Transformative potential of nature-based values that influence the relationships between reported and intended pro-environmental behavior

Dana N. Johnson[1,5]
Carena J. van Riper[1+]
Julianna Rogowski[2]
Evan Salcido[1]
William P. Stewart[3]
Rose Keller[4]

[1]Department of Natural Resources and Environmental Sciences, University of Illinois, USA
[2]Department of Horticulture and Natural Resource, Kansas State University, USA
[3]Department of Recreation, Sport, and Tourism, University of Illinois, USA
[4]Norwegian Institute of Nature Research, Lillehammer, Norway
[5]Institute for Resources, Environment and Sustainability, University of British Columbia, CA

[+]Corresponding author
Department of Natural Resources and Environmental Sciences
University of Illinois at Urbana-Champaign
1102 S. Goodwin Ave.
Urbana, IL, U.S.A., 61801
Email: cvanripe@illinois.edu
Phone: +1 (217) 244-9317

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Abstract

Protected area landscapes embody multiple values of nature that can create meaning in everyday life. Though the values ascribed to these environments theoretically inspire changes in human behavior, surprisingly few studies have empirically evaluated how 'specific values' affect actions that benefit the environment. We used Public Participation in Geographic Information Systems (PPGIS) methods to evaluate the relationships among four nature-based values and the patterns of both reported and intended behavior among visitors to Denali National Park and Preserve, Alaska, USA (n = 667). We found that wilderness, recreation, ecological integrity, and scientific qualities of places were particularly important for characterizing the Denali landscape and accounted for more variation in intended than reported pro-environmental behaviors. We provide new insights on how nature-based values underpin the decisions of visitors and lead to transformative changes after experiencing a high profile, charismatic protected area. Understanding the reasons why people forge connections with natural areas and modeling how these associations relate to different types of behavior advances knowledge of how to effectively build environmental stewardship and guide public land management decisions.

Key words: Specific values, PPGIS, outdoor recreation, protected areas, behavior change

1. Introduction

1.1. The importance of understanding how people value nature within protected areas

Environmentally sustainable public land use decisions require recognition and engagement with the multiple values of nature. Previous research has called for broader conceptualizations of human values that reflect a diverse range of priorities among people who are affected by change (Chan et al., 2012; Pascual et al., 2023; Kenter et al., 2019). Particularly over the past two decades, scholars have argued that values span individual, communal, and societal domains that vary across space and time (Manfredo et al., 2014; van Riper et al., 2018) and show discernable patterns within cultural contexts (Kendal & Raymond, 2019; Schwartz, 1994). ‘Specific values’ in particular - defined as the preferred qualities people associate with landscape features – increasingly garner research attention (Brown et al., 2020; Sherrouse et al., 2011) given their potential to represent the relative perceived importance of environmental features and provide insight on transformative pathways for inducing change (Gould et al., 2023). However, specific values have been predominantly considered correlates of attitudes and preferences for land use rather than being positioned as direct predictors of human behavior (van Riper et al., 2019), despite their integral role in participatory processes that are linked to policy outcomes (Kenter, 2015; Raymond et al., 2022). Empirical evidence is therefore needed to better understand how specific values relate to patterns of pro-environmental behavior (PEB), conceptualized herein as actions that are either reported or intended to benefit the environment (Bamberg & Möser, 2007; Steg & Vlek, 2009).

Because protected areas provide people with opportunities to build deep-seated connections to nature, they are prime locations to understand the ways in which specific values can energize behavior change (Engen et al., 2018; Ives et al., 2018; Winkler-Schor et al., 2020).

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The vast expanse of public lands in the U.S.A. is unparalleled in its ability to inspire and facilitate transformative experiences that encourage stewardship (Manning et al., 2022). These landscapes protect diverse flora and fauna that are enjoyed by recreationists, reflect stories about the history of American conservation, act as reservoirs of knowledge and focal points for civic engagement, and facilitate both partnerships and collaboration with a range of interest groups (Manning et al., 2016). Although nationally designated protected areas symbolize aspects of identity and heritage (Runte, 1997; Nash, 2014), their full value remains necessarily elusive (Kellert, 1997; Harmon & Putney, 2003) and requires approaches to valuing nature that accommodate different forms of knowledge and representation of interest groups (Barnhardt & Kawagley, 2005; Cebrián-Piqueras et al., 2020). Further complicating the relationship between specific values and PEB is the spatial variability in how people interact with local versus regional landscapes (Brown & Reed, 2012; Johnson et al., 2019; Laursen et al., 2021; Pietilä & Fagerholm, 2016). That is, specific values vary across space and time, reflecting a diverse array of reasons why people visit protected areas (Pietilä & Kangas, 2015) and perform behaviors that show care or aspirations to improve the quality of places (Raymond et al., 2021).

1.2. Conceptualization and measurement of pro-environmental behavior

There is a longstanding body of research focused on PEB (Hines et al., 1997; McKenzie-Mohr, 2000; Osbaldiston, 2013; Steg & Vlek, 2009) that has conceptualized human action as intended, reported, or observed (Bamberg & Möser, 2007; Bissing-Olson et al., 2013; Kaiser et al., 2005; Schneider et al., 2017). The study of intended behavior has been advanced by the Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991), which is underscored by an assumption that people are rational actors whose behavioral intentions are positively correlated with attitudes toward an action, subjective norms, and perceived behavioral control over their ability to influence outcomes (Ajzen, 1991, 2006; Miller, 2017; Oreg & Katz-Gerro, 2006). Conversely, previous research on reported behaviors has been guided by the Norm Activation Model (Schwartz, 1970), which suggests people are morally bound and most likely to engage in PEB when normative pressures are activated (Steg et al., 2016). As an extension to this line of inquiry, Stern et al. (1999) developed the Value-Belief-Norm (VBN) theory, which posits that values are the exogenous basis for acting in ways that benefit the environment. That is, individuals first draw on their broad values, then respond to environmental concerns, form beliefs about the consequences of inaction, ascribe responsibility to themselves, and experience feelings of moral obligation (van Riper & Kyle, 2014). Conceptualizing the antecedents of PEB as aligning with this chain of variables reflects the general hypotheses of the VBN (Stern et al., 1999; Stern, 2000). Though previous research has integrated these behavioral theories (Coon et al., 2020), intentions are thought to be overestimations of actual behavior due to response biases such as social desirability (Kormos & Gifford, 2014).

