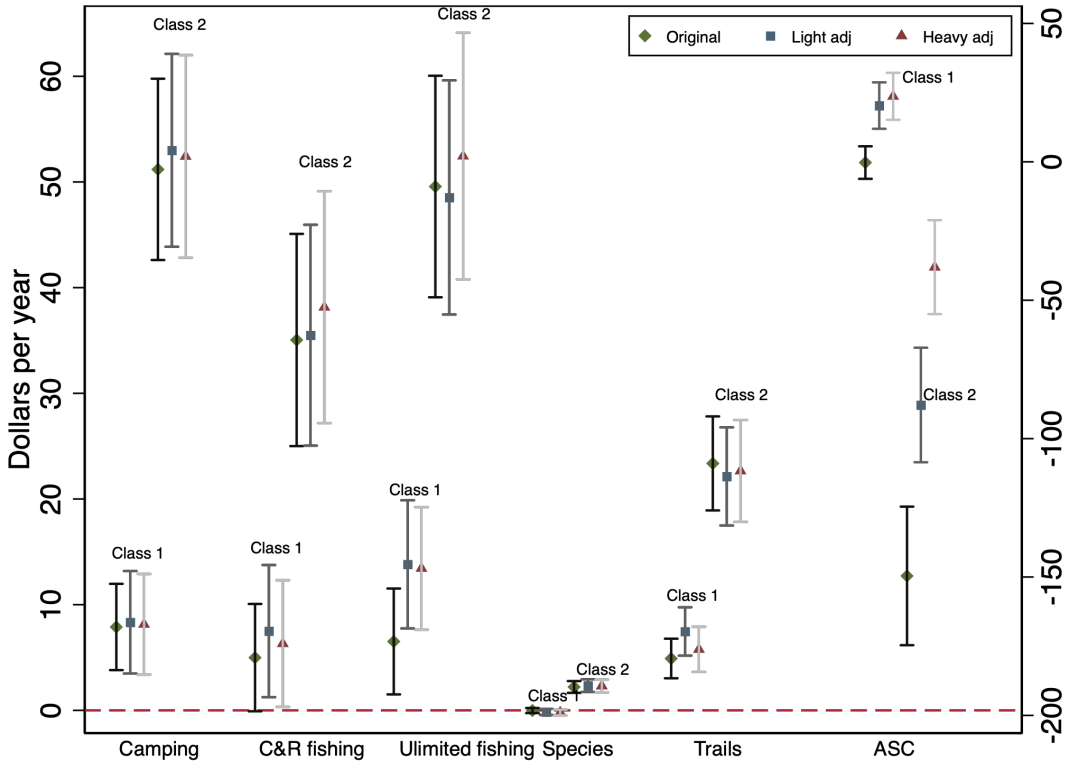
Note: This figure shows the correlations between childhood experiences. Respondents nature-related childhood experiences are narrowly defined, which means an individual's nature-related experience is coded as one if an individual did this activity frequently and zero if an individual never did such activity or did it occasionally in their childhood.

Figure 4: Relationship between Childhood Experience and WTP for Grassland Restoration with Certainty Adjustments (Narrowlly Defined Experience)



Note: Respondents' MWTP for each attribute is recovered using the orginal sample and the light and heavy certainty adjustment specifications in our analysis (Table 3 Column (1)- (3)). We regression the recovered individual-specific means on their childhood experiences with nature and demographics and plot the estimations with 95% confidence interval in the Figure. Part (a) - (f) show the relationship between childhood expereince and MWTP for different attributes of a restored grassland respectively.

Figure 5: Latent Class Model: MWTP for Grassland Restoration



Note: The figure shows the MWTPs for each attribute from both class 1 (less experience) and class 2 (more experience) with 95% confidence intervals. The respondents are classified into two classes based on their childhood expereinces with nature (narraowlly defined expereince) and demographic characteristics. Respondents with nature-lated childhood experiences are more likely to be in class 2, while respodents without nature-lated childhood experiences are more likely to be in class 1.

Table 1: Survey Attributes and Levels

Attribute	Levels	Description
Number of species	(10 species) 20 species 30 species	The number of different bird species in the restored grassland. A higher number means you are more likely to see different kinds of birds in the grassland
Multi-use trails	(0 mile) 1 mile 2 miles 3 miles	Length of multi-use, marked trails in the restored grassland. Trails allow visitors to experience the tallgrass prairie by walking or biking. No motorized vehicle allowed. All trails are open 24 hours
Fishing	(No fishing) Catch and release only Unlimited fishing	At least one lake or pond on the restored grassland has fish. Different levels of fishing on the restored grassland may be allowed. A current state fishing license is required
Camping	(Camping is not allowed) Camping is allowed	Different levels of camping in the restored grassland may be allowed.
Annual cost to household	(0) $10 $55 $100	The amount of money your household will have to pay every year to restore and maintain the grassland. The money will be paid through an increase in annual property tax.

Note: Status quo levels for each attribute are presented in parentheses.

Table 2: Comparison of State Population and Sample

State		Income[a] ($1000)	Education (% of adults with Bachelor degree or above)	Female (% female over age 18)
Illinois	State Mean	54	30	51
	Sample Mean[b]	50-75	52(50)	66(47)
Iowa	State Mean	58	28.9	50
	Sample Mean	50-75	38 (49)	71(45)
Minnesota	State Mean	65	34	50
	Sample Mean	50-75	49(50)	65(48)

Note:
[a] Sample mean represents median income range for survey respondents
[b] Values in parentheses indicate standard deviations

