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Research article

Learning pathways for engagement: Understanding drivers of pro-environmental behavior in the context of protected area management

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A B S T R A C T

The participation of local communities in management decisions is critically important to the long-term salience and therefore, success, of protected areas. Engaging community members in meaningful ways requires knowledge of their behavior and its antecedents, particularly values. Understanding how learning influences cooperation in conservation initiatives is also fundamentally important for supporting decisions being made about public lands. However, there is little empirical evidence of how learning from different information sources works in conjunction with values that shape behavior. Using data from a household survey of residents living in the Denali region of Interior Alaska, U.S, we estimated a two-step structural equation model to understand the psychological reasons why stakeholders made decisions to collectively benefit the environment. Results showed that more diverse pathways by which learning occurred were instrumental in explaining why residents performed pro-environmental behaviors over the past year. Additionally, values that reflected the goals of eudaimonia influenced the transfer and negotiation of knowledge exchange among stakeholders as a correlate of behavior. Environmental concern and personal norms were positively associated with reported behaviors operationalized as social environmentalism and living in an environmentally conscientious manner, whereas environmental concern and willingness to pay for protected area management positively influenced civic engagement. We argue that broadening the range of learning spaces and considering a more diverse array of values in communities surrounding protected areas will encourage daily lifestyle changes, social interactions to support environmentalism, and more robust, pluralistic forms of public engagement in natural resource management.

1. Introduction

1.1. Understanding human behavior to support protected area management

The successful management of protected areas hinges on active and meaningful engagement of nearby residents in decision-making processes (Hernes and Metzger, 2017; Knapp et al., 2014; Palomo et al., 2014). The concept of 'inclusive conservation' was introduced as a goal for protected areas to better incorporate local communities and their diverse perspectives into a holistic vision for the future that can be evaluated for its feasibility, acceptability, and social equity (Mace, 2014; Tallis and Lubchenco, 2014; Raymond et al., 2022). Part of the inclusive conservation framework includes residents, decision-makers, and other stakeholders learning from one another in ways that recognize a range of diverse values giving rise to behaviors that benefit the environment (van Riper et al., 2019; Goodson et al., 2022). As a result, research spanning a gamut of disciplines, and especially environmental psychology, has established the importance of understanding human behaviors in support of inclusive natural resource management (e.g., Stern, 2000; Kollmuss and Agyeman, 2002; Schultz, 2011; Klöckner, 2013; Selinske et al., 2018; Dietsch et al., 2020; Nilsson et al., 2020).

We define 'pro-environmental behaviors' as actions that are adopted by individuals with the intention of generating positive environmental outcomes (Kaiser et al., 1999; Vaske and Kobrin, 2001; Bamberg and Möser, 2007; Larson et al., 2015; Landon et al., 2018; Bennett et al., 2018). Private sphere behaviors comprise a *conservation lifestyle,* including actions taken at the individual or household level such as recycling or avoiding personal travel to reduce carbon emissions. Public sphere behaviors comprise *environmental citizenship* and indicate individual actions performed to impact policy and decision-making through civic engagement. Finally, *social environmentalism* is reflected by collective arrangement through peer-to-peer interactions and influences from groups on the environment. Given the importance of human

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behaviors for advancing agendas that support environmental management, a considerable amount of research attention has been directed toward the psychological principles that give rise to behavior under assumptions of rationality (Fishbein and Ajzen, 1977; Miller, 2017) and moral obligation that is rooted in values (Dietz et al., 2005; Stern et al., 1999; van Riper and Kyle, 2014).

1.2. Internal drivers of pro-environmental behaviors

Individual values are defined as fundamental guiding principles that transcend contexts to influence engagement in pro-environmental behaviors (Stern et al., 1999; Rokeach, 1973; Karp, 1996; Dietz et al., 2005; Winkler-Schor et al., 2020). Early conceptualizations of human values placed them along the opposing motivational axes of self-transcendence and self-enhancement (Schwartz, 1992). The self-transcendence axis is comprised of 'altruistic' (i.e., care for human welfare) and 'biospheric' values (i.e., care for the biophysical environment), whereas 'egoistic' values reflecting self-interest were positioned along the self-enhancement axis. Building on this work, Stern et al. (1999) developed the Value-Belief-Norm Theory of Environmentalism (VBN) that connected values to other predictors of environmentally relevant actions. Integral extensions to the VBN theory have since been proposed to incorporate hedonic and eudaimonic values as predictors of behavior (López-Mosquera and Sánchez, 2012; van Riper et al., 2019; Shin et al., 2022). Guided by Goal Framing Theory (Lindenberg and Steg, 2007; Steg et al., 2014), 'hedonic' values rooted in gratification from experiencing pleasure were established as another facet of self-enhancement. Also, in support of human well-being (Ryff and Singer, 2008; Ryan et al., 2008; Shin et al., 2022; van den Born et al., 2018), 'eudaimonic' values that reflect principles for living a good life have been established as motivators for behavior based on autonomy, self-actualization, and excellence (Huta and Waterman, 2014). Based on the reviewed literature, we contend there are five types of individual values that are relevant to environmental contexts, including biospheric, altruistic, egoistic, hedonic, and eudaimonic values.