The differences that exist between reported and intended activities are complicated by the multi-dimensional structure of PEB. Although previous research in protected areas has accounted for variation in behavior measured using composite scores (Halpenny, 2010), past work has shown empirical distinctions among types of behavior that are differentially influenced by a range of antecedents (Landon et al., 2018a; Shipley et al., 2023). For example, Stern (2000) theorized that activism and non-activism spanned public, private, and organizational spheres of behavior. Extending this argument, Larson et al. (2015) conducted research with rural residents in New York and showed differences across conservation lifestyle behaviors, social environmentalism, environmental citizenship, and land stewardship. Other studies have supported a three-dimensional structure of PEB, including Landon et al. (2018a) who measured willingness to sacrifice, localism, and eco-behavior. Given the range of approaches to conceptualizing and measuring behavior, behavioral metrics should be tailored and made relevant to a particular site (Harland et al., 2007), while maintaining specificity between behavior and its predictors (Tarrant & Cordell, 1997). Therefore, a clear need exists to further recognize the multi-dimensional structure of intended and reported behavior relevant to various contexts and environmental problems.

1.3. Role of specific values in explaining pro-environmental behavior

The specific values literature is a rich area of inquiry that spans multiple disciplinary perspectives (Brown, 1984; Brown & Reed, 2000; Zube, 1987; Kenter et al., 2019). Values have been conceptualized as core principles that transcend context and guide modes of conduct (Rokeach, 1973; Schwartz, 1994; Raymond & Kenter, 2016), felt experiences (Schroeder, 2013), relational associations with environments (Chan et al., 2018), and preferences that reveal the relative importance of places (Brown & Reed, 2000). Specific values are individualized but can be aggregated to illustrate shared beliefs about what exists in the natural world (Raymond et al., 2014; Massenberg, 2019). This research approach aligns with previous studies that have argued specific values illustrate how people view environments when faced with prioritizing and making tradeoffs among competing landscape conditions (Alessa et al., 2008; Brown et al., 2020; Bagstad et al., 2017; van Riper et al., 2012).

Previous research has measured specific values in systematic ways that are designed to be relevant for decision-makers yet has simultaneously struggled to establish a theoretical basis for understanding relationships among different types of values. An early attempt at measuring specific values was made by Rolston & Coufal (1991) who developed a typology that sought to represent a more comprehensive array of use *and* non-use values that characterized forests. Bengston and Xu (1995) further advanced this conceptualization of forest values and called to question the relationship between 'values' such as life sustaining qualities of nature (i.e., conceptions of what is good) and 'objects of value' such as recreation (i.e., outcomes that provide direct benefit to people). This typology was subsequently refined by Brown & Reed (2000) and included 12 categories such as spiritual, economic, life sustaining, and recreation values that natural landscapes afforded to people. An expansive body of research that relies on Public Participation in GIS (PPGIS) methods has applied this typology to engage communities in discussions about places (see Brown et al., 2020). Typically, PPGIS studies involve ranking categories of specific value and spatially locating them through mapping exercises. The psychometric properties of specfiic value scales and the potential for associated dimensions have been overlooked (for exception see Carr et al., 2022). It could be that objects of value within this typology are defined and interpreted in distinguishable ways by community members. 'Nature-based' values that represent objects of interest – including wilderness, recreation, ecological integrity, and scientific – may be most likely to share conceptual space, because they are similarly inspired by topography, climate, and other environmental conditions.

We sought to understand how a theoretically derived measure of nature-based, specific values could be related to both past (i.e., reported) and future (i.e., intended) PEB. We were interested in deepening knowledge of how these specific values were expressed and spatially located, while considering the possibility that such expressions would influence behavior change, and in turn, result in new ways for caring about a protected area landscape. Thus, the purpose of this study was to evaluate the transformative potential for specific values to influence behavior.

We were guided by three objectives: 1) Examine the relative importance and spatial dynamics of specific values associated with Denali National Park and Preserve; 2) Understand the relationship between reported pro-environmental behavior preformed over the past year and behaviors that were intended after returning home from a charismatic protected area; and 3) Determine the effects of nature-based values on the behavioral patterns of visitors.

2. Methods

2.1. Study location and context

Denali National Park and Preserve (Denali) is located within Interior Alaska and encompasses over six million acres, making it one of the largest protected landscapes in the U.S. (see Figure 1). Denali is home to Mt. Denali (formerly Mt. McKinley), the highest mountain peak in North America at 20,310 ft (6,190 m), as well as diverse wildlife and outdoor recreation opportunities that attract people from around the globe who visit to hike, camp, climb, and view wildlife (Stamberger et al., 2018). There were 427,562 visits in 2022 and an average of 381,549 visits over the last five years (National Park Service, 2023). The Department of the Interior works in cooperation with other federal, state, and local organizations to oversee the protected area and focus particular attention on sustaining ecological integrity, including the structures and functions of ecosystems, while also meeting the needs of tourists and local communities. To access Denali, there is a 92-mile (148 km) road that leads to the heart of the protected area; private vehicles are limited past mile 15 (24 km) and park use tends to congregate along the park road (Cai et al., 2023), which includes several scenic vistas and visitor centers.