Table 3: MWTP to Restore Grassland - the MMNL Results in the WTP-Space

	(1)	(2)	(3)
Mean MWTP Coefficients	Original Sample	Light Adjustment	Heavy Adjustment 2
Status quo	-61.826***	-34.237***	-6.911*
	(4.465)	(4.103)	(3.812)
Species	1.099***	0.959***	0.618***
	(0.161)	(0.176)	(0.135)
Trails	16.952***	15.889***	13.503***
	(1.404)	(1.269)	(1.048)
C&R fishing	27.802***	25.217***	25.659***
	(3.049)	(3.193)	(2.864)
Unlimited fishing	38.816***	37.376***	38.693***
	(3.383)	(3.213)	(3.342)
Camping	34.637***	32.161***	34.201***
	(2.923)	(3.049)	(3.007)
λ (cost coefficient)	-3.579***	-3.580***	-3.500***
	(0.054)	(0.060)	(0.061)
Std. Dev.			
Status quo	63.239***	55.995***	57.383***
	(5.829)	(6.727)	(6.153)
Species	1.356***	2.120***	1.540***
	(0.198)	(0.259)	(0.218)
Trails	10.520***	10.713***	6.303***
	(1.747)	(1.522)	(1.631)
C&R fishing	30.963***	33.261***	32.835***
	(3.649)	(4.454)	(4.030)
Unlimited fishing	39.231***	26.332***	39.193***
	(3.352)	(3.865)	(3.199)
Camping	45.216***	44.693***	47.541***
	(2.534)	(3.540)	(3.045)
λ (cost coefficient)	1.219***	1.290***	1.294***
	(0.070)	(0.102)	(0.096)
Observation (Respondent)	18324 (1018)	18324 (1018)	18324 (1018)
LR chi2	3174.531	3612.936	3457.849
Prob >chi2	0	0	0
Log lik.	-4828	-4992.2	-4984.6
BIC	9960	10327.94	10312.76
AIC	9686	10054.39	10039.2

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Column (1) provides the results the WTP-space model for the full sample. Column (2) makes a certainty adjustment that recodes any follow-up questions with a certainty level less than 6 to the status quo option. Column (3) makes a certainty adjustment that recodes any follow-up questions with a certainty level less than 7 to the status quo option. This adjustment can be interpreted as moving from less restrictive (Column (1)) to more restrictive (Column (3)). MWTP values are still significant for all attributes with slightly smaller magnitudes. The restriction used in Column (3) can be considered as a fairly strict certainty threshold (7 or higher on a scale of 10) (Ready et al., 2010). Strict restrictive assumptions regarding certainty adjustments may over-correct hypothetical bias and underestimate the true MWTP (Penn and Hu, 2020).

Table 4: Equality-constrained Latent Class (ECLC) Model Accounting for Attribute Non-attendance (ANA)

	MMNL -WTP space	ECLC ANA Model		ANA with Light Adj		ANA with Heavy Adj	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Coef	MWTP	Coef	MWTP	Coef	MWTP
Status quo	-61.8	-1.271***	-52.8	-0.305***	-12.6	0.536***	27.4
	[-70.6,-53.1]	(0.141)	[-64.5,-41]	(0.098)	[-20.5,-4.7]	(0.107)	[15.1,39.6]
Species	1.1	0.024***	1	0.022***	0.9	0.018***	0.9
	[0.8,1.4]	(0.003)	[0.8,1.2]	(0.002)	[0.7,1.1]	(0.002)	[0.7,1.2]
Trails	17	0.229***	9.5	0.219***	9.1	0.199***	10.2
	[14.2,19.7]	(0.021)	[7.7,11.3]	(0.018)	[7.4,10.8]	(0.017)	[8.1,12.3]
C&R fishing	27.8	0.363***	15	0.345***	14.3	0.332***	17
	[21.8,33.8]	(0.048)	[11.0,19.1]	(0.045)	[10.4,18.1]	(0.043)	[12.3,21.6]
Unlimited fishing	38.8	0.459***	19.1	0.473***	19.6	0.470***	24.1
	[32.2,45.4]	(0.050)	[14.7,23.4]	(0.045)	[15.3,23.8]	(0.042)	[18.8,29.3]
Camping	34.6	0.567***	23.5	0.520***	21.5	0.457***	23.4
	[28.9,40.4]	(0.046)	[19.6,27.5]	(0.036)	[18.2,24.9]	-0.020***	[19.4,27.4]
Cost coefficient		-0.024***		-0.024***		-0.020***	
		(0.001)		(0.001)		(0.001)	
Class share							
All Attended		0.32		0.35		0.33	
Price Non-attended		0.45		0.4		0.4	
Grassland Attributes Non-attended		0.1		0.14		0.12	
No Attribute attended		0.13		0.11		0.15	
AIC	9686	9723		10060		10096	
BIC	9960	9787		10124		10160	
LL	-4808	-4848		-5017		-5035	
N	18324	18324		18324		18324	

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Column (1) shows the MWTP for each grassland restoration attribute with 95% confidence intervals estimated in the MMNL model in WTP-space (Based on results in Table 3 Column (1)). The Column (2) and (3) show the estimated coefficients and MWTP for each attribute using the ECLC ANA model. The Column (4) and (5) presents the ECLC ANA model results with a light certainty adjustment and the Column (6) and (7) presents the results with a heavy certainty adjustment.

Table 5: Benefits per Household for Hypothetical Scenarios

Panel A: Total WTP without ASC				
Scenario	(1) Original	(2) Light Adjustment	(3) ANA	(4) ANA with Light Adj
(A) Grassland with 10 bird species, 1 mile trail, C&R fishing	\$55.7	\$50.7	\$34.5	\$32.4
(B) Grassland with 30 bird species,3 mile trail unlimited fishing, camping	\$157.3	\$138.5	\$101	\$95.4
Panel B: Total WTP with ASC				
Scenario	(1) Original	(2) Light Adjustment	(3) ANA	(4) ANA with Light Adj
(A) Grassland with 10 bird species, 1 mile trail, C&R fishing	\$117	\$84.9	\$87.3	\$46.96
(B) Grassland with 30 bird species, 3 mile trail unlimited fishing, camping	\$218	\$172.2	\$153.75	\$108
Panel C: Total WTP by class - without ASC				
Scenario	(1) Class 1 (less exp)	(2) Class 2 (more exp)		
(A) Grassland with 10 bird species, 1 mile trail, C&R fishing	\$9.8	\$60.63		
(B) Grassland with 30 bird species, 3 mile trail, unlimited fishing, camping	\$29	\$177		
Panel D: Total WTP by class - with ASC				
Scenario	(1) Class 1 (less exp)	(2) Class 2 (more exp)		
(A) Grassland with 10 bird species, 1 mile trail, C&R fishing	\$9.8	\$210.63		
(B) Grassland with 30 bird species, 3 mile trail, unlimited fishing, camping	\$29	\$327		