Previous research has provided empirical evidence that connects values to behavior through multiple pathways of predictor variables (Schwartz, 1973; Stern, 2000; de Groot and Steg, 2009; van Riper and Kyle, 2014). One established chain of predictor variables includes values, beliefs such as environmental concern, and personal norms defined as feelings of guilt and pride that induce behavior change when activated (Vaske and Donnelly, 1999). Environmental concern focuses on a person's care about environmental problems (Schultz et al., 2005), which influences behavior through feelings of moral obligation (i.e., personal norms) (Schwartz, 1973). Finally, 'environmental attitudes' that encompass positive or negative evaluations of management interventions can also influence pro-environmental behavior (Heberlein, 2012; Kaiser et al., 1999). People's attitudes towards user fees, taxes, or other financial resources that help to support the environment provide useful insights on human cognition and affect, which can support protected area management (López-Mosquera and Sánchez, 2012) and help decision makers respond to challenges such as dwindling natural resource budgets (Wilkie et al., 2001). Despite mixed arguments about payment programs, empirical evidence has demonstrated that different user groups respond to fees based on their values (Martín-López et al., 2007; Ojea and Loureiro, 2007; Obeng and Aguilar, 2018; Bravo-Vargas et al., 2019), particularly in the context of protected areas (Carr et al., 2022).

1.3. Learning from multiple sources may promote pro-environmental behaviors

Stakeholders often use a range of information sources—including interactive dialogues and collaborative exchange—to learn about environmental management topics (Goodson et al., 2022), which in turn, may translate to pro-environmental behaviors (Phipps, 2010). In particular, creating learning spaces has been posited as a promising avenue to advance inclusivity and trust to support decision making (Stern et al., 2021). Similarly, researchers have emphasized the importance of learning characterized through a dynamic, iterative process that includes stakeholders exchanging knowledge and experiences, with potential to shift preferences for the future (e.g., van Riper et al., 2018). The idea of learning from others via interactions, deliberation, or collaboration is aligned with social learning (e.g., Bandura, 1971; Reed et al., 2010; Tam et al., 2021). Social learning occurs through deliberative learning communities (Kilpatrick et al., 2003), which include informal and crowd-based sources, such as friends, family, and social media. For instance, discussions between friends and family about the environment are likely to encourage individuals to seek additional information that may lead to action (Mead et al., 2012; Stevenson et al., 2019).

As a social process, learning from other people and organizations may also increase or further internalize the perceived societal and environmental benefits of an action (Pelling et al., 2008; Sawitri et al., 2015), as well as broaden a person's perspectives across a range of environmental issues (Pahl-Wostl et al., 2007). As a result, learning from a variety of sources within one's social network could promote behavioral engagement by clarifying the effects of decisions when faced with complex, uncertain, or conflicting scenarios (Röling and Wagemakers, 1998). For instance, Arif et al. (2022) found that learning through a range of information sources was linked to pro-environmental behaviors that resulted in improved environmental outcomes via clean production elements in a riparian corridor. Yet, there is limited empirical evidence of how learning from a variety of sources may work in tandem with human values to energize behavior change (van Riper et al., 2018; Gerlak et al., 2019).

1.4. Research objective

We examined the role of learning from friends, family, community, and professional groups—alongside other established psychological phenomena—in promoting public engagement in pro-environmental behaviors within a protected area context. Our primary research objective was to understand the relationships among values, environmental concern, personal norms, attitudes, and learning sources as predictors of pro-environmental behavior. To do so, we estimated a two-step structural equation model (SEM) to test a series of hypothesized relationships established by previous research (see supplemental materials, Table S1).

2. Methods

2.1. Study area

We conducted research with residents living in Interior Alaska and the Northern Matanuska-Susitna Valley, which we refer to as the "Denali region" (Fig. 1). Almost two-thirds of the total land area in Alaska is managed by the federal government (Vincent et al., 2014), with the Denali region being home to the Denali National Park and Preserve and Denali State Park. The scenic resources provided by the landscape, plant, and wildlife species are primary factors that draw people to the region, with over half a million visitors per year (Fix et al., 2012).