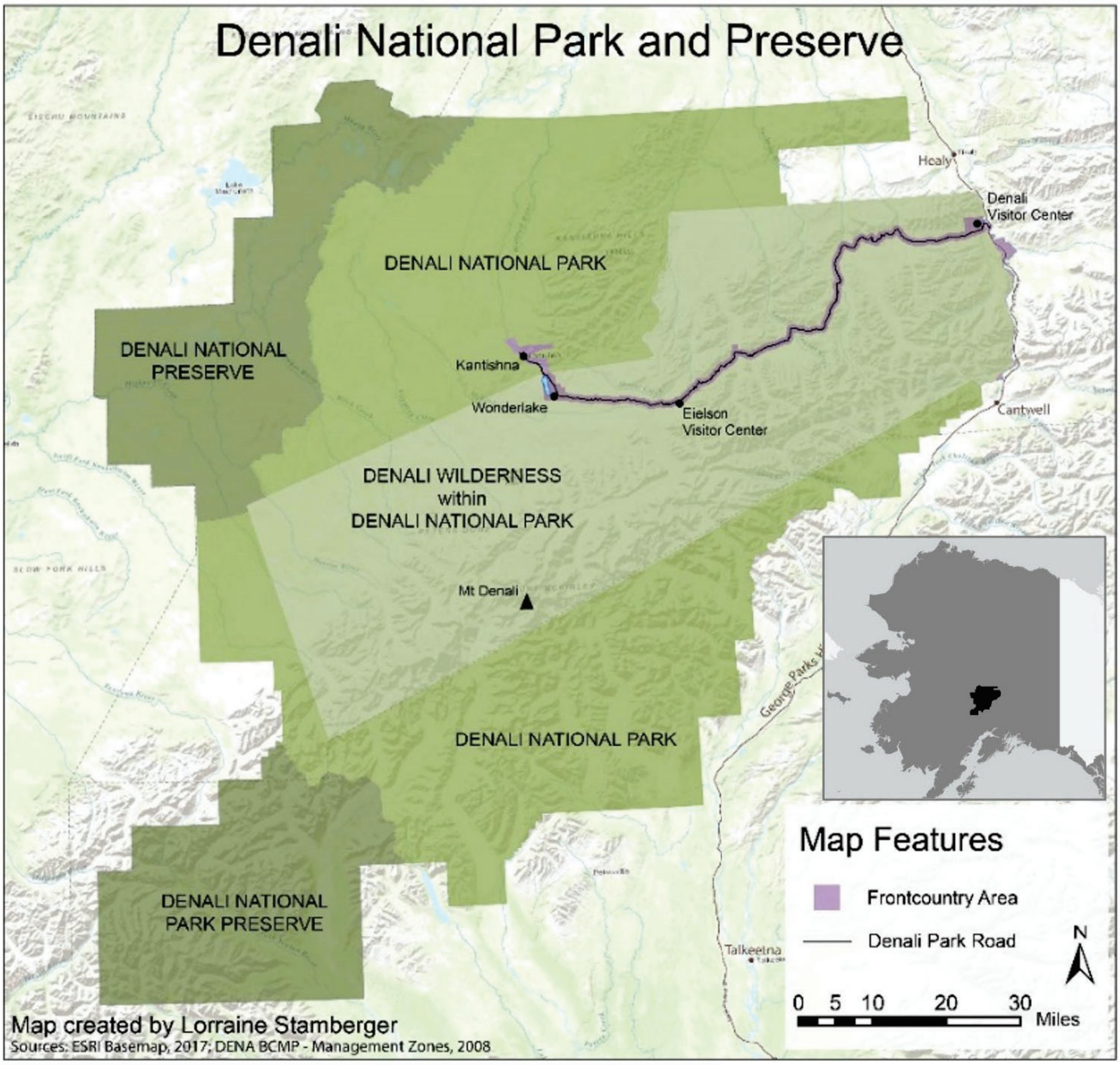

Figure 1. Map of Denali National Park and Preserve

2.2. Data collection process

During the high use season (June-August 2016), on-site, self-administered surveys were distributed to visitors over the age of 18. Trained survey administrators from the University of Illinois approached every "nth" visitor depending on the flow of foot traffic. For groups, the individual with the most recent birthday was asked to complete the survey to avoid group leader bias, which can be introduced if a survey administer selects a preferred person to participate in the study (Battaglia et al., 2008). The survey schedule was stratified by day of the week and time of day, and data were collected in daylight hours using survey tablets (Insignia MS-P10A6100) and Qualtrics software. Additionally, paper surveys were available when necessary. The survey took approximately 20 minutes to complete and contact logs were used to monitor response rates and record on-site observations across five sampling locations near the beginning of the Denali Park Road. Non-response bias was evaluated by comparing the sample to the total number of people who were contacted on site and asked to participate in the study. Small differences were detected based on gender (χ^2 = 0.759) and group size (t = 1.967, df = 710). The final sample size was 667 and a response rate of 90.6% was achieved.

2.3. Measurement and analysis

To measure specific values, respondents were asked to engage in a two-step mapping exercise following Sherrouse et al. (2011). Respondents first evaluated 13 specific values that we adapted from Brown and Reed (2000) and tailored to the study context in consultation with park managers. Each respondent allocated 100 preference points across these 13 categories to indicate the importance of Denali. Next, respondents were asked to spatially locate specific values identified in the first step of the mapping exercise by pointing to places on a 34 in × 13 in map of the park, created by the National Geographic Society. This map of Denali had an approximate scale of 1:225,000 and served as a visual basis for dialogue with survey respondents. Respondents identified up to 10 places in the park that they believed embodied the specific values. To measure both reported and intended PEB, we adapted scales from Stern et al. (1999) and Larson et al. (2015). Specifically, respondents were asked to evaluate a battery of questions that included 12 survey items that reflected the dimensions of *Conservation Lifestyles* (e.g., recycling), *Social Environmentalism* (e.g., participating in scientific research), and *Environmental Citizenship* (e.g., donating money to support environmental protection). Each dimension was measured using four survey items from the 12-item scale. We included other questions such as socio-demographics and trip characteristics in the questionnaire.

