JOURNAL OF LEISURE RESEARCH
https://doi.org/10.1080/00222216.2024.2358319

Taylor & Francis
Taylor & Francis Group

Wildland encounter norms across time and activity type: Stable preferences and shifting thresholds

William L. Rice[a] and Christopher A. Armatas[b]

[a]Department of Society and Conservation, University of Montana, Missoula, Montana, USA; [b]Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station, USDA Forest Service, Missoula, Montana, USA

ABSTRACT

Social and ecological conditions are constantly changing, but research concerning how visitors to wildlands perceive such changes across time is both limited and narrow. With a focus on the social settings of recreation experiences, this study provides an understanding of how perceptions of wildland visitors have changed over time. Specifically, across three time periods (1989, 1994, and 2022) within a wildland unit in Montana (USA), we found that preferences for encounters with other visitors remained relatively stable, levels of acceptable encounters (or thresholds) increased across time in some instances, and levels of acceptable encounters varied across the activity types that visitors encountered. By expanding evaluative norms research to include both activity type and multiple time periods, we contribute to both theory and application of wildland recreation management.

KEYWORDS

Limits of acceptable change; solitude; wilderness character; trends; norm stability

Introduction

Change is difficult to avoid. Wilderness, often romanticized as unchanging, is in constant flux. The northern Rockies of the United States—home to many designated wilderness areas—for instance, are burning more today than they have in millennia (Higuera et al., 2021). Insects are changing forest communities. Grizzly bear encounters are on the rise (Chaney, 2020), while wolverines are becoming scarcer (Barrueto et al., 2022). And recreational use of these wildlands is changing (Borrie & McCool, 2007). Similarly, the ways society frames and interacts with wildlands are in flux (Kuentzel et al., 2020; Rice, 2022). Principally, this is why adaptive management of wildlands is encouraged (Graefe et al., 2011; Kuentzel & Heberlein, 2003). However, adaptive management requires an understanding as to how conditions are changing so that an iterative cycle of defining the problem, establishing the goals, implementing strategies to achieve goals, and assessing outcomes can be realized.

Some conditions in wildlands are easier to monitor than others. Within recreation social settings (see Manning, 2011), there are a variety of tools used to aid managers in understanding *descriptive* changes (i.e., the objective characteristics of recreation

CONTACT William L. Rice will.rice@mso.umt.edu

area; e.g., how many people, where people go, how long they stay, etc.) within parks and protected areas. For instance, there are long-used tools such as trail counters and GPS units to understand visitor numbers, travel patterns, and use density. Increasingly, emerging tools like remote sensing (e.g., Kendall et al., 2021), textbots (e.g., Lia et al., 2023), and mobile phone location data (see review by Whitney et al., 2023) are also being employed. And yet, as noted by Manning (2007) and Whittaker et al. (2011), collecting and incorporating *evaluative* data (i.e., social judgements concerning the recreation area and related experiences) into monitoring and management plans is also critical. However, collecting and incorporating evaluative data (i.e., visitor evaluations of their experiences, including their assessment of social, environmental, and managerial conditions) to support wildland management decisions is challenging.

First, there is increasing recognition around the complexity of wildland visitors' experiences. When considering social settings (our primary focus herein), research has long recognized that 'crowding', a negatively framed phenomena that is generally considered undesirable in wildland recreation settings, is not simply a function of user density and encounters, but also a function of type of use/user encountered, location of encounters, and personal preferences and expectations of visitors (Absher & Lee, 1981; Cole & Carlson, 2010; Graefe et al., 2011; Heberlein, 1977; Kuentzel et al., 2020; Lee, 1977; McCool et al., 1977; Stankey, 1973). Second, there is a limited amount of research focused on monitoring the *multi-faceted* recreation experience of visitors in wildlands. While there is recognition that visitors process social settings during a recreation experience in complex ways, most of the literature (and applied science studies) monitoring changes over time focuses on perceptions of visitor use density and numbers of encounters. That is, there is a limited amount of literature that focuses on how views change regarding visitor interactions with different behaviors, such as activity type.

The upshot of a relatively narrow focus of evaluative monitoring over time on user density and encounters, despite recognition that wildland visitor experiences are more complex, is that wildland managers continue to make management decisions concerning use levels often solely based on descriptive (e.g., people-at-one-time) and evaluative (e.g., surveys eliciting acceptability of various levels of people-at-one-time) measures of visitor use density, encounters, or other numerical volumes (Cole & Carlson, 2010). Indeed, there is continued recognition that focusing on numbers of people encountered is a simplistic approach to measuring experiential quality (Graefe et al., 2011; Kuentzel et al., 2020); however, this practice largely continues due to the relative ease of measuring density and encounters—and visitors' evaluations of density—compared to other social indicators (e.g., visitor behavior, instances of conflict) (Landres et al., 2005). Further, even if simply describing and evaluating use levels provided a comprehensive understanding of wildland recreation experiences, there are relatively few wildland units (compared to the number of total units) that have knowledge about how visitors' perceptions of wildland encounters *change* over time.

Within the context of wildland research focused on normative evaluations (i.e., visitor preferences and thresholds) of encounters with other wildland users, we aim to address two primary literature gaps to support more nuanced decision-making by wildland recreation managers and planners. First, we provide an additional setting for assessing differences between preferences and thresholds concerning density/encounters,

while providing the first analysis of *both* preferred conditions and thresholds concerning visitor encounters across *three* time periods. Second, we move beyond considering each encounter (or individual's presence) as equal, by examining of how changes in preferences and thresholds vary across the activity type (e.g., biking, hiking) of those encountered. Therefore, we outlined the following research questions to be addressed in a wildland setting near Missoula, MT (USA):

> R1: How do visitors' preferences concerning encounters vary between 1989, 1994, and 2022?
>
> R2: How do visitors' thresholds concerning encounters vary between 1989, 1994, and 2022?
>
> R3: Do trends concerning preferences and thresholds vary by the behavior of those encountered?

Literature review

The evolution and relationship between norms research and recreation management

Early norms research in U.S. wildlands was motivated, in part, by the need to address the recreation mandate that federally designated wilderness areas provide for "outstanding opportunities for solitude or a primitive and unconfined type of recreation" (Section 2C) and the emergence of the concept of recreation carrying capacity (Stankey, 1973). As stated by Hendee et al. (1978):

> As with the ecological model of capacity, the social model involves a number of specific elements, any one of which might define an area's social carrying capacity. A manager will want information about total number of encounters, the number of encounters with other kinds of users, crowding at campsites, and so forth. (p. 184)

Principally, this method requires defining an indicator (e.g., people-at-one-time in a spatial- or time-bound setting, number of encounters in a day or at a campsite), measuring visitors' preference or acceptability for varying levels of the selected indicator, and, finally, establishing a capacity for use levels based on descriptive (i.e., number of encounters) and evaluative (i.e., acceptability) data—hopefully considering other data, such as ecological impacts, in the process (Whittaker et al., 2011).