Note: Panel A provides an individual's WTP (per year per household) for grassland restoration under two different hypothetical restoration scenarios based on MWTP estimates in Table 3 and Table 4.
Panel B provides the WTPs (per year per household) for grassland restoration from two classes of respondents under two two different hypothetical restoration scenarios. Respondents in class 1 are less likely to have childhood experience with nature, while respondents in class 2 are more likely to have childhood experience with nature.

Table 6: Relationship between Childhood Experience and MWTP for Grassland Restoration (Narrowly Defined Experience)

	(1) Species	(2) Trails	(3) C&R fishing	(4) Unlimited fishing	(5) Camping	(6) Status quo
Camping exp	0.266***	1.632***	6.701***	4.470**	9.664***	-11.141***
	(0.081)	(0.626)	(1.788)	(1.924)	(2.378)	(3.682)
Fishing exp	0.103	0.378	2.245	4.482**	2.432	0.678
	(0.077)	(0.597)	(1.707)	(1.837)	(2.270)	(3.516)
Brid-watching exp	0.014	0.360	-0.426	-0.445	-2.717	-3.233
	(0.101)	(0.783)	(2.239)	(2.409)	(2.978)	(4.611)
Hiking exp	0.085	0.589	1.771	1.790	1.293	-3.357
	(0.066)	(0.510)	(1.457)	(1.568)	(1.938)	(3.001)
Lived near grassland(1day)	0.027	-0.264	1.099	-0.142	3.828*	-0.549
	(0.079)	(0.611)	(1.747)	(1.881)	(2.324)	(3.599)
Lived near grassland(20min)	0.225***	1.815***	4.907***	4.061**	3.657	-10.651***
	(0.082)	(0.638)	(1.822)	(1.961)	(2.423)	(3.752)
Visited nature	0.122*	0.924	2.505	1.955	2.918	-6.654**
	(0.073)	(0.567)	(1.621)	(1.745)	(2.156)	(3.339)
Env education	0.238**	1.813**	5.192**	3.630	4.065	-11.920***
	(0.098)	(0.763)	(2.182)	(2.348)	(2.902)	(4.494)
Outdoor	0.014	0.259	-0.162	-0.183	-1.691	-2.195
	(0.077)	(0.601)	(1.717)	(1.848)	(2.284)	(3.537)
Visited grassland	-0.064	-0.145	-1.968	0.315	-3.390	3.412
	(0.095)	(0.739)	(2.113)	(2.274)	(2.810)	(4.351)
Learned biking	0.014	0.155	-0.226	1.879	-2.206	1.446
	(0.123)	(0.958)	(2.738)	(2.946)	(3.641)	(5.639)
Negative exp	-0.114	-1.077	-2.397	-3.964*	-1.252	2.990
	(0.085)	(0.657)	(1.878)	(2.021)	(2.497)	(3.868)
Constant	0.957***	16.639***	24.499***	35.985***	28.154***	-57.564***
	(0.169)	(1.311)	(3.746)	(4.032)	(4.983)	(7.716)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1017	1017	1017	1017	1017	1017

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: The presents the OLS results when we regression respondents' MWTP for each attribute on their childhood experiences with nature while controlling for their demographics like age, gender, income, race, and the number of children currently in the household. The conditional individual-specific MWTP is recovered using the primary specification in our analysis (Table 3 Column (1)). Individual's childhood experience with nature is narrowly defined. An individual's nature-related experience is coded as one if an individual did this activity frequently and zero if an individual never did such activity or did it occasionally in their childhood.

Table 7: Relationship between Childhood Experience and WTP for Grassland Restoration (Broadly Defined Experience)

	(1) Species	(2) Trails	(3) C&R fishing	(4) Unlimited fishing	(5) Camping	(6) Status quo
Camping exp	0.188***	0.994*	4.739***	3.570**	8.061***	-7.149**
	(0.071)	(0.556)	(1.589)	(1.707)	(2.134)	(3.277)
Fishing exp	0.271***	1.772***	5.529***	7.691***	4.376**	-8.262**
	(0.073)	(0.569)	(1.626)	(1.751)	(2.184)	(3.353)
Brid-watching exp	0.155**	1.066**	3.353**	3.511**	3.118	-5.892*
	(0.066)	(0.513)	(1.465)	(1.574)	(1.968)	(3.021)
Hiking exp	0.149	1.359*	2.907	3.857	2.111	-7.447
	(0.103)	(0.802)	(2.290)	(2.472)	(3.076)	(4.722)
Visited nature	-0.003	-0.103	0.587	-2.910	1.564	-2.967
	(0.124)	(0.966)	(2.758)	(2.963)	(3.705)	(5.688)
Env education	0.176**	1.374**	3.493**	3.774**	2.818	-8.130**
	(0.072)	(0.562)	(1.606)	(1.725)	(2.157)	(3.311)
Outdoor	0.312**	2.304*	6.436*	6.299*	6.326	-16.158**
	(0.156)	(1.218)	(3.479)	(3.773)	(4.672)	(7.173)
Visited grassland	0.088	0.778	1.660	1.680	0.996	-4.553
	(0.079)	(0.618)	(1.767)	(1.899)	(2.373)	(3.643)
Lived near grassland(1day)	-0.048	-0.795	-0.601	-0.080	1.878	3.062
	(0.079)	(0.612)	(1.748)	(1.952)	(2.347)	(3.604)
Lived near grassland(20min)	0.189**	1.621***	3.997**	3.303*	2.317	-9.456**
	(0.080)	(0.622)	(1.777)	(1.909)	(2.387)	(3.665)
Learned biking	-0.101	-0.670	-2.854	0.932	-5.424	6.812
	(0.122)	(0.951)	(2.716)	(2.952)	(3.648)	(5.600)
Negative exp	-0.128	-1.178*	-2.733	-4.384**	-1.478	3.486
	(0.081)	(0.631)	(1.804)	(1.938)	(2.422)	(3.719)
Constant	0.339*	12.298***	10.998**	25.190***	13.308**	-28.220***
	(0.204)	(1.587)	(4.534)	(4.871)	(6.089)	(9.349)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
N	1017	1017	1017	1017	1017	1017