Survey data were analyzed in three phases to understand the three study objectives. First, descriptive statistics were used to evaluate the relative importance of all specific values using data generated during the first step in the on-site mapping exercise (see Table 1). *Wilderness, scientific, ecological integrity,* and *recreation* specific values were selected for further consideration given their shared definitions related to the process of understanding environmental conditions through outdoor recreation. One mean value composite score was created to reflect all nature-based values associated with Denali National Park and Preserve. This first phase of analysis also involved analyzing the spatial distribution and density of specific values points assigned to the protected area, where the PPGIS data were added to an ArcGIS geodatabase that included coordinates for all digitized points drawn from the mapping exercise. The digitized points were evaluated in ArcGIS using kernel density analysis of the nature-based values, which followed a quadratic kernel function that defined a smoothly curved surface that fit over each point and extended to a defined search radius (Silverman, 2018). The volume below each surface was determined by a weight assigned to each point, and we assigned all points to a default weight of 1.0, given the assumption that all data points were equal in weight. The kernel density output cell size of 700 km was selected with a search radius specified at 10,000 km (Law & Collins, 2015). All analyses were performed in ArcGIS V10.8, Statistical Package for the Social Sciences (SPSS) V23.0, and RStudio V1.3 using the '*R Tidyverse*' package.

Table 1. Definitions of 13 specific values assigned to places by survey respondents in Denali National Park and Preserve

Assigned Values[1]	**Mean (SD)**
Wilderness. *I value Denali because it represents minimal human impact and/or intrusion into natural environment.*	17.16 (17.46)
Aesthetic. *I value Denali for the attractive scenery, sights, sounds, or smells.*	15.77 (15.62)
Ecological Integrity. *I value Denali for its intact ecosystem where predators (e.g., wolves) and prey (e.g., Dall sheep) are in balance.*	12.38 (12.55)
Future. *I value Denali because it allows future generations to experience this place.*	10.28 (10.86)
Recreation. *I value Denali because it provides a place for my favorite outdoor activities.*	7.95 (9.70)
Scientific. *I value Denali because it provides an opportunity for scientific observation or experimentation.*	6.91 (8.27)
Intrinsic. *I value Denali in and of itself for its existence.*	6.23 (9.80)
Learning. *I value Denali because I can learn about natural and cultural resources.*	5.42 (6.98)
Therapeutic. *I value Denali because it makes me feel better physically, emotionally and/or mentally.*	5.02 (7.01)
Cultural. *I value Denali because it preserves historic places and archaeological sites that reflect human history.*	4.33 (6.39)
Soundscape. *I value Denali I can hear natural sounds.*	3.06 (6.11)
Spiritual. *I value Denali because it is spiritually significant to me.*	3.04 (6.46)
Economic. *I value Denali because it provides economic benefits from recreation and tourism opportunities.*	2.57 (5.12)

[1]Note. Respondents were given 100 points to divide among the available categories of assigned value.

The next phase of analysis evaluated and compared reported and intended behavior, both of which included three multi-item dimensions of four items each (i.e., *Conservation Lifestyle, Social Environmentalism,* and *Environmental Citizenship*). The measurement properties of both scales were evaluated using a confirmatory factor analysis (CFA) (Kline, 2015). We also estimated the mean values and standard deviations for all survey items to understand the variation in behavioral performance prior to parceling the data into two composite scores that represented the frequency of engagement in reported and intended PEB (Little et al., 2002). We used Paired Sample t-tests to examine the relationship between reported and intended behavior across the three dimensions of behavior.

The final phase of analysis involved evaluating the relationship between specific values and behavior. All survey items within the reported and intended behavior scales were combined into mean value scores for each construct. These scores were compared to the four nature-based values from the first phase of analysis including *wilderness, scientific, ecological integrity,* and *recreation.* Linear regression models were estimated to determine the extent to which nature-based values accounted for variation in both reported and intended behavior. Three covariates were included in the analysis to account for potential effects of these variables on the relationship between reported and intended behavior, including 1) user type that indicated whether the respondent was a frontcountry (i.e., those who prefer spending time in developed settings) or backcountry (i.e., those who prefer remote and Wilderness-like settings) recreationist; 2) the number of times a respondent visited Denali National Park and Preserve; and 3) age. We identified backcountry versus frontcountry respondents using the locations that corresponded to either backcountry permitting or tour purposes that indicated the type of environment that would likely be experienced.

3. Results

3.1. Socio-demographics and trip characteristics

Our results showed that half of respondents were male (50.6%) with a mean age of 44.03 years (*SD* = 17.31) and a household size of 2.54 (*SD* = 2.49). Just under half (40.9%) held a graduate degree, 68% reported an annual income between $50,000 and $199,999, and the majority (88.6%) was White (see Table 2). Nearly three quarters (71.6%) were U.S. residents. According to an analysis of trip characteristics, the self-reported group size was just above three people on average (*M* = 3.13, *SD* = 3.42), including the two largest group types of family

(54.1%) and friends (26.5%). On average, respondents spent 3.24 nights (*SD* =5.24) in the protected area or surrounding area and 79.9% were visiting for the first time. The most common recreation activities were photography (73.0%), viewing wildlife (69.4%), hiking (65.6%), and taking bus trips (63.0%).

Table 2. Respondent socio-demographic profile

	N (%)
Gender	
Male	330 (50.6)
Female	322 (49.4)
Education	
Less than high school	2 (0.3)
High school graduate	88 (13.7)
Vocational/trade school certificate	24 (3.7)
Two-year college degree	44 (6.8)
Four-year college degree	222 (34.5)
Graduate degree	263 (40.9)
Income	
Less than $49,999	113 (19.3)
$50,000 to $99,999	197 (33.7)
$100,000 to $199,999	201 (34.4)
Greater than $200,000	74 (12.6)
Ethnicity	
Hispanic or Latino	28 (4.3)
Not Hispanic or Latino	622 (95.7)
Race[1]	
American Indian or Alaska Native	9 (1.4)
Asian	47 (6.3)
Black or African American	6 (0.9)
Native Hawaiian or other Pacific Islander	4 (0.6)
White	575 (88.6)

[1]Respondents could check all that applied so column totals may not equal 100%.