The recreation carrying capacity concept fundamentally posited that there was some number of people that could be accommodated to sustain both social and ecological conditions. This fundamental idea suggests that the enjoyment derived from a recreational activity decreases in direct proportion to the increase in the number of people encountered. It is theorized that any disturbance to a person's solitude negatively impacts the quality of their recreational experience (see review by Graefe et al., 1984b). In this way, density or encounters are operationalized as indicators upon which thresholds are instituted by managers (Whittaker et al., 2011).

However, understanding concerning the failings of this method in recognizing the nuance within the multiple dimensions of a recreation experience began decades ago. For instance, research in 1970s began to uncover that density and encounters are not complete (or even nearly-complete) measures of crowding or solitude (Heberlein, 1977;

Lee, 1977; McCool et al., 1977; Stankey, 1973). As found by Stankey (1973), individuals' sense of crowding goes beyond use levels encountered, but includes the types of use encountered, where the encounters take place, and the behavior of those encountered. From their study of backcountry visitors to Yosemite National Park in the late 1970s, Absher and Lee (1981) conclude, "Crowding is less a response to social density than a product of the interaction setting, how it is defined, and the particular attributes, preferences, and expectations of the people present" (pp. 244-245).

While density and the number of encounters are important indicators of visitors' evaluations of crowding and solitude in wildland settings (Absher & Lee, 1981; Stankey, 1973), normative evaluations of density are also strongly influenced by the personal characteristics of visitors, themselves, and the perceived characteristics and behaviors of recreationists they encounter (Manning, 2011). However, both management practice and research that move beyond a focus on user density and numbers is sparse. Regarding management practice, incorporating a narrow focus on visitor numbers, as a primary facet of visitor use management, is contemporarily driven by planning and policy requirements. For instance, managers of Wild and Scenic Rivers in the U.S. are mandated by policy to establish a 'user capacity'. That is, even if recreation managers wanted to broaden the approach to monitoring recreation experience (e.g., via the application of social indicators beyond visitor numbers such as self-reported conflicts), there are institutional barriers to developing an approach that does not at least have some focus on visitor numbers.

Regarding research, there is a similarly narrow focus on norms related to visitor numbers (Needham et al., 2014), with a limited amount of research focus on behavior. Zhang and Chung (2015) used photo-based methods for eliciting acceptability of social conditions by incorporating scuba diver behavior into their model, in addition to people-at-one-time. Stanfield et al. (2005) employed similar methods by changing the apparent race of hikers featured in photos of varying levels of density. More recently, Rice et al. (2021) furthered this line of inquiry by altering the behavior of hikers depicted in the photos showed to respondents (during the COVID-19 pandemic) by changing the level of mask-wearing, along with people-at-one-time. The authors found a significant interaction between visitor density and the level of mask use, indicating that recreationists have different normative thresholds for visitor density based on the behaviors of those they encounter.

Norm stability

Importantly, the interaction between mask use (i.e., a specific behavior) and density revealed by Rice et al. (2021) in May 2020 would likely not be identical to the level of interaction between these variables if the study was replicated in 2023. Norms concerning the wearing of masks during outdoor recreation have likely shifted due to changes in science-based guidance and rates of infection. Thus, we assume that this norm lacks stability—longitudinal uniformity of visitors' normative thresholds (Nettles et al., 2020). Norm stability is important because often—especially in the case of use levels—use limits or other management actions are determined based on normative evaluations of conditions at a particular window in time. If norms are not stable (i.e., shifting) and management actions based on a previous baseline are still employed,

unintended consequences may arise. For instance, use may be limited and activities may be restricted to levels that unnecessarily prohibit access (Stankey & McCool, 1984). Alternatively, levels of use may exceed current normative thresholds and activities may be allowed when they are no longer seen as acceptable.

Assessing the stability of norms concerning recreation conditions (i.e., density, behavior, visitor characteristics, etc.) enables managers to understand if visitor norms, and related thresholds, change over time (Bacon et al., 2001). Such research requires at least two data collections to occur during two, distinct temporal windows—beginning with a baseline data collection to which subsequently collected data can be compared. Lucas (1985) provides perhaps the first attempt at this research approach by assessing changes in normative evaluations of the number of encounters visitors experienced in the Bob Marshall Wilderness between 1972 and 1980, finding no difference between years. Cole et al. (1995) continue this line of research by assessing normative stability (and other trends) across three U.S. wilderness areas. The authors found that the mean preferred number groups camped with in sight or sound of respondents decreased significantly from 1972 to 1990 in the Desolation Wilderness. Cole et al. (1995) also found that paddlers in the Boundary Waters Canoe Area Wilderness felt significantly more crowded in 1991 compared to 1969—despite unchanging levels of interparty contact. In Shining Rock Wilderness, however, the same authors found the opposite trend—with normative evaluations of density decreasing from 1978 to 1990. Similarly, Riley et al. (2015) found that perceptions of crowding decreased from 2006 to 2011 in Oregon Dunes National Recreation Area and Wall-Reinius and Bäck (2011) found that visitors to protected areas in northern Sweden found decreased importance in minimized encounters from 1980 to 2003.

Importantly, however, much of the norm stability research related to evaluations of density have found stable patterns across time. Employing a similar research question to Cole et al. (1995), Hall and Davidson (2013) found that the frequency of visitors reported being crowded in the Bridger Wilderness did not significantly change between 1969 and 2010. Bacon et al. (2001) assessed differences in preferences for the number of hiking parties seen during trips in the Denali National Park and Preserve Wilderness between 1978 and 2000—finding stable norms across this 22 year span. Borrie and McCool (2007) and Kuentzel and Heberlein (2003) report similar findings from the Bob Marshall Wilderness and Apostle Islands National Seashore, respectively. Nettles et al. (2020), again, report this finding of stable norms concerning preferred use density conditions at Cumberland Island National Report between 2011 and 2018, however the authors found that visitors had higher thresholds (tolerance for denser conditions)—reflecting the same finding of Kuentzel et al. (2020) stemming from a 24 year study of Apostle Islands visitors. Interestingly, Kyle and Landon (2021) report a different trend, with levels of crowding on Lake Travis in Texas maintaining stability between 2008 and 2016, while preferences for encounters varied.

While no clear, generalizable trend concerning norm stability (or lack of stability) emerges from this literature, the recent findings of Nettles et al. (2020) and Kuentzel et al. (2020) suggest a possible trend of increasing thresholds for encounters in wildland settings in the U.S. This possible trend invites future research in additional wildland contexts (Nettles et al., 2020). Additionally, the established knowledge of how behaviors impact normative thresholds has yet to be incorporated into norm stability

research in outdoor recreation—thus inviting a question concerning how norm stability may vary across the use levels of different activity styles over time. Improving our understanding of norm stability in wildland settings is critical to guide managers' decision-making concerning either maintaining baselines or engaging in adaptative management. If normative thresholds change over time, for instance, this would signal that wildland managers should likely adjust their management thresholds, if ecological and managerial capacities allow. This would challenge the frequent practice of maintaining baselines, common in wilderness management in the U.S., but may offer managers a key pathway in improving management and maximizing access in an era of increasing recreation demand.