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: In an OLS model, we regression respondents' MWTP for each attribute on their childhood experiences with nature while controlling for their socio-demographics informations. We recover the conditional individual-specific MWTP for each attribute using the primary specification in our analysis (Table 3 Column (1)). Individual's childhood experience with nature is broadly defined. An individual's nature-related experience is coded as one if an individual did this activity frequently or occasionally and zero if an individual never did such activity in their childhood.

Table 8: Latent Class Model: Class Membership for All Variables (Narrowly Defined Experience)

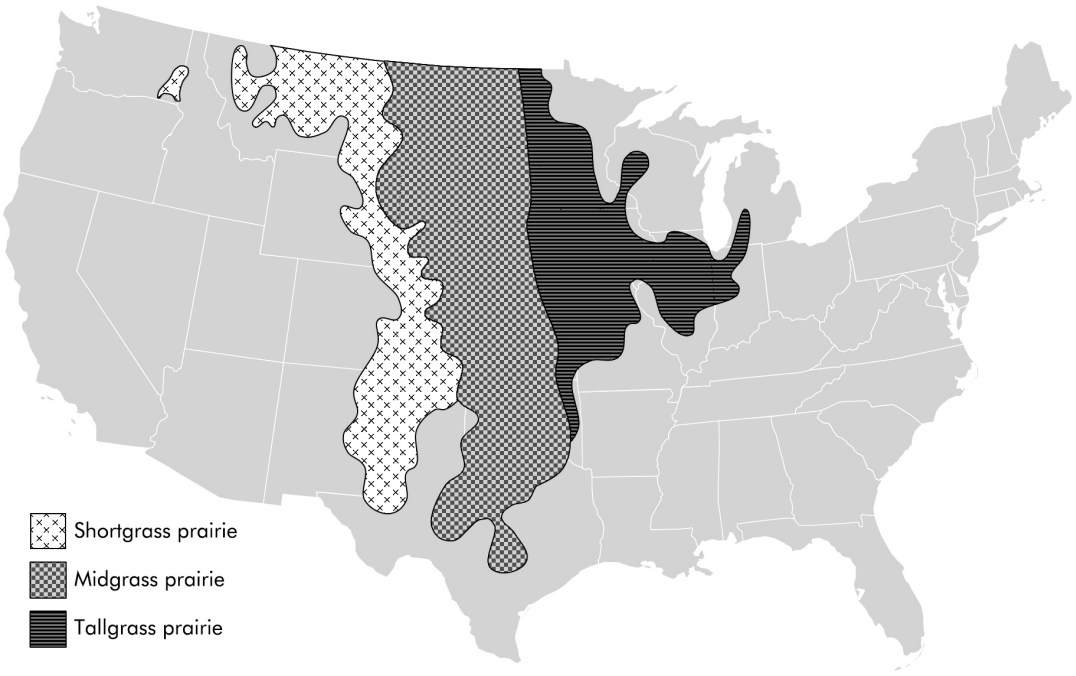
	(1) Original sample	(2) Light Adjustment	(3) Heavy Adjustment
Camping exp	-0.549**	-0.32	-0.266
	(0.239)	(0.22)	(0.21)
Fishing exp	-0.121	-0.147	-0.212
	(0.215)	(0.20)	(0.19)
Bird-watching exp	-0.126	-0.206	0.04
	(0.297)	(0.28)	(0.26)
Hiking exp	-0.259	-0.229	-0.118
	(0.169)	(0.16)	(0.16)
Lived near grassland (1day)	-0.018	-0.106	-0.004
	(0.203)	(0.19)	(0.19)
Lived near grassland (20 min)	-0.501**	-0.560***	-0.585***
	(0.232)	(0.22)	(0.21)
Visited nature	-0.528***	-0.526***	-0.571***
	(0.193)	-0.181	(0.17)
Env education	-0.743**	-0.667**	-0.672**
	(0.331)	(0.28)	(0.27)
Outdoor	-0.198	-0.167	-0.177
	(0.191)	(0.19)	(0.18)
Visited grassland	0.137	0.277	0.062
	(0.279)	(0.25)	(0.25)
Learned biking	0.287	0.025	-0.316
	(0.318)	(0.30)	(0.30)
Negative exp	-0.041	-0.052	0.004
	(0.231)	(0.21)	(0.21)
Female	-0.313*	-0.188	-0.098
	(0.169)	(0.17)	(0.16)
Hispanic	-0.720*	-0.157	-0.206
	(0.424)	(0.34)	(0.33)
Black	-0.552	-0.261	-0.691*
	(0.490)	(0.43)	(0.42)
White	0.256	0.134	-0.076
	(0.333)	(0.32)	(0.31)
# child	-0.046	-0.103	-0.037
	(0.078)	(0.07)	(0.07)
High edu	0.054	-0.027	0.122
	(0.226)	(0.22)	(0.21)
High income	0.330*	0.356*	0.265
	(0.195)	(0.19)	(0.19)
Constant	-0.312	0.543	0.999**
	(0.435)	(0.43)	(0.41)
N	18306	18306	18306

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Using class 2 as the reference class, the class membership provided in Table 8 Column (1) shows that compared to people in class 2, respondents in class 1 are less likely to have childhood experiences with nature. To justify our results' robustness, we conduct certainty adjustment and re-perform the latent class model analysis. The class membership results under certainty adjustments are presented in Column (2)-(3), which are consistent with the findings using the original sample.