3.2. Distribution and density of specific values

We first evaluated the spatial dynamics of specific values within the context of Denali National Park and Preserve. The protected area was considered important for several reasons, including the four highly rated nature-based values of *wilderness* (*M* = 17.16, *SD* = 17.46), *ecological integrity* (M = 12.38, SD = 12.55), *recreation* (M = 7.95, SD = 9.70), and *scientific* (M = 6.91, SD = 8.27). When tasked with spatially locating the specific values that were identified in the first step of the participatory mapping exercise, respondents indicated that specific values were ascribed to a broad swath of places across the entire 2,428,113.85 hectares of the protected area. In particular, the spatial density of specific values tended to cluster along the park road, as well as around visitor centers, Mt. Foraker, and Mt. Denali (see Figure 2). In other words, we observed places of value abundance along the park road and near iconic symbols of the protected area (see Figure 3). Along the road, these value allocations were most densely concentrated along major overlooks such as Polychrome Pass and Eielson Visitor Center located approximately 40 and 60 miles from the start of the park road, respectively.

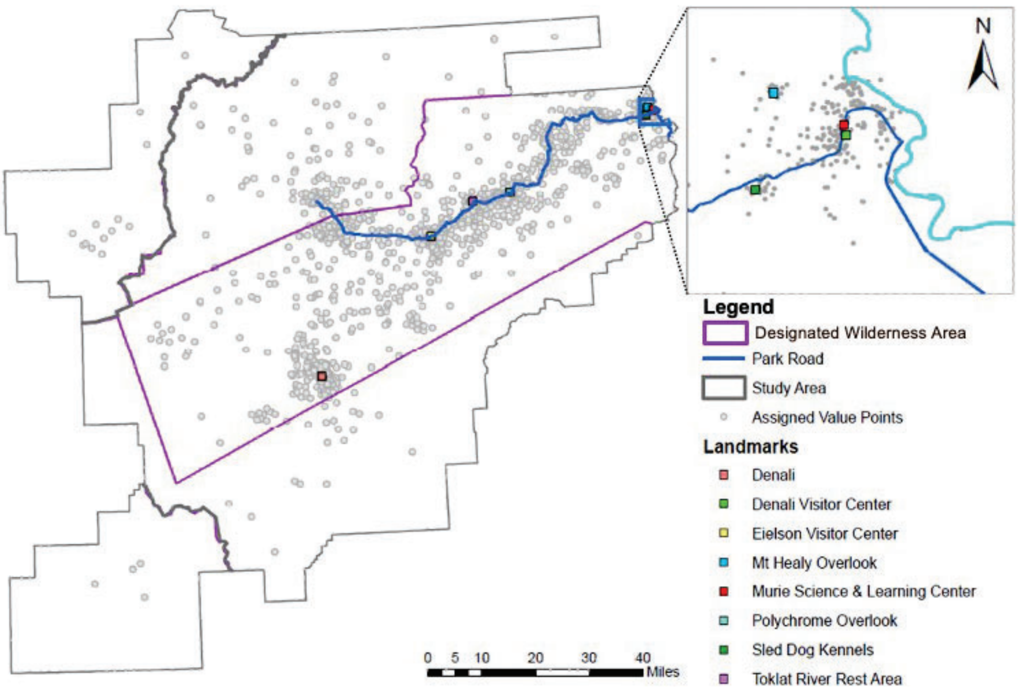

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Figure 2. Map of assigned value points in Denali National Park and Preserve.