Methods

Study area

The Rattlesnake National Recreation Area and Wilderness (RNRAW) are located on the Lolo National Forest in western Montana (USA), a few miles north of the City of Missoula. Designated in 1980, the RNRAW—coined "America's best backyard" by Congressman Pat Williams (Chaney, 2021), is a popular recreation area for Missoula residents and tourists to the Missoula area. The RNRAW offers year-round opportunities for hiking, dog walking, mountain and gravel biking, fat tire biking, backpacking, running, fishing, cross country skiing, alpine ski touring, horseback riding and packing, and pack rafting. The Wilderness contains numerous high mountain lakes, and the National Recreation Area is bisected by Rattlesnake Creek. The entirety of the RNRAW is managed using a 1992 Limits of Acceptable Change management direction. As identified in this management direction, and The Rattlesnake National Recreation Area and Wilderness Act of 1980, the RNRAW is to serve as research laboratory for wildland management. Two primary visitor surveys were conducted in the RNRAW in 1989 and 1994 with the purpose of establishing baselines for future management actions concerning conflict and crowding (Watson et al., 1996).

Data collection

The present study draws upon three separate data collections occurring in 1989, 1994, and 2022–2023 (simplified to 2022 throughout this manuscript). This 33 year timespan makes this study the one of the longest temporal assessments of norm stability, perhaps second to only Hall and Davidson's (2013) 49 year span and Borrie and McCool's (2007) 34 year span. Due to changes in policy, research ethics standards, and technology, data collection methods varied to varying degrees between data collections. This is not uncommon for recreation trends, and, particularly, recreation norm stability research spanning multiple decades (see Bacon et al., 2001; Hall & Davidson, 2013; Kuentzel et al., 2020; Wall-Reinius & Bäck, 2011). Similar changes were required for this present research. The minimum age for participation was changed from 15 to 18 and the amount of non-response bias questions was limited due to Institutional Review Board recommendations. Additionally, for budgetary purposes, the data collection occurred via an on-site exit survey in 2022, instead of the mailback technique used

in 1989 and 1994. This is a notable limitation of this research, as—though all three samples stemmed from on-site intercepts—varying sampling modalities can lead to varying results. For instance, Ferguson et al. (2022) found that encounters thresholds of visitors to White Mountain National Forest (New Hampshire, USA) varied significantly between those intercepted on-site and those surveyed off-site. Further, metadata concerning how visitors were randomly (or non-randomly) selected for participation in the 1989 and 1994 surveying efforts was not recorded. Thus, the 2022-2023 study employed stratified random sampling. Finally, as frequently is the case in recreation norm stability research (e.g., Hall & Davidson, 2013; Nettles et al., 2020; Wall-Reinius & Bäck, 2011), the data collections varied in breadth and scope year to year. Therefore, other survey items (not included in these analyses) varied year to year.

1989

Sampling occurred from May through September 1989 on weekday and weekend days. Sampling was conducted at the Main Rattlesnake, Gold Creek, and the West Gold Creek Trailheads. Applying a stratified-cluster sampling method, sampling was randomly stratified by location, day of the week, and time of day. On each sampling day, a four-hour time block was selected at random, beginning no earlier than 8 AM and ending no later than 8 PM. Visitors entering or exiting the study area were asked to participate. All agreeing participants over the age of 15 were surveyed to collect basic on-site information regarding length of visit, travel destinations, and group characteristics. All were also asked if they would be willing to receive a mailback questionnaire with further questions. The data archive of the 1989 study (Watson et al., 2015), including raw data and supplemental materials, is publicly available.

1994

Sampling occurred from June through December 1994 on weekday and weekend days. Sampling was conducted at the Main Rattlesnake, Sawmill Gulch, Gold Creek, and the West Gold Creek Trailheads. Applying a stratified-cluster sampling method, sampling was randomly stratified by location, day of the week, and time of day. On each sampling day, a six-hour time block was selected at random, beginning no earlier than eight AM and ending no later than eight PM. Visitors entering or exiting the study area were asked to participate. All agreeing participants over the age of 15 were surveyed to collect basic on-site information regarding length of visit, travel destinations, and group characteristics. All were also asked if they would be willing to receive a mailback questionnaire with further questions. An initial survey was sent after each sampling day, followed by a reminder postcard one week later. Failing to receive a completed survey, a second survey was sent two weeks later, and, finally, a third survey was sent at approximately three weeks later. The data archive of the 1994 study (Watson et al., 2015), including raw data and supplemental materials, is publicly available.

2022

Sampling occurred from May 2022 through February 2023 on weekday and weekend days. Sampling was conducted at the Main Rattlesnake, Equestrian, Sawmill Gulch, Gold Creek, and the West Gold Creek Trailheads. Applying a stratified-cluster sampling

method, sampling was randomly stratified by location, day of the week, and time of day. On each sampling day, an eight-hour time block was selected at random, beginning no earlier than eight AM and ending no later than eight PM. Only visitors exiting the study area were asked to participate. We employed a random number generator and methodically intercepted individuals or groups, approaching every *n*th based on a random number of minutes between one and nine, requesting their participation in the study. In the case of groups, a single individual over the age of 18 was invited to complete the survey. If multiple people were willing, the person with the closest birthday was chosen to participate. If that person declined, another group member could volunteer if they wished.

Questionnaire

Across the three data collections, a few key questions were retained throughout. These included an assessment of group size, frequency of visitation, and normative evaluations of use levels—including preferred conditions and maximum acceptable conditions (thresholds). Across data collections, visitors were asked to provide their preferred and maximum "total number of people I see along the trail each day" and their preferred and maximum number of hiker groups, joggers, bicyclists, and groups with a dog. Importantly, the number of joggers, bicyclists, and groups with a dog were added to the survey in 1994, and, thus, data are not available for these items in the 1989 dataset. Additionally, the 1994 data collection contained two survey versions, one asking for preferred conditions and another asking for maximum acceptable conditions. Therefore, half of the respondents were asked to report their preferred conditions and half were asked to report their maximum acceptable conditions. In all three data collections, respondents were given the following prompt prior to providing their preferred and maximum numbers:

> We would now like to explore your specific evaluations of conditions in this area. Different people desire different things and managers need to know what things you find acceptable and what things you find unacceptable. Managers can use this information in determining success of their actions to control impacts.

The origin of this question and the associated prompt are not known, however they appear to be similar to questions developed for understanding encounter norms during this era (Manning, 2011). Additionally, in all three data collections, visitors were allowed to skip the question if they were uncertain or did not have a preference.

Data cleaning and analysis

Data used in this analysis was downloaded from U.S. Forest Service Research Data Archive (Rice et al., 2024; Watson et al., 2015; Watson et al., 2015). Data cleaning followed methods prescribed by Vaske (2019). First, all three surveys were joined into a single dataset. Outliers were removed and incorrectly entered data was corrected (i.e., text data was converted to numeric data) or removed. Second, all variables measured in at least two of the three surveying efforts (1989, 1994, or 2022)—using the same measures—were combined into single, joined variables. Third, a series of one-way analyses of variance (ANOVAs) were conducted to assess differences in group size,

visits-per-year, normative encounter preferences, and normative encounter thresholds across years (Vaske, 2019). Levene's F test was employed to determine if equality of variance could be assumed for the dependent variables. If equality of variance couldn't be assumed, Welch's test of Equality of Means was utilized to adjust the significance level of the overall test. Furthermore, post hoc tests were performed to identify significant differences between the three data collections. The specific post hoc test employed depended on whether equality of variance could be assumed, with either Scheffe's S or Tamhane's T2 used accordingly. These post hoc tests were chosen for their conservative estimation of significance (Vaske, 2019). Eta-squared (η^2) was used to assess effect size, with the following thresholds: 0.01 (small), 0.06 (medium), and 0.15 (large) (Abbott, 2016).