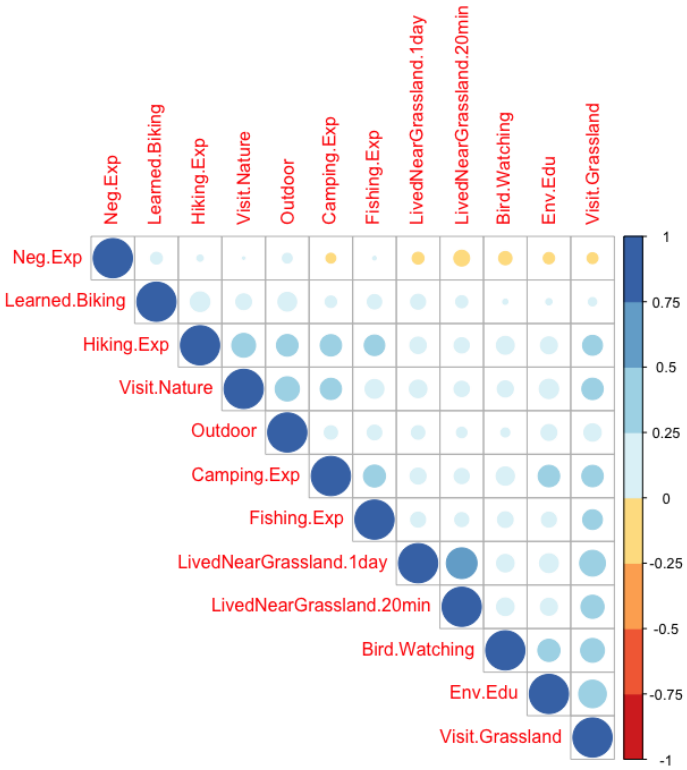
A Appendix A

Figure A1: Distribution of Grassland types in the U.S.



Source: Modified from image obtained from Wikimedia Commons
($http://commons.wikimedia.org/wiki/File:US\_Great\_Plains\_Map.svg$).

Figure A2: Correlation between Childhood Experiences (Broadly Defined Experience)



Note: This figure shows the correlations between childhood experiences. Respondents nature-related childhood experiences are broadly defined, which means an individual's nature-related experience is coded as one if an individual did this activity frequently or occasionally and zero if an individual never did such activity in their childhood.

Table A1: Latent class model - number of classes

Classess	Log-likelihood	Nparam	AIC	CAIC	BIC
2	-4946.15	28	9948.299	10114.22	10086.22
3	-4740.54	49	9579.083	9869.437	9820.437
4	-4652.39	70	9444.784	9859.576	9789.576
5	-4623.43	91	9428.859	9968.088	9877.088
6	-4490.17	112	9204.341	9868.007	9756.007
7	-4446.65	133	9159.298	9947.403	9814.403
8	-4432.01	154	9172.013	10084.55	9930.555
9	-4391.62	175	9133.243	10170.22	9995.222

Note: This table presents the CAIC and BIC associated with the different numbers of classes used in the Latent Class Model estimation. Based on the information criterion, the optimal number of classes would be four classes. However, variation in CAIC and BIC are small across the different numbers of classes. Thus, we believe that a latent class model with two classes can fit the data well and provide reasonable estimations. In this paper, we classify respondents into two classes based on their childhood experience with nature and demographic characteristics. We pick two classes in this paper to simplify the discussion of the results and compare respondents with and without childhood experiences.

Table A2: MWTP for Grassland Restoration in WTP Space - by State

Mean MWTP Coefficients	(1) Full Sample	(2) Illinois	(3) Iowa	(4) Minnesota
Status Quo	-69.277***	-37.096***	-46.867***	-62.819***
	(4.82)	(5.93)	(6.32)	(7.05)
Species	1.194***	1.478***	1.071***	1.269***
	(0.19)	(0.29)	(0.25)	(0.25)
Trails	16.477***	24.477***	17.928***	16.124***
	(1.49)	(2.75)	(2.35)	(2.29)
C&R fishing	28.070***	34.546***	40.122***	20.054***
	(3.23)	(5.77)	(5.35)	(4.87)
Unlimited fishing	40.955***	38.474***	46.869***	33.622***
	(3.57)	(6.44)	(5.89)	(5.59)
Camping	35.001***	37.692***	50.117***	24.238***
	(3.40)	(5.38)	(5.52)	(4.40)
Cost	-3.525***	-3.572***	-3.526***	-3.321***
	(0.07)	(0.10)	(0.11)	(0.09)
SD of Random Parameters				
Status Quo	65.418***	36.863***	63.489***	70.974***
	(6.406)	(8.015)	(7.711)	(11.505)
Species	1.445***	1.589***	0.714*	1.836***
	(0.180)	(0.283)	(0.376)	(0.358)
Trails	10.227***	17.981***	13.034***	12.073***
	(1.652)	(2.112)	(2.321)	(3.277)
C&R fishing	30.428***	41.586***	38.231***	45.900***
	(4.066)	(5.408)	(6.946)	(6.131)
Unlimited fishing	39.751***	41.995***	42.636***	53.875***
	(3.906)	(5.235)	(6.711)	(4.234)
Camping	47.843***	50.626***	56.667***	45.559***
	(2.999)	(4.159)	(4.156)	(5.456)
Cost	1.474***	1.444***	1.378***	1.491***
	(0.096)	(0.141)	(0.143)	(0.151)
N	18324	5940	6084	6300

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: Column (1) presents the results from our primary specification (Table 3 Column (1)). Column (2)-(4) present the MMNL results estimated in WTP-space separately for Illinois, Iowa, and Minnesota. Results from each of these states are mostly consistent with the results from the pooled sample. Respondents in all three states prefer to have some restoration rather than none, and they would gain utility from having more bird species, longer hiking trails, provided with the option of fishing and camping in a restored grassland.