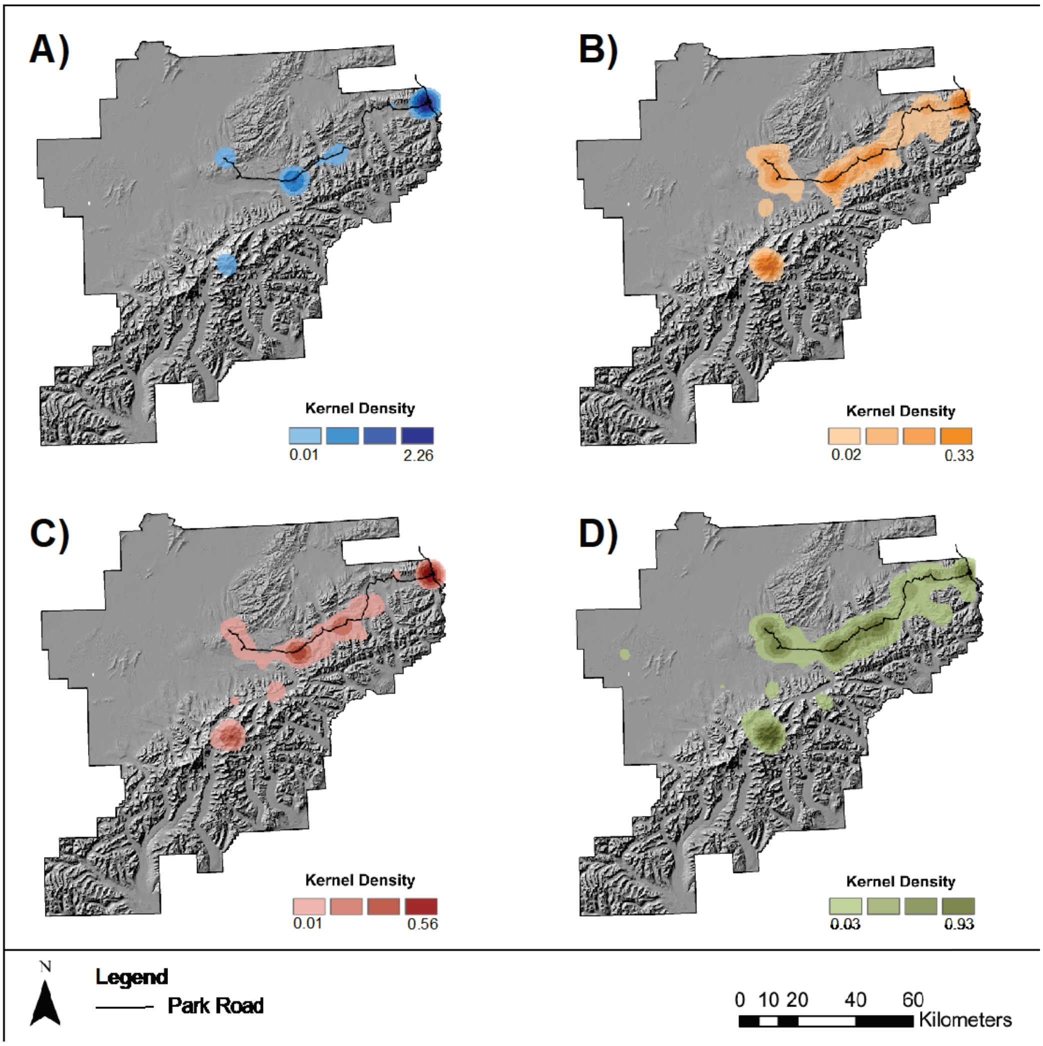

Figure 3. Kernel density analysis of four nature-based values including A) *recreation*, B) *scientific*, C) *ecological integrity*, and D) *wilderness* assigned to places by survey respondents. Kernel density layers are not normalized across the four specific value types.

Table 3. Reported and intended pro-environmental behavior of survey respondents. Responses were measured on a Likert scale where 1= "Never" and 5= "Very Often." α = Cronbach's alpha; ρ = Composite Reliability; λ = Factor loading score.

	Reported behavior		Intended behavior	
Variable	**λ**	***Mean (SD)***	**λ**	***Mean (SD)***
Conservation Lifestyle (α=0 .805; ρ=0.814)				
Recycle paper, plastic or metal	0.664	4.36 (0.96)	0.704	4.61 (0.60)
Conserve water or energy	0.781	4.35 (0.70)	0.806	4.46 (0.57)

Buy environmentally friendly and/or energy efficient products	0.743	3.83 (1.27)	0.798	4.11 (0.95)
Social Environmentalism (α=0.867; ρ=0.891)				
Participate as an active member of a discussion about the environment	0.737	1.91 (1.55)	0.842	2.32 (1.70)
Volunteer for environmental causes (e.g., restore native or remove exotic species)	0.752	1.90 (1.38)	0.765	2.55 (1.47)
Work with other people to address an environmental problem landscape	0.870	2.40 (1.75)	0.897	2.85 (1.70)
Environmental Citizenship (α=0.782; ρ=0.742)				
Participate in scientific research related to the environment	0.714	2.29 (1.69)	0.754	2.84 (1.70)
Donate money to support environmental protection	0.682	2.23 (1.53)	0.684	2.77 (1.46)
Write a letter or leave a comment about an environmental issue	0.810	1.87 (1.34)	0.781	2.29 (1.49)

3.3. Pro-environmental behavior

Results from the CFA were used to verify the factor structure of our two PEB scales (see Table 3) prior to creating two mean value scores that indicated overall reported and intended behavior. Each scale was evaluated for internal consistency and composite reliability according to Cronbach's alpha and rho coefficients $\leq$ 0.70 (Kline, 2015). Three survey items were dropped due to low factor loading scores (i.e., < 0.4), including the extent to which respondents avoided feeding wildlife (M = 4.60; SD = 0.90), hiked in areas that were more durable and less likely to be impacted by human use (M = 3.50; SD = 1.36), and spoke with other people about the environment (M = 3.25; SD = 1.29). Following these modifications, the final scales showed acceptable model fit for reported behavior (X^2 = 127.453, df = 24, RMSEA = 0.083 CI = 0.069 – 0.097, CFI = 0.955, SRMR = 0.044) and intended behavior (X^2 = 155.728, df = 24, RMSEA = 0.093 CI = 0.080 – 0.107, CFI = 0.955, SRMR = 0.045) (Hu & Bentler, 1999). We then created mean value scores for the two PEB scales and compared the two. Results from an Paired Sample

T-tests showed that intended behaviors were greater than reported behaviors ($t(628) = 10.70$, $p < 0.001$).

Table 4. Regression results showing the effects of four nature-based values on reported and intended pro-environmental behavior

	Reported behavior		Intended behavior	
Specific value type	**Beta (β)**	**SE**	**Beta (β)**	**SE**
Wilderness	0.013	0.002	-0.001	0.002
Recreation	-0.023	0.004	-0.023	0.004
Ecological integrity	0.100	0.003	0.153*	0.003
Scientific	0.084*	0.004	0.127*	0.004
Covariates				
Age	0.106*	0.002	0.104*	0.002
User type (i.e., front vs. backcountry)	0.238*	0.082	0.206*	0.074
Times visited Denali	0.149*	0.001	0.150*	0.001

* = $p < 0.05$.

3.4. Relationship between specific values and behavior

Multiple linear regression models were estimated to understand the drivers of reported and intended behavior (see Table 4). First, reported behavior was regressed on four nature-based values while controlling for the effects of age, user type, and times visited Denali National Park and Preserve. In this model, *ecological integrity* ($\beta = 0.10$, $p = 0.02$) was positively correlated with reported behavior ($R^2 = 0.02$) ($F[7,501] = 4.06$, $p < 0.001$). Next, we regressed intended behavior on four nature-based values and included the same covariates as the previous model. *Ecological integrity* ($\beta = 0.15$, $p = 0.001$) and *scientific* ($\beta = 0.13$, $p = 0.003$) values significantly increased intended behavior ($R^2 = 0.04$) ($F[7, 504] = 7.75$, $p <0.001$). When aggregated, all predictor variables (including covariates) accounted for 29.4% and 31.2% of variance in reported and intended behavior, respectively. That is, when our covariates (i.e., age, times visited Denali National Park and Preserve, and frontcountry versus backcountry designation) were added to the

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model, our predictive capacity notably increased. We therefore aggregated our four nature-based values (i.e., *Wilderness, recreation, ecological integrity,* and *scientific*) into one composite score and found positive, bivariate associations with reported and intended behavior (see Figure 4).