Results

Response rates

1989

A total of 296 surveys were mailed to visitors recruited through the on-site sampling. Three mailed surveys were not deliverable, while two more were returned but were not usable. 211 completed questionnaires were returned, offering a response rate of 73%. No non-response bias was found (Watson et al., 1991).

1994

Approximately 1485 were mailed to visitors recruited through the on-site sampling. 1054 completed questionnaires were returned, offering a response rate of 71%. No non-response bias was found (Watson et al., 1996).

2022

Approximately 304 surveys were completed by visitors recruited through the on-site sampling, for a response rate of 66%. To assess non-response bias, we assessed visitor activity type, as we hypothesized that bikers' high speed of travel into the RNRAW may result in more survey refusals. Following a chi-square test comparing visitors refusing and accepting the survey, a non-response bias was found ($\chi^2 = 4.707$, $p = 0.030$). However, the effect size was minimal (Cramer's $V = 0.091$), thus no adjustments were made (Needham et al., 2004; Vaske et al., 2002).

Visitor characteristics

Two visitor characteristics were collected in all three data collections: group size and frequency of visitation (see Table 1). Since 1989, the average group size of visitors decreased, from 2.73 to 1.84 in 1994 and to 1.77 individuals in 2022. Since 1989, the average number visits per year have steadily increased, from 11.88 to 26.59 in 1994 and to 48.73 times per year in 2022. Similarly, the standard deviation of visits per year increased from 1989 (20.03) to 1994 (40.00), and again in 2022 (71.44)—suggesting increasing variation over time.

Table 1. Differences in group size and visits per year between 1989, 1994, and 2022.

	n	Min	Max	Mean	SD	F-value	Levene statistic	Eta^2
Average Group Size	1610					65.38[a]	9.59[b]	.047
1989	408	1	7	**2.73**	1.42			
1994	898	1	50	**1.84**[c]	2.12			
2022	304	1	5	**1.77**[c]	0.90			
Average Visits Per Year	1433					46.60[a]	62.09[b]	.049
1989	186	1	150	**11.88**[d,e]	20.03			
1994	968	1	400	**26.59**[c,e]	40.00			
2022	279	1	350	**48.73**[c,d]	71.44			

[a]Statistically significant at a 99.9% confidence interval: at least two groups are significantly different.
[b]Equality of variances cannot be assumed.
[c]Statistically significantly different than 1989 respondents at a 95% confidence interval.
[d]Statistically significantly different than 1994 respondents at a 95% confidence interval.
[e]Statistically significantly different than 2022 respondents at a 95% confidence interval.

Norm stability

Analyzing the preferred number of encounters (Table 2), some significant differences are observed between the years. For the preferred number of hiker groups encountered, there were significant increases in both 1994 (5.85) and 2022 (5.42) compared to 1989 (2.71) ($p < 0.01$, $\eta^2 = 0.023$). Similarly, the preferred number of jogger encounters significantly increased from 1994 (6.07) and 2022 (8.52) ($p < 0.01$, $\eta^2 = 0.020$). However, no significant differences were found for the preferred total number of people, number of bicycles, or groups with dogs encountered. Additionally, the effect sizes for these differences are small.

Concerning the maximum acceptable number of encounters (Table 3), significant differences are evident between the years. In terms of the total number of people seen along the trail each day, the mean values were significantly higher in both 1994 (31.31) and 2022 (30.23) compared to 1989 (16.31) ($p < 0.001$, $\eta^2 = 0.030$). Similarly, for the number of hiker groups encountered, the mean values were significantly higher in both 1994 (10.64) and 2022 (12.68) compared to 1989 (4.98) ($p < 0.001$, $\eta^2 = 0.030$). Additionally, there was a significant difference in the maximum acceptable number of bicycles seen across the years, with the mean values being significantly lower in 1994 (15.73) compared to 2022 (20.47) ($p < 0.001$, $\eta^2 = 0.014$). Furthermore, a significant difference was observed in the maximum acceptable number of people with dogs encountered, with the mean values being significantly lower in 1994 (10.62) compared to 2022 (20.53) ($p < 0.001$, $\eta^2 = 0.074$). Effect sizes for these differences ranged across small (0.014), small-medium (0.030), and medium (0.074) categories (Abbott, 2016).

Discussion

R1: How do visitors' preferences concerning encounters vary between 1989, 1994, and 2022?

Preferences concerning encounters remained relatively stable across the various data collections. The largest change in preferences is reported for the "number of hiker groups I see along the trail each day" which increased significantly from 1989 to 1994 (116%). Additionally, preferences for the number of joggers respondents see along the trail each day increased 40% between 1994 and 2022. All other norms remained stable, with no significant differences across years. Thus, these data follow the results of Nettles et al.

Table 2. Preferred number of encounters reported by respondents in 1989, 1994, and 2022.

	n	Min	Max	Mean	SD	F-value	Levene statistic	Eta^2
Total number of people I see along the trail each day	651					1.74	1.29	–
1989	91	0	50	**8.55**	8.75			
1994	335	0	100	**9.41**	11.55			
2022	225	0	125	**10.98**	13.82			
Number of hiker groups I see along the trail each day	629					14.51[a]	9.34[b]	.023
1989	91	0	25	**2.71**	4.31			
1994	327	0	50	**5.85**[c]	7.61			
2022	211	0	60	**5.42**[c]	6.46			
The number of bicycles I see along the trail each day*	530					2.98	5.96[b]	–
1989	–	–	–	**-**	–			
1994	316	0	100	**9.90**	12.80			
2022	214	0	100	**8.12**	10.73			
The number of joggers I see along the trail each day*	503					8.73[a]	6.81[b]	.020
1989	–	–	–	**-**	–			
1994	300	0	25	**6.07**[e]	6.42			
2022	203	0	60	**8.52**[d]	10.60			
Number of groups with dog(s) I see along the trails each day*	514					1.89	.606	
1989	–	–	–	**-**	–			
1994	311	0	90	**7.11**	10.94			
2022	203	0	50	**8.45**	10.63			

[a]Statistically significant at a 99% confidence interval: at least two groups are significantly different.
[b]Equality of variances cannot be assumed.
[c]Statistically significantly different than 1989 respondents at a 99.9% confidence interval.
[d]Statistically significantly different than 1994 respondents at a 99.9% confidence interval.
[e]Statistically significantly different than 2022 respondents at a 99.9% confidence interval.
*Item not included in 1989 survey.