Table A3: Relationship between Childhood Experience and WTP for Grassland Restoration (Narrowly Defined Experience)- Full Table Results

	(1) Species	(2) Trails	(3) C&R fishing	(4) Unlimited fishing	(5) Camping	(6) Status quo
Camping exp	0.266***	1.632***	6.701***	4.470**	9.664***	-11.141***
	(0.081)	(0.626)	(1.788)	(1.924)	(2.378)	(3.682)
Fishing exp	0.103	0.378	2.245	4.482**	2.432	0.678
	(0.077)	(0.597)	(1.707)	(1.837)	(2.270)	(3.516)
Brid-watching exp	0.014	0.360	-0.426	-0.445	-2.717	-3.233
	(0.101)	(0.783)	(2.239)	(2.409)	(2.978)	(4.611)
Hiking exp	0.085	0.589	1.771	1.790	1.293	-3.357
	(0.066)	(0.510)	(1.457)	(1.568)	(1.938)	(3.001)
Lived near grassland(1day)	0.027	-0.264	1.099	-0.142	3.828*	-0.549
	(0.079)	(0.611)	(1.747)	(1.881)	(2.324)	(3.599)
Lived near grassland(20min)	0.225***	1.815***	4.907***	4.061**	3.657	-10.651***
	(0.082)	(0.638)	(1.822)	(1.961)	(2.423)	(3.752)
Visited nature	0.122*	0.924	2.505	1.955	2.918	-6.654**
	(0.073)	(0.567)	(1.621)	(1.745)	(2.156)	(3.339)
Env education	0.238**	1.813**	5.192**	3.630	4.065	-11.920***
	(0.098)	(0.763)	(2.182)	(2.348)	(2.902)	(4.494)
Outdoor	0.014	0.259	-0.162	-0.183	-1.691	-2.195
	(0.077)	(0.601)	(1.717)	(1.848)	(2.284)	(3.537)
Visited grassland	-0.064	-0.145	-1.968	0.315	-3.390	3.412
	(0.095)	(0.739)	(2.113)	(2.274)	(2.810)	(4.351)
Learned biking	0.014	0.155	-0.226	1.879	-2.206	1.446
	(0.123)	(0.958)	(2.738)	(2.946)	(3.641)	(5.639)
Negative exp	-0.114	-1.077	-2.397	-3.964*	-1.252	2.990
	(0.085)	(0.657)	(1.878)	(2.021)	(2.497)	(3.868)
Female	-0.011	0.009	-0.329	-0.470	1.029	-1.050
	(0.066)	(0.516)	(1.475)	(1.588)	(1.962)	(3.039)
Hispanic	0.238*	2.058**	5.510*	3.964	6.250	-12.532**
	(0.130)	(1.011)	(2.889)	(3.110)	(3.843)	(5.951)
Black	0.309*	1.721	7.861**	8.322**	11.888**	-7.502
	(0.168)	(1.301)	(3.717)	(4.000)	(4.944)	(7.656)
White	-0.081	-1.087	-0.984	-1.140	2.418	6.368
	(0.126)	(0.982)	(2.807)	(3.021)	(3.733)	(5.781)
# children	0.047*	0.116	1.302**	1.070	2.393***	-0.835
	(0.028)	(0.219)	(0.626)	(0.674)	(0.833)	(1.290)
High edu	-0.091	-0.280	-2.434	-3.499*	-3.635	-0.539
	(0.088)	(0.681)	(1.945)	(2.093)	(2.587)	(4.006)
High income	-0.131*	-0.596	-3.307*	-2.729	-6.906***	4.668
	(0.079)	(0.615)	(1.757)	(1.891)	(2.337)	(3.618)
Constant	0.957***	16.639***	24.499***	35.985***	28.154***	-57.564***
	(0.169)	(1.311)	(3.746)	(4.032)	(4.983)	(7.716)
Observations	1017	1017	1017	1017	1017	1017

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A4: Relationship between Childhood Experience and WTP for Grassland Restoration (Broadly Defined Experience)- Full Table Results

	(1) Species	(2) Trails	(3) C&R fishing	(4) Unlimited fishing	(5) Camping	(6) Status quo
Camping exp	0.188***	0.994*	4.739***	3.570**	8.061***	-7.149**
	(0.071)	(0.556)	(1.589)	(1.707)	(2.134)	(3.277)
Fishing exp	0.271***	1.772***	5.529***	7.691***	4.376**	-8.262**
	(0.073)	(0.569)	(1.626)	(1.751)	(2.184)	(3.353)
Brid-watching exp	0.155**	1.066**	3.353**	3.511**	3.118	-5.892*
	(0.066)	(0.513)	(1.465)	(1.574)	(1.968)	(3.021)
Hiking exp	0.149	1.359*	2.907	3.857	2.111	-7.447
	(0.103)	(0.802)	(2.290)	(2.472)	(3.076)	(4.722)
Visited nature	-0.003	-0.103	0.587	-2.910	1.564	-2.967
	(0.124)	(0.966)	(2.758)	(2.963)	(3.705)	(5.688)
Env education	0.176**	1.374**	3.493**	3.774**	2.818	-8.130**
	(0.072)	(0.562)	(1.606)	(1.725)	(2.157)	(3.311)
Outdoor	0.312**	2.304*	6.436*	6.299*	6.326	-16.158**
	(0.156)	(1.218)	(3.479)	(3.773)	(4.672)	(7.173)
Visited grassland	0.088	0.778	1.660	1.680	0.996	-4.553
	(0.079)	(0.618)	(1.767)	(1.899)	(2.373)	(3.643)
Lived near grassland(1day)	-0.048	-0.795	-0.601	-0.080	1.878	3.062
	(0.079)	(0.612)	(1.748)	(1.952)	(2.347)	(3.604)
Lived near grassland(20min)	0.189**	1.621***	3.997**	3.303*	2.317	-9.456**
	(0.080)	(0.622)	(1.777)	(1.909)	(2.387)	(3.665)
Learned biking	-0.101	-0.670	-2.854	0.932	-5.424	6.812
	(0.122)	(0.951)	(2.716)	(2.952)	(3.648)	(5.600)
Negative exp	-0.128	-1.178*	-2.733	-4.384**	-1.478	3.486
	(0.081)	(0.631)	(1.804)	(1.938)	(2.422)	(3.719)
Female	-0.019	-0.038	-0.511	-0.880	0.840	-0.793
	(0.065)	(0.505)	(1.443)	(1.553)	(1.938)	(2.976)
Hispanic	0.203	1.784*	4.721*	3.526	5.496	-10.484*
	(0.128)	(0.994)	(2.841)	(3.052)	(3.815)	(5.857)
Black	0.393**	2.265*	9.844***	8.715**	14.401***	-12.344
	(0.165)	(1.286)	(3.673)	(3.947)	(4.933)	(7.574)
White	-0.048	-0.904	-0.192	-0.331	3.542	4.782
	(0.123)	(0.957)	(2.733)	(2.941)	(3.671)	(5.636)
# children	0.036	0.023	1.089*	0.880	2.261***	-0.218
	(0.027)	(0.214)	(0.611)	(0.656)	(0.820)	(1.259)
High edu	-0.058	-0.033	-1.720	-2.693	-3.029	-2.178
	(0.085)	(0.662)	(1.892)	(2.035)	(2.540)	(3.900)
High income	-0.132*	-0.628	-3.357*	-2.526	-6.950***	5.041
	(0.078)	(0.605)	(1.729)	(1.858)	(2.322)	(3.565)
Constant	0.339*	12.298***	10.998**	25.190***	13.308**	-28.220***
	(0.204)	(1.587)	(4.534)	(4.871)	(6.089)	(9.349)
Observations	1017	1017	1017	1017	1017	1017