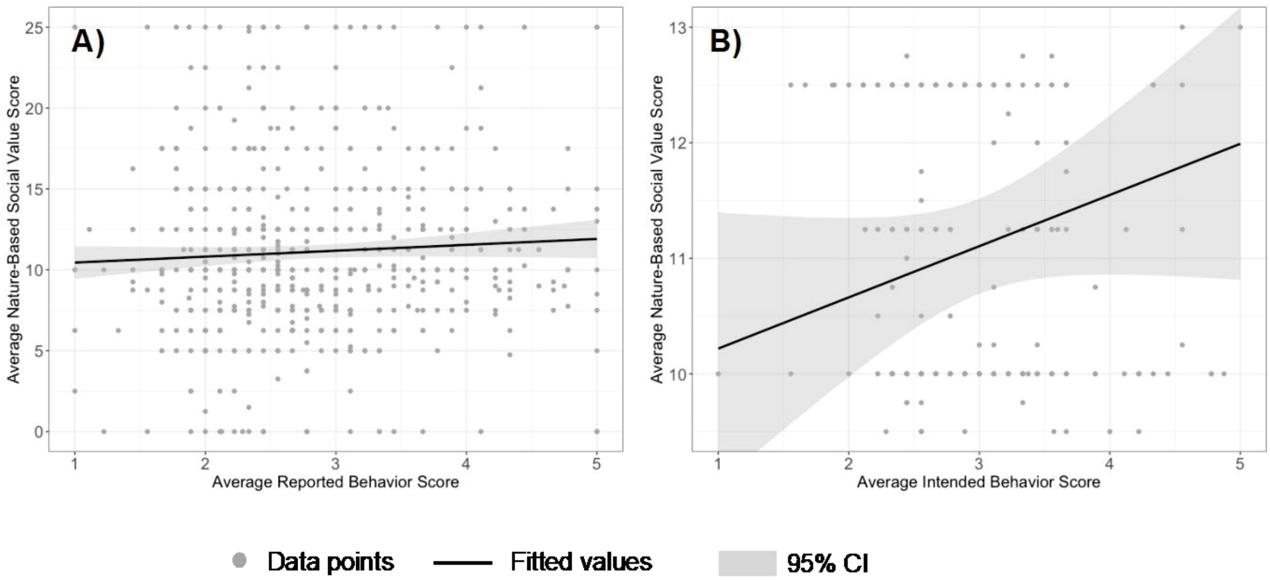

Figure 4. Results showing a bivariate association between (A) nature-based values and reported behavior; and (B) and nature-based values and intended behavior.

4. Discussion

4.1. Overview of study findings

This study advanced knowledge of the multiple values of nature that can reinforce or inspire environmental stewardship after experiencing a high profile, charismatic protected area like Denali National Park and Preserve in Alaska, U.S.A. We build on a rapidly expanding body of previous research that harnesses the potential for value concepts to more broadly characterize the reasons why people care about and ascribe meaning to places (Brown, 1984; Brown et al., 2000; Kenter et al., 2019; Pascual et al., 2023; Raymond et al., 2021). We sought to establish a theoretical dimension within Brown and Reed's (2000) typology, which we suggest should be comprised of wilderness, recreation, ecological integrity, and scientific 'objects of value'

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(Benston & Xu, 1995). We also drew from two environmental social science theories (Stern et al., 1999; Ajzen, 1991) to distinguish between reported and intended pro-environmental behaviors, and then evaluated how these different actions were influenced by an aggregated valuation score. To our knowledge, this is one of the first studies (for exception see Kyttä et al., 2018) to empirically evaluate how specific values influence both reported and intended behavior. We aimed to generate a deeper understanding of the reasons why people feel compelled to engage in PEB given the importance of recognizing a broad range of values when making resource management decisions.

4.2. Spatial dynamics of specific values focused on nature-based experiences

Our results showed that protected area visitors valued Denali National Park and Preserve for a multitude of reasons including *wilderness, ecological integrity, scientific,* and *recreation*. The spatial locations of visitors' interactions with places showed discernable patterns. In particular, specific values were associated with places that were experienced *and* places like Mt. Denali that respondents were not likely to be experienced first-hand (Cai et al., 2023). In line with previous research, protected area visitors may have become attuned to these distant features due to knowledge and interpretation offered within the protected area (van Riper & Kyle, 2014). Our participatory research process revealed that value points congregated along the park road, visitor centers, Mt. Foraker, and Mt. Denali. This spatially explicit information can guide managerial attention toward high and low priority places such as areas of value abundance or underappreciated resources that have the potential to spur interest in functioning ecosystems and environmentalism (Johnson et al., 2019). With dedicated resources to generate knowledge through interpretation and a values-centered philosophy, we contend that visitors will be better able to recognize and appreciate the benefits of protected area landscapes.

We observed that nature-based values were important for explaining why visitors appreciated Denali. Though four specific values were most salient and conceptually distinguishable from the other categories in our original typology adapted from Brown & Reed (2000), two were particularly important for activating reported and intended behaviors. First, respondents who expressed that Denali was valued for *ecological integrity* indicated a concern for biological diversity and the importance of natural processes to sustain life. It could be that this specific value was deemed important because such principles were previously held by visitors or conveyed by public land management agencies such as the National Park Service (Woodley, 2010). Second, *scientific* values indicated that visitors recognized the importance of Denali for investigation and experimentation, as well as providing benchmark conditions that can be monitored over time (Manning et al., 2016). The comparatively high scores for these two specific values also illustrate visitors' general support for building an environmentally conscious society that can help to develop solutions for sustaining protected areas in the future. Though despite these high levels of environmentalism, respondents intended to perform more behaviors after returning home in response to what was learned during their visit. Though it is well known that people do not always act on their intentions, this result provides evidence that on-site experiences at Denali can lead to (intended) behavior change.