(2020), wherein preferences remained relatively stable across years. These findings also mirror the results reported by Bacon et al. (2001) and Borrie and McCool (2007), wherein encounter preferences among wilderness recreationists remained stable over 22 and 34 year periods, respectively. These findings are not reflective, however, of Kyle and Landon's (2021) findings among boaters on Lake Travis, wherein preferences for densities of use did change over time. While the authors provide minimal discussion concerning this change in preferences (the primary focus of their research concerned evaluations of crowding—as influenced by preferences and expectations), they do note changing population and landscape change around Lake Travis that might account (in part) to these changing normative preferences. Here we return to the reminder of Cole et al. (1995) that each area is unique, thus making it difficult to generalize trends across wildlands.

R2: How do visitors' thresholds concerning encounters vary between 1989, 1994, and 2022?

In contrast to visitor preferences, visitor reported thresholds for the maximum acceptable number of encounters generally shifted across the data collections. From 1989 to 1994,

Table 3. Maximum acceptable number of encounters reported by respondents in 1989, 1994, and 2022.

	n	Min	Max	Mean	SD	F-value	Levene statistic	Eta[2]
Total number of people I see along the trail each day	654					38.11[a]	16.66[b]	.030
1989	100	3	50	**16.31**	9.24			
1994	330	0	200	**31.31**[c]	33.58			
2022	224	0	200	**30.23**[c]	31.19			
Number of hiker groups I see along the trail each day	633					35.23[a]	12.75[b]	.030
1989	93	0	25	**4.98**	4.43			
1994	329	0	100	**10.64**[c]	15.33			
2022	211	0	100	**12.68**[c]	14.39			
The number of bicycles I see along the trail each day*	525					6.70[a]	6.67[b]	.014
1989	–	–	–	**-**	–			
1994	311	0	100	**15.73**[e]	18.03			
2022	214	0	150	**20.47**[d]	22.12			
The number of joggers I see along the trail each day*	447					3.17	5.51	–
1989	–	–	–	**-**	–			
1994	248	0	150	**19.28**	21.47			
2022	199	0	100	**23.17**	24.52			
Number of groups with dog(s) I see along the trails each day*	476					32.78[a]	32.11[b]	.074
1989	–	–	–	**-**	–			
1994	275	0	100	**10.62**[e]	13.11			
2022	201	0	100	**20.53**[d]	21.77			

[a]Statistically significant at a 99% confidence interval: at least two groups are significantly different.
[b]Equality of variances cannot be assumed.
[c]Statistically significantly different than 1989 respondents at a 99.9% confidence interval.
[d]Statistically significantly different than 1994 respondents at a 99.9% confidence interval.
[e]Statistically significantly different than 2022 respondents at a 99.9% confidence interval.
*Item not included in 1989 survey.

the thresholds for the total number of people and the number of hiker groups respondents see along the trail each day increased 91% and 114%, respectively. Additionally, thresholds for the number of bicycles and groups with dogs respondents see along the trail each day increased 30% and 93%, respectively, from 1994 to 2022. Interestingly, thresholds for the total number of people and the number of hikers respondents see along the trail each day remained stable from 1994 to 2022. However, the overall evidence of non-stable (or shifting) normative thresholds is consistent with the findings of Kuentzel et al. (2020) and Nettles et al. (2020). The longitudinal trajectory of the RNRAW and Apostle Islands National Lakeshore (Kuentzel et al., 2020; Kuentzel & Heberlein, 2003) is worthy of note here. In both cases, sampling occurred within a decade from designation. As stated by Kuentzel et al. (2020), one of the primary objectives of their study was to track changes as a new protected area was established. This was also a goal of Watson et al. (1990; 1996). As posited by Kuentzel et al. (2020), changing encounter thresholds are part of a protected area's maturation process. As with the RNRAW, the Islands became more of a destination, attracting a larger range of visitors, and thus thresholds have evolved with an evolving and maturing destination.

In the case of the RNRAW, the change in normative thresholds is also likely influenced by both local and national trends. Locally, the RNRAW (designated in 1980) was still being developed in 1989. Prior to mid-1984, motorcycle traffic was allowed on major trails the National Recreation Area (McCool, 1985). The equestrian trailhead along Rattlesnake Creek was not yet constructed in 1989, and a ban on dogs had recently been lifted. According to newspaper accounts from the time (Devlin, 1992; McGlaughlin, 1992), use appears to have increased rapidly during these early years. A 1992 article in the *Missoulian* reports growing numbers of conflicts between users and increasingly congested trails (McGlaughlin, 1992). Into the mid-1990s, frequent visitors to the RNRAW were still coping with increasing visitor use levels. As stated in a 1996 article in *The Daily Inter Lake*, "This is all very difficult for the users who saw the Rattlesnake when it was less crowded and more pastoral" (Devlin, 1996, p. B3). Therefore, normative thresholds for the total number of encounters were likely influenced by shifting expectations and increasing capacity to cope with increased use levels between 1989 and 1994 (Cole & Hall, 2008)—while preferences remained relatively stable. Additionally, national trends are likely of influence. According to bi-annual surveys by the American Pet Products Association (2021), dog ownership in the U.S. increased from 36% to 54% from 1994 to 2021. Similarly, fat tire biking—a highly popular winter activity in the RNRAW—saw truly exponential growth in popularity from 2008 to 2014 (Monz & Kulmatiski, 2016). These, and numerous other national trends, are likely also influencing norms in the RNRAW.

R3: Do trends concerning preferences and thresholds vary by the behavior of those encountered?

As described above, norm stability (or lack thereof) varies based on the behaviors (e.g., activity-style or visiting RNRAW with a dog) of those encountered at the RNRAW. The degree to which preferences and thresholds shift—or if they shift at all—appears to depend on the activities of those encountered. While others have studied how encounter norms vary across activities at a single point in time, this is a new finding—as far as we are aware. The implications of this finding are numerous. First, this highlights an already-noted limitation of using gross encounters as a sole an indicator of quality for visitor experience (e.g., solitude) in wilderness management (Absher & Lee, 1981). The behaviors of others around us influence our normative evaluations of density (Absher & Lee, 1981; Heberlein, 1977; Lee, 1977; McCool et al., 1977; Rice et al., 2021; Stankey, 1973; Zhang & Chung, 2015). Graefe et al. (1984a) note this as one of the points concerning visitor capacity issues on which there is consensus: "All types of contacts between visitors do not have the same effects. A given individual may be quite tolerant of contacts with one type of user and very intolerant of contacts with another user type" (p. 499).

Similarly, this finding highlights an already-noted limitation of the implementation of visitor capacities in parks and protected areas: the emphasis on a single number (or set of numbers) leads to oversimplification of the issue (Lindberg et al., 1997). Lastly, this finding underscores the value of reevaluating of visitor capacities (or use limits) in parks and protected areas when trends in visitor behaviors and activity-styles change—as

preferences and thresholds for encounters vary based on the behaviors of those encountered. This may be challenging, however, as once a numeric visitor capacity is institutionalized, like other agency decisions, it is often highly resistant to change (Mccool et al., 2007). Thus, given the findings of this present research—paired with the recent findings of Kuentzel et al. (2020) and Nettles et al. (2020)—visitor capacities in wildland settings must be nimbly responsive to changing norms and changes in visitor characteristics and behaviors (Greist, 1976). However, it should be noted, that this view is not universally held by managers: "Arguments about whether evolution of norms should be incorporated into management plans are divided" (Manning, 2007, p. 54). Though Manning (2007) concludes, "It seems reasonable to reassess park and recreation norms as part of this process and incorporate these findings into long-term planning processes" (p. 54).