Residents living in Alaska receive a dividend, known as the Alaska Permanent Fund Dividend (APFD) as part of a statewide effort to benefit current and future generations (O'Brien and Olson, 1990). This dividend is generated by state revenue from the oil industry and requires residents to submit an annual application that provides evidence of residency and the intent to remain an Alaskan resident indefinitely. The dividend can be used in any way the recipient sees fit. Some residents donate portions, or all, of their dividends to charitable organizations or support local land management agencies (personal correspondence). Thus, the APFD represents a financial asset that is saved, spent, or donated in a variety of

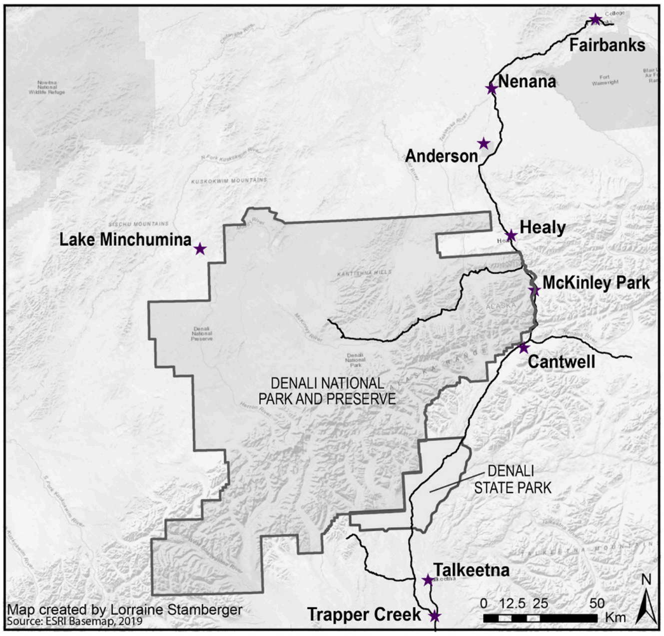

Fig. 1. Communities of the 'Denali region' of Interior Alaska included in our household survey administered in 2020.

ways, which may in turn reflect the priorities of Alaskan residents for protected area management.

2.2. Survey administration

We measured the effects of learning sources on behavioral engagement through a regional household survey administered June–August of 2020 (IRB # 18679 through the University of Illinois at Urbana-Champaign). We administered the survey to 3,000 households in the Denali region identified through the Marketing Systems Group (MSG) using a waved design that included three points of contact (Dillman et al., 2014). The first mailing included a hand-addressed, colored envelope that was green, purple, or brown, an introductory cover letter, questionnaire, and paid postage to return the questionnaire. After a week and a half, those who had not returned their questionnaires were sent a reminder postcard. Finally, a second copy of the questionnaire and cover letter were sent to those who had not yet participated a week and a half after receiving the reminder postcard. Respondents could return their questionnaire by postal mail or participate in an online survey using Qualtrics.

We achieved a response rate of 12.3% after accounting for invalid addresses and a final sample size of 332. Survey respondents were balanced in terms of gender, with 166 who identified as male (50.0%) and 142 who identified as female (42.8%). The average age was 55 years ($SD = 15.1$), 60.5% of respondents held a bachelor's degree or higher and the median household income was $50,000-$100,000 before taxes. There were 215 residents who identified as subsistence users (64.8%), indicating their customary and traditional use of natural resources for food and shelter. Respondents largely identified as American Indian and/or Alaska Native (7.5%) and White (80.1%). Respondents could select multiple options for racial identity. See supplemental materials for the full report of sociodemographic information (Table S2).

2.3. Survey constructs

2.3.1. Pro-environmental behavior

We measured three dimensions of pro-environmental behavior to understand the different ways residents acted to benefit the environment: conservation lifestyles, environmental citizenship, and social environmentalism (Larson et al., 2015; Stern, 2000; van Riper et al., 2019). We used nine items to measure the frequency of engagement in specific behaviors over the past 12 months (Table 1). Specifically, respondents were asked, "How frequently have you engaged in the following activities over the past 12 months" and could respond on a scale of 1–5, with (1) very rarely to (5) very frequently. We created three composite scores by averaging responses across the survey items to gauge frequency of engagement in each behavioral domain.

2.3.2. Learning sources

We measured how respondents learned about protected area management from 12 potential sources. We identified the range of learning sources in consultation with partners in the National Park Service and an advisory board comprised of 10 local experts from different interest groups. Learning sources included professional (e.g., public agencies and government websites) and informal (e.g., social media, friends and family) avenues used to inform respondents' perspectives on issues related to public land management in the area where they lived. We retained six items, focusing on information sources that likely involved two-way interactions between individuals or groups to exchange information and learn from one another within a social context. We then calculated a summative score to represent the number of different information sources a respondent used to learn about protected area management in the region, where larger values represented learning from a greater array of sources (Table 2).

2.3.3. Values

We measured values using 15 items that spanned five dimensions, including biospheric, altruistic, egoistic, hedonic, and eudaimonic (Steg and de Groot, 2010; Stern et al., 1999; van Riper et al., 2019; Winkler-Schor et al., 2020). We asked respondents to rate the extent to which each value was considered a guiding principle in life (Table 3). Respondents answered these questions on a Likert scale ranging from (1) unimportant to (5) very important. Respondents were presented with a 9-point scale if they completed the survey online, so we standardized the scale across the two survey modes by adding 1 to their selection and dividing by 2, ((x+1)/2). Before standardizing the scale, we verified no significant difference in the way people responded to the mail-back (1–5) and online scales (1–9) using a standardized *t*-test between the two collection methods.