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Summary Statistics

Variable	Mean	Min	Max
Employment			
Employed	0.58	0	1
Self-employed	0.06	0	1
Unemployed	0.165	0	1
Retired	0.16	0	1
Student	0.035	0	1
Income level			
$0 - $49,999	0.43	0	1
$50,000 - $99,999	0.36	0	1
$100,000+	0.21	0	1
Education			
Less than high school	0.06	0	1
High school degreen or associate	0.47	0	1
Bachelor degree or above	0.47	0	1

B Appendix B: Sample Survey

Welcome

Welcome to the survey! Thank you for taking time to complete it. We begin with some background information about the subject: grasslands.

Grasslands are important to the environment

- provide habitat for grassland birds
- reduce soil erosion
- reduce flooding by storing and releasing rainfall
- support mammals, reptiles, and insects
- remove greenhouse gases from the atmosphere
- provide beautiful views
- support potential recreational activities

Background Information

Illinois has lost most of its original prairie grasslands. The state government has proposed grassland restoration projects that will take public marginal unused land and turn it back into grasslands. The unused marginal land might be marginal farmland or abandoned land.

Without restoration, this area has almost no birds or wildflowers and is not open to the public. Restored grasslands will be actively maintained after restoration.
Restoration usually involves

- removing non-grassland plants and trees
- soil preparation
- seeding and planting of native prairie plants
- mowing

Grasslands in Illinois are normally tallgrass that naturally grow to be around 4 to 6 feet tall. Restored grasslands can offer different recreational activities including bird watching, biking, hiking, fishing, and camping.

Sample Pictures of Tall-grass Prairie

Hiking in Tall Grassland

Prairie Pond

Tall Grassland Flowers

Grassland Birds

The next page describes some of the features of grasslands that this survey focuses on. Please read the descriptions of the features before starting the survey.

Survey Instructions

We are interested in how much you would support a possible grassland restoration project and how that support would depend on the features and recreational activities available at the grassland project site. The survey has two sections.

In section one of the survey, you will be asked six choice questions. In each of those questions, we will ask you to choose between two possible projects to restore a new grassland and the current situation (no restoration).

In section two of the survey, there are some short questions about you so that we can understand what factors affect the way people feel about grasslands.

NOTE: Some researchers find that people sometimes say in surveys that they are willing to pay more for something than they actually are. For this reason, please imagine your household actually paying the money for grassland restoration projects when you make each of your choices. Remember that paying for grassland restoration means that you have less money available for other purchases.

Survey Instructions

Fixed Features of Grassland Restoration Scenarios

For the purposes of this survey you should assume that **every** possible grassland restoration project in the choice questions has the following features.

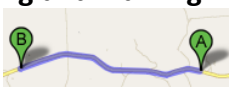
- It is about 40 miles away from your home.
- It takes 100 acres (about 92 football fields) of **unused marginal land** in Illinois and restores it to be a grassland which will be managed and maintained.
- It restores an area that functions as a natural grassland.
- At least 20% of the restored land area is covered by wildflowers.
- Some birds, butterflies, and mammals (e.g. deer) are present in the restored area.
- It has a lake or pond with fish.
- It has signs with information about the plants, birds, and other animals that live in the grassland area, but it does not have a staffed visitor center.
- It has picnic tables and toilet facilities.
- It is paid for by an annual fee charged to each household in the state.
- Mowing and grazing are used for general grassland site management.
- Fire is used sometimes as a tool to restore and maintain the site. The fire management is done by trained professional workers and is not likely to spread to neighboring areas. The fire management typically last a few hours and may create smoke and ash.
- Visitors may bring dogs but they must be leashed at all times.
- Anytime there are amenities like trails, fishing, or camping, they are accessible to people with disabilities.

Variable Features of Grassland Restoration Scenarios

Depending on how they are restored and managed, restored grasslands can have different features and recreational activities.

The **variable features of grassland restoration scenarios described on the next page** are of interest in this survey. Please read this carefully in order to answer the questions in the survey.