Key contributions and management implications

According to the 'adaptable human hypothesis', as put forth by Cole and Hall (2008) within the context of visitor use management in wildlands: "People do care about how many other people they encounter. However, they learn; they plan; they adjust their expectations; they cope; they rationalize; they view things in relative terms – rather than in absolutes" (p. 129). The results above reinforce the adaptable-recreator idea, with visitors showing generally stable preferences, and changing thresholds for both encounters overall (regardless of activity) and encounters by activity type. For wildland recreation managers, this highlights a potential conflict between maintaining baselines and adaptive management. An iterative (adaptive) management cycle, whereby management issues and challenges are occasionally reconsidered (i.e., the problems facing managers are reconsidered and potentially reframed), is often considered flexible with problems being framed in relation to evolving social-ecological systems. However, one legacy of entrenched and long-running recreation management frameworks is that conditions (e.g., social settings) are often considered in more absolute terms. For instance, applied wilderness management, and wilderness character monitoring (Landres et al., 2005) more specifically, is thought about in terms of preserving wilderness character, which includes maintaining qualities of wilderness character at the level that is established during a baseline assessment of wilderness character (ideally around when designation of a unit happens). If opportunities for solitude are defined by a high probability of having recreation experiences that are below some threshold of acceptable encounters, then it is unclear how an adaptive management cycle might incorporate changing levels of acceptability in terms of visitor encounters.

In RNRAW, for instance, the current management plan (from 1992) assesses the quality of the social setting during a recreation experience, in part, through trail encounters (acceptable thresholds vary depending on the area (i.e., opportunity class) at issue). Every year, managers monitor the RNRAW to see how many encounters occur within each area and, over time, if the thresholds (or 'standards') are exceeded at some frequency, then a host of management actions may be implemented. Within the context of wilderness character preservation, the 1992 plan's encounter thresholds represent the maximum allowable amount of degradation to 'opportunities for solitude'; this baseline level of solitude aligns with, and was likely informed by, the evaluative data from 1989. In 2022, however, our evaluative study highlights a near doubling in

the acceptable level of encounters, according to visitors. Given this, one could argue that doubling the level of acceptable encounters within the recreation management plan would: (1) continue to provide the baseline level opportunities for solitude and; (2) allow for increased visitation and access (assuming, for the sake of this example, a perfect positive correlation between visitation and encounters) without a need to implement additional management actions. In other words, amending the thresholds for encounters, based on the changes in evaluative norms of visitors, could be viewed not as a change in the baseline level of 'opportunities for solitude', but as a change in the definition of what maintaining the baseline level of solitude would entail. Correspondingly, such a change would also lead to a reorientation of how descriptive monitoring is interpreted. For instance, if the number of observed encounters between 1989 and 2022 remained constant while, at the same time, evaluative norms of visitors for encounters doubled, then, within the context of wilderness character monitoring, it is arguable that opportunities of solitude have increased over time. The potential to adapt thresholds across time, while also maintaining a baseline level of wilderness character highlights the importance of evaluative monitoring over time.

In summary, key implications for wildland managers stemming from this work are as follows. 1) This is the third recent wildland study (along with Nettles et al., 2020 and Kuentzel et al., 2020) revealing shifting normative thresholds related to encounters, thus signaling that managers can not assume that encounter thresholds are stable. 2) Visitors adapt their expectations about encounters in wildlands, challenging managers to balance the maintenance of baselines with the adaptation to these changes. 3) Traditional management practices, focusing on fixed conditions, may clash with evolving visitor expectations and social settings. 4) Adjusting encounter thresholds in management plans could align with changing visitor norms, potentially redefining baseline wilderness character without compromising it.

Limitations and future research

Study-specific

Like nearly all multi-decadal norm stability studies in outdoor recreation, this study contains important limitations concerning congruency in methods across data collections. These include changing the minimum age of participation from 15 to 18 years and changing the response-style to in situ in 2022. It is also not known how the 1989 and 1994 samples were randomized. Differences in the survey between 1989 and 1994 also made assessing changes in activity participation (and nearly all other visitor characteristics) incomparable. Likewise, differences in sampling methods (i.e., on-site vs. mailback) may have influenced responses given the duration between experience and evaluation, with increased opportunity for bias among mailback responses (Vaske, 2019) and the recent findings of Ferguson et al. (2022), wherein encounter thresholds varied by survey modality. Additionally, as noted above, the RNRAW experienced changes to its physical, managerial, and social setting from 1989 to 2022. Wildfires have changed the landscape. Trailheads have been built, and trail networks have expanded. New activity-styles have been introduced. Like all norm stability studies, this research did not occur in a static environment. Finally, differences in the months the surveys were administered may have influenced responses concerning normative evaluation of encounters.

Normative evaluation of encounters

It is also important to recognize that the visitors recreating in this area in 2022 likely do not reflect the same visitors (or characteristics of the visitors) intercepted in 1994 or 1989. The changes in normative thresholds described here are likely, in part, due to changes in the visitorship of the recreation area, as visitors with lower normative thresholds for encounters have likely displaced to alternative recreation areas over time. Further, we did not assess differences in preferences and thresholds for encounters between activities within a single survey period; this emerges as an important area of future research. Nor did we empirically assess the potential drivers of the changes in thresholds across time. Understanding what influences changes in thresholds over time is a critically important avenue of future research.

Additionally, several applied recreation management frameworks (e.g., ROS, LAC, the Interagency Visitor Use Management Framework) share a scientific and professional foundation, and are likely more similar than different in their approach to recreation management (Whittaker et al., 2011). Foundational to these frameworks is the recreation opportunity demand hierarchy, which is both historically dominant and still prevalent today, and shares a foundation with market-based approaches, whereby recreation experiences are assumed to be judged solely upon the associated settings (Williams et al., 1992). While this approach is beneficial in that it frames the management task as one of primarily 'producing' the right settings/opportunities to meet the other demands in the hierarchy, relying upon this mechanistic, 'commodity metaphor' also has its limitations, including its perpetuation of the "notion that recreation settings are theoretically interchangeable, even reproducible, given that the replacement provides a similar combination of attributes" (Williams et al., 1992, p. 30).

We did not, in this study, move beyond the commodity metaphor but, instead, aim to support more nuanced management of wildlands within the context of popular recreation frameworks that, primarily, rely on quantitative and measurable attributes of a recreation experience. However, positioning this paper within the broader theory and application of recreation research is important, as it serves as a reminder to both researchers and practitioners that there remains value in creatively (and substantively) incorporating qualitative approaches in to recreation management. In other words, hard to quantify meanings and values associated with wild places, such as intrinsic value, cultural and spiritual meanings, and place attachment, are not easily (or possibly) quantifiable.

Ethics statement

The study was approved by the University of Montana Institutional Review Board (certificate number: #56-22).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Funding for this research was provided by the City of Missoula, MT, USA and the Aldo Leopold Wilderness Research Institute, Rocky Mountain Research Station, USDA Forest Service. The

findings and conclusions in this publication are those of the authors and should not be construed to represent any official U.S. Department of Agriculture or U.S. Government determination or policy.