Table 1
Descriptive statistics for scale measuring the frequency of pro-environmental behaviors for residents living in the Denali region of Interior Alsaka (n = 332).

Pro-environmental behavior domains[a]	n	Mean[b]	SD
Social Environmentalism ($\alpha = 0.74$)		**2.88**	**0.89**
Encouraged other people to attend an event related to the environment	321	2.22	1.12
Talked to other people about the environment	318	3.72	1.08
Learned from other people like longtime residents or Elders to solve an environmental problem	319	2.72	1.13
Conservation Lifestyle ($\alpha = 0.55$)		**3.66**	**0.79**
Took measures like re-purposing products to reduce my waste	322	4.09	0.98
Avoided traveling out of town for non-local products	314	3.48	1.13
Looked up scientific information about the environment	321	3.39	1.13
Environmental Citizenship ($\alpha = 0.80$)		**2.39**	**1.03**
Participated in a policy process like a public comment period that affected the environment	320	2.51	1.20
Donated money with the intention of benefiting the environment	321	2.47	1.23
Wrote a letter or email about an environmental issue	321	2.19	1.23

[a] Survey prompt: How frequently have you engaged in the following activities over the past 12 months?.

[b] Responses measured on a Likert scale ranging from 1 ("Very Rarely") to 5 ("Very Frequently").

Table 2
The percentage of residents living in the Denali region of Interior Alaska (n = 332) learning about public land management issues from social, professional, and community sources.

Learning Sources[a]	n	Valid Percent
Friends and Family	248	74.7%
Environmental Groups	183	55.1%
Social Media	156	47.0%
Public Meetings	149	44.8%
Hunting/trapping Organizations	94	28.3%
Professional Societies	41	12.3%

[a] Survey Prompt: Where have you learned about issues related to public land management in the area where you live? (check all that apply).

2.3.4. *Environmental concern, personal norms, and payment attitudes*

We measured a suite of internal drivers including environmental concern, personal norms, and attitudes towards payment fees that connected values to behavior. The environmental concern construct included six items that spanned three dimensions: 1) affective, 2) cognitive, and 3) conative concern (Diekmann and Preisendörfer, 2003). Personal norms were measured using three items that encompassed a respondent's obligation to behave in an environmentally friendly way (van Riper and Kyle, 2014). To examine attitudes, we assessed respondents' willingness to use a portion of their yearly dividend from the APFD as a financial method to support protected area management. This attitudinal scale was a derivative of willingness to pay for ecosystem services provided by a landscape (Nielsen-Pincus et al., 2017). Respondents indicated their level of agreement with three items that reflected their payment attitudes toward the APFD.

2.4. *Statistical analysis*

We adopted a two-step structural equation modeling (SEM) approach (Anderson and Gerbing, 1988) using the 'lavaan' package of the program R (Rosseel, 2012). First, we estimated a measurement model using a confirmatory factor analysis to evaluate the psychometric properties of our survey scales. Secondly, we estimated a structural regression model to test the relationships among predictors of pro-environmental behavior. We evaluated the measurement model according to the comparative fit index (CFI) $\geq$ .90, root mean square error (RMSEA) $\leq$ 0.07, and standardized root mean square residual (SRMR) $\leq$ 0.07 to provide a more robust understanding of model fit alongside χ^2, given this statistic's sensitivity to sample sizes above 200 (Kline, 2015). Finally, we determined whether adding learning sources as a predictor of pro-environmental behavior significantly improved the model using a χ^2 difference test. Scale reliability was evaluated using Cronbach's alpha with a minimum acceptable threshold of 0.60 or greater (Cortina, 1993). We calculated the factor loadings for each survey item and dropped two total survey items (one from the egoistic and eudaimonic values scales) that were less than 0.40 (Hair et al., 2006).

We examined missing data patterns to determine whether responses were missing at random (MAR) or missing completely at random (MCAR) following the procedure outlined by Enders (2010). Little's (1988) global test revealed the data were not MCAR ($p < 0.004$). We deemed the data MAR given that most of our sample (77.71%) responded to the entire suite of survey questions and the behavior items were sensitive to respondent privacy. We used the full-information maximum likelihood (FIML) method to account for the MAR pattern of missing data (Allison, 2003). Additionally, we found that survey responses did not exhibit normality for pro-environmental behavior based on the Shapiro-Wilk Normality Test ($p < 0.10$). In response, we selected a robust maximum likelihood estimation procedure (MLR), which corrected for our standard errors and χ^2 statistics (Satorra and Bentler, 2001).

Table 3
Scaled survey items that predicted the frequency of engagement in pro-environmental behaviors for residents living in the Denali region of Interior Alsaka (n = 332).