4.3. Relationships between reported and intended pro-environmental behavior

We observed higher levels of intended than reported PEB, which aligns with previous research (Ebreo & Vining, 2001). Although the amount of behavioral variation explained by specific values was low across both types of behavior (i.e., the predictor variables explained 1.8% of variation in reported behavior and 4.0% in intended behavior), these associations with places may have inspired and motivated visitors during their time spent in the protected area because their behavioral intentions were more prevalent and more likely to increase. Because national parks afford an array of opportunities for education and direct, extraordinary landscape experiences, visitors who valued Denali for its nature-based qualities, rather than its therapeutic qualities, may be more likely to commit to future behaviors that would serve as the basis for conserving natural areas in the future. Indeed, it could be that visitors' intentions to benefit the environment were influenced by transformational on-site experiences such as wildlife viewing (Hughes, 2013). Importantly, we could not examine longer term changes in behavior in the present study. Intentions may also have been overestimations of actual behavior due to response biases such as social desirability, while previously reported and observed behaviors likely reflected more accurate accounts of action (Gifford & Nilsson, 2014; Kormos & Gifford, 2014).

In addition to extending previous research that has investigated the differences between reported (e.g., Stern et al., 1999) and intended (e.g., Ajzen, 1991) behavior, our findings supported a multi-dimensional conceptualization of behavior (Landon et al., 2018b; van Riper et al., 2019). That is, behaviors related to personal conservation lifestyles, social environmentalism, and environmental citizenship were distinguishable (Larson et al., 2015). Visitors to Denali were more likely to report intended behaviors. In line with previous research (Winkler-Schor et al., 2020; Andrade et al., 2022), it could be that intentions to act at the individual and household level to support environmentalism are most prominent because they require the least amount of effort. Future research should continue to distinguish among the multiple dimensions of behavior and seek to unveil the complex interplay of how individuals and groups make decisions in support of environmental sustainability.

4.4. Value-behavior relationships can guide protected area management decisions

The nature-based values investigated in this study are important to the park's purpose and provide a basis for enhancing communication with visitors. Denali is a protected area with a relatively large team of scientists as compared to other U.S. parks that are not as well known. It could be that the resources allocated to support science and visitor education in this context are successfully conveying key values from the agency to the public, particularly the idea of *ecological integrity* that is prominent in Denali National Park's resource protection strategy (National Park Service, 2014). In response to these findings, resource management agencies might consider modifying their communication strategies to not only align with visitors' values but also consider how their own positions compare. A primary goal of education and outreach within protected areas is to help the public understand how they are experiencing unique and special places, thereby addressing a mandate to maintain high-quality visitor experiences without degrading the environment (Winks, 1996). This goal can be enhanced with knowledge of what people value, and it simultaneously reflects what is desired by the management agency. Revisiting interpretive messages about the importance of not feeding wildlife when visiting the park would present opportunities for conveying *wilderness* values, whereas training sessions where backcountry rangers to discuss Leave No Trace practices with visitors (Lawhon et al., 2013; Stamberger et al., 2018) would create space for social learning about the public's interest in and response to environmental conservation initiatives.

Public land managers are faced with a host of challenges that complicate the decisions being made about visitor experiences in protected areas such as annual budgets, national or organizational political climates, and uncertainty that flows from climate change. Sustaining protected area resources requires conceptual knowledge of specific values and behavior, rigorous methods for analyzing specific values expressed by people who hold different histories and associations with protected area resources, and new scientific insights on how to encourage pro-environmental activity in a rapidly changing world. These advances can equip public land management agencies with reliable insight on what is or is not considered important (Brown & Fagerholm, 2015), anticipated points of conflict over potentially competing uses (Wolf et al., 2018), and guidance on the development of intervention strategies for shaping behavior within and outside of protected area boundaries (Andrade et al., 2023). Collaborative outreach with local and state partners will be key in future protected area work to explore how specific values are imbued in nature beyond protected area borders (Raymond et al., 2022). Upscaling conservation to the landscape level to preserve ecological integrity is also recognized by both international (e.g., The International Union for Conservation of Nature) and national institutions as future priorities (e.g., NPS Director's Order 100: Resource Stewardship for the 21st century; Jarvis, 2016).

Public land management agencies facilitate experiences that contribute to a high quality of life for all people, yet they rely on empirical evidence from the social sciences to better understand the interests of outdoor recreationists (Laursen et al., 2021). Ensuring that public lands are managed in a way that reflects current and future generations requires careful consideration of how human use interfaces with ecosystem structures and functions (Manning et al., 2022). There is a particularly pressing need to understand why people make behavioral decisions that are more environmentally friendly and identify the pathways leading to these outcomes, which are underpinned by the multiple values of nature. The linkage between values and behavior is receiving increased attention by policy initiatives such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) Values Assessment, which is creating decision space to strengthen connections between science and policy and more deeply integrate values into decision-making (Díaz et al., 2019; Pascual et al., 2023). We advance this cause and support the notion of adopting a values-centered management philosophy, which also calls attention to the covariates in our model that played a surprisingly important role in explaining both reported and intended PEB, including user group classification (i.e., frontcountry versus backcountry use), number of previous visits, and age. The importance of these characteristics should not be overlooked by organizations that aim to stem behavior change. Our comparison between specific values and both current and future behaviors thus uncovers the reasons why visitors relate to special places such as protected areas that can inspire environmental stewardship in the face of change.

5. Conclusion

We examine how nature-based values play a role in shaping pro-environmental behavior in a charismatic protected area context. Our results reveal the spatial dynamics of valued objects in a landscape using participatory methods, the relationships between reported and intended action, and the power of an aggregated valuation score to explain previous and future patterns of behavior inspired by Denali National Park and Preserve, Alaska, USA. We also provide empirical evidence to support the theoretical development of a nature-based dimension within a widely adopted PPGIS typology. We also contend that behavioral intentions are more prevalent than the reported on-site activities of protected area visitors. Thus, this article offers insights into the potential role of specific values in catalyzing transformations toward a more sustainable future.

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