ORCID

William L. Rice http://orcid.org/0000-0001-5725-486X
Christopher A. Armatas http://orcid.org/0000-0003-0806-0190

References

Abbott, M. L. (2016). *Using statistics in the social and health sciences with SPSS and Excel*. John Wiley & Sons.

Absher, J. D., & Lee, R. G. (1981). Density as an incomplete cause of crowding in backcountry settings. *Leisure Sciences*, *4*(3), 231–247. https://doi.org/10.1080/01490408109512965

American Pet Products Association. (2021). *2021-2022 APPA national pet owners survey*. Stamford, CT. https://www.americanpetproducts.org/

Bacon, J., Manning, R., Johnson, D., & Vande Kamp, M. (2001). Norm stability: A longitudinal analysis of crowding and related norms in the wilderness of Denali National Park and Preserve. *George Wright Forum*, *18*(3), 62–71.

Barrueto, M., Forshner, A., Whittington, J., Clevenger, A. P., & Musiani, M. (2022). Protection status, human disturbance, snow cover and trapping drive density of a declining wolverine population in the Canadian Rocky Mountains. *Scientific Reports*, *12*(1), 17412. https://doi.org/10.1038/s41598-022-21499-4

Borrie, W. T., & McCool, S. F. (2007). Describing change in visitors and visits to the "Bob. *International Journal of Wilderness*, *13*(3), 28–33.

Chaney, R. (2020). *The grizzly in the driveway: The return of bears to a crowded American West*. University of Washington Press.

Chaney, R. (2021). Dammed if you do, damned if you don't: Rattlesnake Wilderness presents challenges. *Missoulian*, A1.

Cole, D., & Carlson, T. (2010). Numerical visitor capacity: A guide to its use in wilderness. U.S. Department of Agriculture. Forest Service, Rocky Mountain Research Station. https://doi.org/10.2737/RMRS-GTR-247

Cole, D. N., & Hall, T. E. (2008). The "adaptable human" phenomenon: Implications for recreation management in high-use wilderness. In S. Weber & D. Harmon (Eds.), *Rethinking protected areas in a changing world. Proceedings of the 2007 George Wright Society Conference* (pp. 126–131). George Wright Society.

Cole, D. N., Watson, A. E., & Roggenbuck, J. W. (1995). Trends in wilderness visitors and visits: Boundary Waters Canoe Area, Shining Rock, and Desolation wildernesses. *Research Paper INT-RP-483*. U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Devlin, S. (1992). Zoning in the wild: Rattlesnake plan separates areas according to use. *Missoulian*, A1–A11.

Devlin, S. (1996). 'Backyard wilderness' gets crowded. *The Daily Inter Lake*, B3.

Ferguson, M. D., Perry, E. E., Lynch, M., Ferguson, L. A., Kiewra, L. A., Leberman, M., Koopman, A., Barcelona, R., Reigner, N. P., & Manning, R. E. (2022). Expanding the viewshed: Insights and implications for examining visitor use management across scales and modalities in an iconic national forest. *Journal of Outdoor Recreation and Tourism*, *40*, 100570. https://doi.org/10.1016/j.jort.2022.100570

Graefe, A. R., Cahill, K., & Bacon, J. (2011). Putting visitor capacity in perspective: A response to the capacity work group. *Journal of Park and Recreation Administration*, *29*(1), 21–37.

Graefe, A. R., Vaske, J. J., & Kuss, F. R. (1984a). Resolved issues and remaining questions about social carrying capacity. *Leisure Sciences*, *6*(4), 497–507. https://doi.org/10.1080/01490408409513051

Graefe, A. R., Vaske, J. J., & Kuss, F. R. (1984b). Social carrying capacity: An integration and synthesis of twenty years of research. *Leisure Sciences*, *6*(4), 395–431. https://doi.org/10.1080/01490408409513046

Greist, D. A. (1976). The carrying capacity of public wild land recreation areas: Evaluation of alternative measures. *Journal of Leisure Research*, *8*(2), 123–128. https://doi.org/10.1080/00222216.1976.11970263

Hall, T. E., & Davidson, A. (2013). Changes in Bridger wilderness visitors' experiences of crowding and attitudes toward management. *Journal of Park and Recreation Administration*, *31*(4), 45–61.

Heberlein, T. A. (1977). Density, crowding, and satisfaction: Sociological studies for determining carrying capacities. In D. W. Lime & C. A. Fasick (Eds.), *Proceedings: River recreation management and research symposium*. U.S. Department of Agriculture.

Hendee, J. C., Stankey, G. H., & Lucas, R. C. (1978). Wilderness management. *Miscellaneous Publication No. 1365*. U.S. Department of Agriculture.

Higuera, P. E., Shuman, B. N., & Wolf, K. D. (2021). Rocky Mountain subalpine forests now burning more than any time in recent millennia. *Proceedings of the National Academy of Sciences*, *118*(25), e2103135118. https://doi.org/10.1073/pnas.2103135118

Kendall, M. S., Williams, B. L., Winship, A. J., Carson, M., Grissom, K., Rowell, T. J., Stanley, J., & Roberson, K. W. (2021). Winds, waves, warm waters, weekdays, and which ways boats are counted influence predicted visitor use at an offshore fishing destination. *Fisheries Research*, *237*, 105879. https://doi.org/10.1016/j.fishres.2021.105879

Kuentzel, W. F., & Heberlein, T. A. (2003). More visitors, less crowding: Change and stability of norms over time at the Apostle Islands. *Journal of Leisure Research*, *35*(4), 349–371. https://doi.org/10.1080/00222216.2003.11950001

Kuentzel, W. F., Heberlein, T. A., & Mccollum, D. W. (2020). Why do normative encounter standards change? The social evolution of recreational crowding. *Journal of Leisure Research*, *53*(3), 357–376. https://doi.org/10.1080/00222216.2020.1811178

Kyle, G., & Landon, A. (2021). Shifting setting densities and normative evaluations of recreation experiences over time. *Landscape and Urban Planning*, *208*, 104034. https://doi.org/10.1016/j.landurbplan.2020.104034

Landres, P. B., Boutcher, S., Merigliano, L., Barns, C., Davis, D., Hall, T., Henry, S., Hunter, B., Janiga, P., Laker, M., McPherson, A., Powell, D. S., Rowan, M., & Sater, S. (2005). *Monitoring selected conditions related to wilderness character: A national framework*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Lee, R. G. (1977). Alone with others: The paradox of privacy in wilderness. *Leisure Sciences*, *1*(1), 3–19. https://doi.org/10.1080/01490407709512867

Lia, E. H., Derrien, M. M., White, E. M., Winder, S. G., & Wood, S. A. (2023). Community science with a text-messaging chatbot provides a novel approach to monitoring outdoor recreation. *Digital Geography and Society*, *5*, 100059. https://doi.org/10.1016/j.diggeo.2023.100059

Lindberg, K., McCool, S., & Stankey, G. (1997). Rethinking carrying capacity. *Annals of Tourism Research*, *24*(2), 461–465. https://doi.org/10.1016/S0160-7383(97)80018-7

Lucas, R. C. (1985). Visitor characteristics, attitudes, and use patterns in the Bob Marshall Wilderness Complex, 1970-82. *Research paper INT-345*. U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Manning, R. E. (2007). *Parks and carrying capacity: Commons without tragedy*. Island Press.