Survey Items	n	λ	Mean	SD
Values				
Altruistic Values ($\alpha = 0.83$)			**4.30**	**0.83**
Alt 1: Equality: equal opportunity for all	319	0.77	4.40	0.89
Alt 2: Social justice: correcting injustice, care for others all	316	0.92	4.25	1.08
Alt 3: world at peace: free of war and conflict	312	0.69	4.35	0.93
Biospheric Values ($\alpha = 0.86$)			**4.30**	**0.76**
Bio 1: Protecting the environment: preserving nature	319	0.81	4.50	0.76
Bio 2: Unity with nature: fitting into nature	317	0.87	4.26	0.89
Bio 3: A world of beauty: beauty of nature and the arts	316	0.80	4.22	0.92
Egoistic Values ($\alpha = 0.65$)			**2.50**	**0.78**
Ego 1: Authority: the right to lead or command	308	0.93	2.76	1.14
Ego 2: Social power: control over others, dominance	304	0.53	1.73	0.87
Ego 3: Influential: having an impact on people and events[a]	309	–	3.02	1.07
Hedonic Values ($\alpha = 0.80$)			**4.00**	**0.68**
Hed1: Fulfilment of desire: food, fun, pleasure	313	0.72	3.86	0.80
Hed2: Enjoying life: pursuing hobbies, leisure, socializing	314	0.79	4.14	0.78
Hed3: Reducing worries: seeking comfort and relaxation	314	0.75	4.04	0.83
Eudaimonic Values ($\alpha = 0.70$)			**4.30**	**0.59**
Eud1: Personal growth: development of new skills, learning, or gaining insight into something	316	0.71	4.34	0.78
Eud2: Pursuit of excellence: attaining a personal ideal in life	313	0.67	4.07	0.89
Eud3: Autonomy: deciding your own future and doing what you believe in[a]	316	–	4.37	0.74
Eud4: Satisfaction with life: finding meaning, value, and relevance to a broader context	314	0.68	4.41	0.79
Environmental Concern				
Affective, Cognitive, and Conative Concern ($\alpha = 0.93$)			**3.80**	**1.00**
C1: It bothers me when I think about the environmental conditions in which our children and grandchildren will probably have to live in	310	0.80	4.08	0.99
C2: If we continue down the same path, we are heading toward an environmental catastrophe	312	0.92	3.93	1.18
C3: Decision-makers are doing far too little to protect the environment	313	0.90	3.98	1.18
C4: To protect the environment, we should all be willing to reduce our current standard of living	309	0.82	3.48	1.32
C5: In my opinion, many environmental threats are exaggerated	308	0.83	2.28	1.25
C6: There are limits on growth that our industrialized world has already exceeded or will soon reach	309	0.69	3.81	1.06
Learning Sources Scale				
Denali residents learning about land management from social process	332	1.00	2.62	1.41
Personal Norms				
Obligation to Public Lands ($\alpha = 0.81$)			**4.40**	**0.66**
N1: I am morally obligated to minimize environmental impacts on public lands near my home	318	0.83	4.39	0.80
N2: I would feel guilty if I negatively impacted public lands near my home	318	0.76	4.45	0.72
N3: People like me should be proud if they can limit their impact on public lands near my home	315	0.72	4.23	0.80
Payment Attitudes				
Attitudes toward the Alaska Permanent Fund ($\alpha = 0.71$)			**3.50**	**0.99**
A1: Dividends from the Alaska Permanent Fund benefit all generations of Alaskans	319	0.40	4.08	0.95
A2: Reductions in the amount of money per dividend would negatively impact local communities[b]	320	0.63	3.59	1.19
A3: I support the reduction of my dividend from the Alaska Permanent Fund to benefit the environment	319	0.92	3.15	1.52

[a] Dropped from reported scale because loading was <0.40.
[b] Payment attitude items were reverse coded before adding into the SEM.

3. Results

3.1. Descriptive statistics

Survey respondents engaged in behaviors that reflected a conservation lifestyle most frequently ($M = 3.66$; $SD = 0.79$), followed by social environmentalism ($M = 2.88$; $SD = 0.89$) and environmental citizenship ($M = 2.39$; $SD = 1.03$). On average, respondents learned about protected area management in the region from two to three sources, which were most often friends and family (75%), followed by interactions with environmental groups (55%) and social media (47%). Residents living in the Denali region primarily identified with altruistic, biospheric, and eudaimonic values, with hedonic and egoistic values not being as prominent. Respondents reported moderate levels of environmental concern (3.80 ± 1.00) and strong personal norms (4.40 ± 0.66). However, moral obligation to protect public lands did not translate into positive attitudes towards donating money from the APFD to improve protected area management (3.50 ± 0.99).

3.2. Modeling results predicting pro-environmental behavior

Our measurement model fit the sample data ($\chi^2 = 531.43$, df = 343, CFI = 0.96, TLI = 0.95, RMSEA = 0.04, SRMR = 0.05). To follow, we tested a structural regression model to understand the effects of learning sources alongside other predictors of pro-environmental behavior (Fig. 2). Our regression model also indicated good model fit ($\chi^2 = 650.00$, df = 370, CFI = 0.93, TLI = 0.92, RMSEA = 0.05, SRMR = 0.07). Adding learning sources as a predictor of pro-environmental behavior significantly improved the model fit ($\chi^2\Delta = 51.41$, $p < 0.001$).