Variable Features of Grassland Restoration Scenarios

Number of species 	**Number of different species of birds** in the restored area. A higher number of species means you are more likely to see more different **kinds of birds** in the restored area. If there is no restoration, there are only a few species (10 species) of birds at the site.
Biking and walking Trails 	**Length of multi-use marked trails** in the restored area. Trails allow visitors to experience the tallgrass prairie by walking or biking. No motorized vehicle allowed. All trails are open 24 hours. If there is no restoration, there are no trails at the site.
Fishing   	At least one lake or pond on the restored grassland has fish. When fishing is allowed, a current state fishing license is required to take part. **Different levels of fishing** on the restored grassland may be allowed**:** • <u>Unlimited fishing:</u> You are allowed to fish and keep the fish you catch. • <u>Catch and release only:</u> You may fish, but fish you catch should be unhooked and returned to the water. • <u>No fishing:</u> Fishing is not allowed at the site.
Camping  	**Different levels of camping** on the restored grassland may be allowed: • <u>Camping allowed</u>: The restored grassland allows camping in an organized campground. The campground has treated water and restrooms. There is no fee. Reservations are made on a first-come, first-served basis. • <u>Camping not allowed</u>: Campgrounds are not available and camping is not allowed at the site.
Annual cost to your household 	The amount of money your household will have to pay every year to restore and maintain the grassland. The money will be paid through an increase in annual property tax. If you are a renter, this is the amount that you will end paying because of increased rent charged by the landlord.

Section one of the survey will start on the next page. You will be asked 6 choice questions. Remember, each of the six questions is separate and independent from the previous questions. For every question, Scenarios A and B are the ONLY options besides "No Restoration Project." Which would you choose? **Here is an example card.**

Example Card

1) There are three scenarios.

2) choose the one you like most by clicking the button below the card.

3) The third option will always be "No Restoration Project:. This means everything will stay the way it currently is.

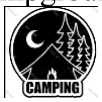
Example Card			
	Option A	**Option B**	**No Restoration Project**
Number of Bird Species	20 different species 	10 different species 	10 different species 
Biking and Walking Trails	1-mile trail 	No trail	No trail
Fishing	Unlimited fishing 	No Fishing 	No Fishing 
Camping	No Camping 	Designated campground Camping 	No Camping 
Cost to your household every year	$10	$55	No cost

Choice questions start from here.

You will not be able to go back to the Survey Instruction section once you start to answer choice questions.

Choice Question 1

If **Option A** and **Option B** are the only grassland projects you could choose. Which one would you choose? If you do not like either option A or option B, then please choose the box market "**No Restoration Project**".

Attribute	Number of Bird Species	Biking and Walking Trails	Fishing	Camping	Cost to your household every year	I would choose
Option A	30 different species 	1 mile trail 	Unlimited fishing 	No camping 	$100	☐ A
Option B	10 different species 	No trail	No fishing 	Designated campground 	$10	☐ B
Option C: No Restoration Project	10 different species 	No trail	No fishing 	No camping 	No cost	☐ C

How confident are you that you would choose the option you indicated?

Not at all confident Extremely confident

0 1 2 3 4 5 6 7 8 9 10

Almost finished

Section two of the survey will start on the next page

Personal Information

The following information is important to help the researchers check that all groups in the survey area have been fairly represented. Your responses are confidential to the extent required and permitted by law.

1. Where did you live before you were 13 years old? Please list all of the places you lived before you were 13 years old.

	Town/City	State	Zip code if known	Country if not U.S.
1.				
2.				
3.				
4.				
5.				

2. Which of the following activities did you do before you were 13 years old? For each row, please check the box that best describes your experience.

	Frequently (For example: Frequently in a specific season, every week, every month)	**Occasionally** (For example: Once or twice a year, at least once ever)	**Never**
Hiking or biking			
Bird watching			
Fishing			
Camping			
Visit any natural areas (places like woods, beaches, rivers, lakes, grasslands, etc.)			
Environmental education			
Spend time outdoors (in places like city parks, playgrounds, gardens, and undeveloped open lot.)			
Visit grassland			

3. Were there any natural areas (such as woods, beaches, rivers, lakes, etc.) near where you lived before age 13 that you could be in them without an overnight stay away from home?

   ❒Yes ❒No ❒Not sure

4. Were there any grasslands near where you lived before age 13 so you could be in them without an overnight stay away from home?

   ❒Yes ❒No ❒Not sure

5. Were there grasslands within a 20-minute walk of where you lived before age 13?

   ❒Yes ❒No ❒Not sure

6. Did you learn how to ride a bike before you were 13 years old?

   ❒Yes ❒No ❒Not sure

7. Before you were 13, did you have any experience with nature that in your mind were seriously negative?

❒Yes ❒No ❒Not sure

8. Are there grasslands within a 20-minute walk of where you currently live?

❒Yes ❒No ❒Not sure

9. Are there any grasslands near where you currently live so you could be in them without an overnight stay away from home?

❒Yes ❒No ❒Not sure

10. What is the highest educational level you have completed? Check one

❒Some high school ❒High school degree (or equivalent) ❒Associate's degree
❒Bachelor's degree ❒Graduate or professional degree ❒Other _____

11. Check all of the following categories that describe you.

❒ Employed full time ❒Employed part time ❒Self-employed
❒Student full time ❒Student part time ❒Recent graduate
❒Retired ❒Not employed ❒Other _____

12. How many children under 18 live in your current household? ____ children
13. What is your marital status?

❒Single ❒Married, or in a domestic partnership ❒Widowed
❒Divorced ❒Separated ❒ Prefer not to answer

14. What is your gender? ❒Male ❒Female ❒ Non-binary ❒ Prefer not to answer
15. Are you of Hispanic, Latino, or Spanish origin? ❒Yes ❒No
16. How would you describe yourself?

❒American Indian or Alaska Native ❒Asian ❒Black or African American
❒Native Hawaiian or other Pacific Islander ❒ White

17. What category comes closest to your total household income in 2018? Check one.

❒ Less than $20,000 ❒$20,000 to $34,999 ❒$35,000 to $49,999
❒$50,000 to $74,999 ❒$75,000 to $99,999 ❒Over $100,000