Manning, R. E. (2011). *Studies in outdoor recreation: Search and research for satisfaction* (3rd ed.). Oregon State University Press.

McCool, S. F. (1985). Does wilderness designation lead to increased recreational use? *Journal of Forestry*, *83*(1), 39–41. https://doi.org/10.1093/jof/83.1.39

McCool, S. F., Lime, D. W., & Anderson, D. H. (1977). Simulation modeling as a tool for managing river recreation. In D. W. Lime & C. A. Fasick (Eds.), *Proceedings: River recreation management and research symposium* (pp. 304–311). U.S. Department of Agriculture.

Mccool, S. F., Clark, R. N., & Stankey, G. H. (2007). An assessment of frameworks useful for public land recreation planning. *General Technical Report PNW-GTR-705*. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

McGlaughlin, K. (1992). Troubled trails: Mountain bikes and horse a volatile mix in the 'Snake. *Missoulian*, *A1*, A7.

Monz, C., & Kulmatiski, A. (2016). The emergence of "fat bikes" in the USA: Trends, potential consequences and management implications. *Journal of Outdoor Recreation and Tourism*, *15*, 20–25. https://doi.org/10.1016/j.jort.2016.04.001

Needham, M. D., Vaske, J. J., & Manfredo, M. J. (2004). Hunters' behavior and acceptance of management actions related to chronic wasting disease in eight states. *Human Dimensions of Wildlife*, *9*(3), 211–231. https://doi.org/10.1080/10871200490479990

Needham, M. D., Vaske, J. J., Whittaker, D., & Donnelly, M. P. (2014). Extending the encounter-norm-crowding generalization to angler evaluations of other social and resource indicators. *Human Dimensions of Wildlife*, *19*(3), 288–299. https://doi.org/10.1080/10871209.2014.883654

Nettles, J. M., Brownlee, M. T. J., Sharp, R. L., Blacketer, M. P., & Hallo, J. C. (2020). Norm stability: Visitors' perceptions of crowding at Cumberland Island National Seashore. *Leisure Sciences*, *45*(6), 559–576. https://doi.org/10.1080/01490400.2020.1855275

Rice, W. L. (2022). The conspicuous consumption of wilderness, or leisure lost in the wilderness. *World Leisure Journal*, *64*(4), 451–468. https://doi.org/10.1080/16078055.2022.2096109

Rice, W. L., Reigner, N., Freeman, S., Newman, P., Mateer, T. J., Lawhon, B., & Taff, B. D. (2021). The impact of protective masks on outdoor recreation crowding norms during a pandemic. *Journal of Leisure Research*, *53*(3), 340–356. https://doi.org/10.1080/00222216.2021.1981791

Rice, W. L., Whitney, P. J., Thomas, E. R., Armatas, C. A. (2024). *Rattlesnake National Recreation Area and Wilderness (RNRAW): Visitor survey data from 2022-2023* [Dataset]. Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2024-0005

Riley, C. J., Pierskalla, C. D., Burns, R. C., Maumbe, K. C., Graefe, A. R., Smaldone, D. A., & Williams, S. (2015). Examining OHV user displacement at the Oregon Dunes National Recreation Area and Sand Lake: A 10-year trend study. *Journal of Outdoor Recreation and Tourism*, *9*, 44–52. https://doi.org/10.1016/j.jort.2015.04.002

Stanfield, R., Manning, R., Budruk, M., & Floyd, M. (2005). Racial discrimination in parks and outdoor recreation: An empircal study. In J. G. Peden & R. M. Schuster (Eds.), *Proceedings of the 2005 northeastern recreation research symposium; 2005 April 10-12; Bolton Landing, NY. Gen. Tech. Rep. NE-341* (pp. 247–253). U.S. Department of Agriculture, Forest Service, Northeastern Research Station.

Stankey, G. H. (1973). Visitor perception of wilderness recreation carrying capacity. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station.

Stankey, G. H., & McCool, S. F. (1984). Carrying capacity in recreational settings: Evolution, appraisal, and application. *Leisure Sciences, 6*(4), 453–473. https://doi.org/10.1080/01490408409513048

Vaske, J. J. (2019). *Survey research and analysis: Applications in parks, recreation and human dimensions* (2nd ed.). Sagamore-Venture.

Vaske, J. J., Gliner, J. A., & Morgan, G. A. (2002). Communicating judgments about practical significance: Effect size, confidence intervals and odds ratios. *Human Dimensions of Wildlife*, *7*(4), 287–300. https://doi.org/10.1080/10871200214752

Wall-Reinius, S., & Bäck, L. (2011). Changes in visitor demand: Inter-year comparisons of Swedish Hikers' characteristics, preferences and experiences. *Scandinavian Journal of Hospitality and Tourism*, *11*(sup1), 38–53. https://doi.org/10.1080/15022250.2011.638207

Watson, A. E., Williams, D. R., & Daigle, J. J. (1991). Sources of conflict between hikers and mountain bikers in the Rattlesnake NRA. *Journal of Park and Recreation Administration*, *9*(3), 59–71.

Watson, A. E., Williams, D. R., & Daigle, J. J. (2015). *Social conditions, conflict, and preference data for users in the Rattlesnake National Recreation Area in 1989*. Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2015-0002

Watson, A. E., Zaglauer, H. P., & Stewart, S. I. (2015). *Social conditions, conflict, and preference data for users in the Rattlesnake National Recreation Area in 1994*. Forest Service Research Data Archive. https://doi.org/10.2737/RDS-2015-0003

Watson, A., Zaglauer, H., & Stewart, S. (1996). Activity orientation as a discriminant variable in recreation conflict research. In C. P. Dawson (Ed.), *Proceedings of the 1995 Northeastern recre-*

ation research symposium (pp. 103–108). U. S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

Whitney, P., Rice, W. L., Sage, J., Thomsen, J. M., Wheeler, I., Freimund, W. A., & Bigart, E. (2023). Developments in big data for park management: A review of mobile phone location data for visitor use management. *Landscape Research*, *48*(6), 758–776. https://doi.org/10.1080/01426397.2023.2198762

Whittaker, D., Shelby, B., Manning, R., Cole, D., & Haas, G. (2011). Capacity reconsidered: Finding consensus and clarifying differences. *Journal of Park and Recreation Administration*, *29*(1), 1–20.

Williams, D. R., Patterson, M. E., Roggenbuck, J. W., & Watson, A. E. (1992). Beyond the commodity metaphor: Examining emotional and symbolic attachment to place. *Leisure Sciences*, *14*(1), 29–46. https://doi.org/10.1080/01490409209513155

Zhang, L., & Chung, S. (2015). Assessing the social carrying capacity of diving sites in Mabul Island, Malaysia. *Environmental Management*, *56*(6), 1467–1477. https://doi.org/10.1007/s00267-015-0586-x