Values directly predicted environmental concern ($R^2 = 0.58$) and learning sources ($R^2 = 0.10$). Environmental concern was positively correlated with biospheric ($\gamma = 0.55$, $p < 0.001$) and altruistic values ($\gamma = 0.33$, $p < 0.001$), and negatively correlated with egoistic values ($\gamma = -0.13$, $p < 0.015$). In turn, environmental concern positively correlated with personal norms ($\beta = 0.65$, $p < 0.001$) and payment attitudes ($\beta = 0.53$, $p < 0.001$), while attitudes toward payment fees were also positively associated with altruistic values ($\gamma = 0.17$, $p < 0.045$). Eudaimonic values were the only value to predict the number of learning sources ($\gamma = 0.17$, $p < 0.05$).

Learning sources, in combination with personal norms and payment attitudes, predicted social environmentalism ($R^2 = 0.25$), a conservation lifestyle ($R^2 = 0.24$), and environmental citizenship ($R^2 = 0.30$). Interestingly, learning sources was the only variable directly related to all three dimensions of behavior. Learning sources were the strongest predictor of social environmentalism ($\beta = 0.36$, $p < 0.001$), followed by personal norms ($\beta = 0.22$, $p < 0.009$). Conservation lifestyle behaviors were predicted by social learning sources ($\beta = 0.28$, $p < 0.001$) and personal norms ($\beta = 0.33$, $p < 0.001$). In contrast, learning sources ($\beta = 0.34$, $p < 0.001$) and payment attitudes significantly correlated with environmental citizenship ($\beta = 0.32$, $p < 0.001$).

Environmental concern and values indirectly influenced engagement in pro-environmental behaviors. Social environmentalism was indirectly predicted by environmental concern through personal norms ($\beta = 0.14$, $p < 0.009$). In turn, biospheric ($\beta = 0.08$, $p < 0.012$) and altruistic ($\beta = 0.05$, $p < 0.030$) values had indirect effects on social environmentalism through environmental concern and personal norms. Similar to social environmentalism, a conservation lifestyle was indirectly influenced by environmental concern through personal norms ($\beta = 0.22$, $p < 0.002$). Biospheric ($\beta = 0.12$, $p < 0.004$), altruistic ($\beta = 0.07$, $p < 0.011$), and egoistic values ($\beta = -0.03$, $p < 0.050$) had indirect effects on conservation lifestyle behaviors through environmental concern and personal norms. For environmental citizenship, environmental concern had indirect effects on adopting a conservation lifestyle through payment attitudes ($\beta = 0.17$, $p < 0.001$) instead of personal norms. Likewise, biospheric ($\beta = 0.09$, $p < 0.002$), altruistic ($\beta = 0.06$, $p < 0.021$), and egoistic values ($\beta = -0.02$, $p < 0.042$) had indirect effects on environmental citizenship through environmental concern and payment attitudes.

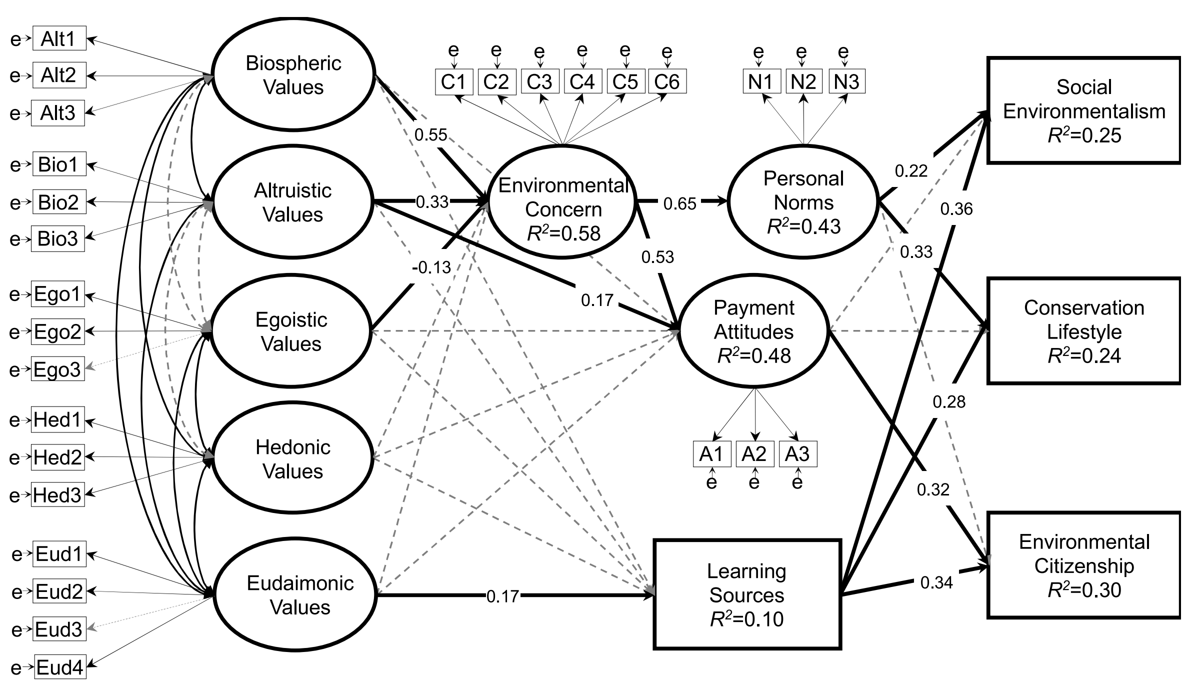

Fig. 2. Results from a latent variable path model of relationships among values, environmental concern, attitudes, norms, learning sources, and engagement in pro-environmental behaviors. Circles represent latent variables. Curved lines indicate covariance between variables and dotted lines represent non-significant relationships, with arrows indicating the direction of the relationship for significant relationships at $p < 0.05$. See Table 3 for lambda estimates for each latent variable.

4. Discussion

Our study adds to a growing literature focused on understanding factors that influence human behavior in support of environmental management, especially in and around protected areas (Saunders, 2003; Selinske et al., 2018; Clayton and Brook, 2005; Dietsch et al., 2020). We identified the pathways through which residents living in Interior Alaska learned and made decisions about the adoption of personal lifestyles, participation in public decision-making arenas, and social engagement that collectively benefited the environment. We found that the process of learning through a broader range of peer- and group-based information sources increased the predictive capacity of our model to explain pro-environmental behavior. Our study is novel insofar as its consideration of the behavioral consequences of learning about land management from difference sources in relation to values. Thus, our study provides empirical evidence to support management and research efforts in inclusive conservation aimed at bridging the perspectives of diverse stakeholders through learning (e.g., Garmendia and Stagl, 2010; Stern et al., 2021). We outline how these relationships can be leveraged to support protected area management by building iterative spaces that recognize the importance of diverse information sources and energizing interactions between communities and regional public land management agencies.

4.1. Learning from diverse sources influences behavior

We found that an increased diversity of learning sources was positively related to engagement in pro-environmental behavior. Likewise, previous research has established that diversifying opportunities to learn can be an effective strategy to spark behavior change across various interest groups (Maynard et al., 2020). It could be that people who have more places to learn are more likely to encounter a message that resonates. Thus, acquired knowledge is more likely to be internalized and go on to influence a broader array of behaviors (Frymier and Houser, 1999; Wiley and Voss, 1999; Byerly et al., 2018). Interestingly, we also found that the effect size of learning was similar across multiple behavioral domains, indicating that the comparative processes undertaken by respondents were equally influenced across a range of pro-environmental actions.

Residents of the Denali region learned about protected area management in a variety of ways, but friends and family were the predominant source. Often, people draw upon informal interactions with others to build an understanding of the environment (Diduck et al., 2020). It could be that the learning processes involving friends and family provided a space for strengthening relational aspects between individuals and groups (Pahl-Wostl et al., 2007; Young et al., 2016), which can extend to activities such as participation in public processes (Reed et al., 2010). In line with arguments made in previous research (Stern et al., 2021), our results indicate that management programs aimed at strengthening relational learning through informal interactions and dialogue among community members could be particularly useful for agencies to develop actionable solutions to natural resource management problems. Decision-makers in the Denali region should continue to live in communities that are adjacent to protected areas so they can act as brokers of knowledge to iteratively share information with the general public. Open houses and volunteer workdays could be other mechanisms for creating informal information exchanges among stakeholders including managers and residents.

4.2. Connecting values to learning and behavior

Understanding and guiding pro-environmental behaviors has been a longstanding goal in environmental psychology research (Reddy et al., 2017; Selinske et al., 2018). We observed support for the longstanding tripartite structure of egoistic, altruistic, and biospheric values as predictors of behavior through environmental concern (Stern et al., 1993). Self-transcendence values were important for positively predicting pro-environmental behaviors when they were mediated by concern for the environment (Lee & Jan 2015). The relationship between altruistic values and attitudes towards payment fees further highlights how values centered around care for others can be activated to guide environmental citizenship (Pradhananga et al., 2017). Our findings also indicated that residents would be more likely to support civic activities (e.g., donations) if they believed an increase in funding would improve the well-being of their communities and local protected areas, signaling concerns about trust that their donation would be used responsibly by public decision-makers to benefit the region (Winter et al., 1999).

Eudaimonic values were not significantly related to environmental concern but were instrumental in explaining the range of sources that were used to learn about protected area management. We found that as eudaimonic values increased, so did the number of learning sources, which energized pro-environmental activities. Similarly, other studies have identified self-development through learning as one of the defining cornerstones of eudaimonic values (Ryan et al., 2008). Thus, learning from various information sources may have satisfied an interest in prioritizing key facets of eudaimonia including excellence and growth (van den Born et al., 2018) to influence pro-environmental behavior (Winkler-Schor et al., 2020). However, the proposed benefits of learning are often exclusively related to altruistic and biospheric goals of meeting social and environmentally sustainable resource management goals over multiple generations (Pahl-Wostl et al., 2007). Therefore, future research should continue to study how different values, especially eudaimonic values, influence someone's propensity to learn from others, the process of learning itself, and the outcomes of learning in the context of environmental management.

4.3. Strategies for behavioral engagement in protected area management decisions

Our research carries implications for understanding and potentially shifting pro-environmental behaviors of residents that live in or around protected areas. Although these residents directly influence the landscape, they can become disconnected from management decisions (Bennett and Dearden, 2014; Oldekop et al., 2016; Goodson et al., 2022). Creating hubs of community-based learning between local experts and public land management agencies can improve these relationships by promoting institutional trust (Davenport et al., 2007). Given the importance of learning from a variety of sources, a key management strategy derived from our study would be to diversify the outlets used to share information about the environment and create opportunities for iterative dialogue and learning spaces (Stern et al., 2021). Building community-based opportunities for resource management through informal networks may strengthen the effects of learning and increase the likelihood that residents will adopt behaviors that benefit the environment (de Lange et al., 2019).

Our results showed there were residents concerned about the environment but not participating in activities related to civic engagement. Uneasy relationships between residents and resource management agencies might prevent feelings of moral obligation from manifesting in public engagement (Hendee, 1984). Focusing on environmentally concerned individuals, especially in cases where trust is fractured amongst various stakeholder groups (Frentz et al., 2000; Goodson et al., 2022), may be a pathway by which inclusive conservation of protected areas is increased through public participation in decision making processes (Tallis and Lubchenco, 2014). Managers seeking greater degrees of input from residents could establish spaces to connect residents who believe their voices are meaningfully heard, especially early in the process of changing an action, practice, or policy (Raymond and Cleary, 2013). These opportunities for engagement should be positioned as spaces for knowledge exchange and learning, rather than information dissemination and public consultation as part of a 'top-down' process. Overall, encouraging public deliberation through a diverse portfolio of learning opportunities could strengthen engagement across various behaviors and help bridge across stakeholder relationships through active listening and reflection (Ercan et al., 2019).

4.4. Limitations and future research directions

Our study is primarily limited by use of a household survey administered during a single point in time versus longitudinal research that would capture the complex, iterative relationships between learning and human behaviors. As a result, it is unclear whether engagement in pro-environmental behaviors fortified interpersonal relationships and encouraged learning over longer time periods. Other studies have positioned learning as an adaptive process that is interrelated with behaviors and that is informed by double and triple loop feedbacks (Reed et al., 2010; van Riper et al., 2018), whereby people collaboratively learn from engaging in pro-environmental activities (Tam et al., 2021). Therefore, a fruitful area of future research will be to examine the extent to which learning and engagement in activities become cyclical or self-fortifying over time. Additionally, our survey also did not distinguish if the learning sources included an explicitly deliberative component and thus could not be directly interpreted through a social learning lens. For instance, learning via social media could be through online discussions encompassing an active dialogue, but may also include less deliberative aspects such as sharing a link to a news article. Future qualitative work further exploring the nature of knowledge exchange through social learning would be a fruitful complement to our quantitative findings. Finally, there is a need to clarify the pathways by which learning and public involvement in management decisions can minimize social conflicts and create change over time (Hernes and Metzger, 2017). Future research should more clearly establish a longitudinal relationship between learning and pro-environmental behavior throughout one's life, or through generational and organizational cycles, to best support protected area management.

5. Conclusion

Our research highlights the importance of learning as a catalyst for pro-environmental behavior in the rural communities surrounding Denali National Park and Preserve and Denali State Park, Alaska, US. We posit that a broad range of learning sources works in tandem with other correlates of human behavior, which can be more readily activated to build inclusivity among residents and public land management agencies. In particular, we show that the effects of learning on pro-environmental behaviors are strengthened when they come through a variety of sources, with emphasis on the importance of informal opportunities for learning that occur between community members. The salience of these learning sources is influenced by values, particularly eudaimonic principles focused on living a good life. A range of other predictor variables, including concern, personal norms, and payment attitudes, are also important factors that shape how residents will approach iterative dialogues between community-based organizations and within social networks. Overall, the topic of learning is primed to link research and practice through participatory approaches that acknowledge the diverse value bases of human decision-making. These research approaches will help to transform the future of protected area management in inclusive ways that ensure their ecological integrity and social equity over time.

Author contributions

Riley Andrade: Conceptualization, Formal analysis, Writing – original draft; **Carena J. van Riper**: Conceptualization, Project administration, Funding acquisition, review and editing; **Devin J. Goodson**: Data curation, review and editing; **Dana N. Johnson**: Data curation, review and editing; **William Stewart**: Supervision, review and editing, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvman.2022.116204.

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