



NPS/PRAC

Nez Perce Creek on a quiet winter day.

University Partnerships Yield Results

ALTHOUGH THIS ISSUE comes out as summer finally arrives in Yellowstone National Park, the winter image above is intended to invoke a sense of natural quiet sometimes harder to come by during the busy summer season. In this issue, Wayne Freimund presents the results of a recent survey on how natural soundscapes influence the experience of winter visitors. With the park's winter use an ongoing area of discussion concerning the values that visitors hold, this research sheds some light on the expectations of winter visitors as well as how they think and feel about soundscapes.

Dr. Freimund was also instrumental in the formation and development of the Native American Student Intern Partnership between the University of

Montana and Yellowstone National Park. In this *Yellowstone Science* interview, the program's first intern, Monica Lomahukluh, describes her experiences during summer 2010.

In her article, Emily Almberg investigates the ecological interactions of pathogens and parasites on the park's canids. In recent years, there have been noticeable impacts on the park's wolf and coyote populations that can be traced to disease outbreaks. Do these diseases cause only short-term declines or could they jeopardize the long-term population survival of Yellowstone canids?

We hope you enjoy the issue, and the summer.

Soundscapes and the Winter Visitor Experience

Wayne Freimund, John Sacklin, Mike Patterson, Keith Bosak, and Shelley Walker Saxen



Winter use by visitors to Yellowstone National Park continues to be a high-profile management issue.

WINTER USE in Yellowstone National Park has been a subject of debate for decades. Since the mid-1990s, the debate has intensified and centered on the role and place for oversnow motorized vehicles (snowmobiles and snowcoaches) in the winter experience of park visitors. This debate spawned multiple winter use management plans and multiple lawsuits in two different Federal District Courts, arguing about what is the most appropriate way for visitors to enjoy Yellowstone in the winter. The planning-litigation cycle continues today.

Prior to 2004, oversnow vehicle use was predominantly snowmobiles, with an average of 800 unguided, two-stroke engine snowmobiles using the park each day. Snowcoaches amounted to a handful of vehicles per day. That changed beginning in the winter of 2004–2005, with the implementation of a fully managed winter use program. Since 2004, winter visitors must be with a commercial guide; private snowmobile and snowcoach use is not allowed. Snowmobiles must be “Best Available Technology,” which are the cleanest and quietest snowmobiles available and meet National Park Service (NPS) requirements. A daily limit on snowmobiles and snowcoaches was instituted, speed limits reduced, and the park was closed to oversnow vehicle use at night. In

recent years the number of commercially guided snowmobile groups has been similar to the number of commercially guided snowcoaches entering the park each day.

To help understand winter-related issues and inform the planning processes, the NPS instituted resource monitoring focused on air quality, human health and safety, snowpack chemistry, wildlife, and soundscapes. Limited, short-term soundscapes monitoring occurred in the late 1990s. More systematic soundscapes monitoring began in 2003, and has primarily collected information about the natural and human influenced aspects of the park’s soundscapes in a variety of settings, with a focus on measuring the percent of time oversnow vehicles are audible and the loudness of those vehicles.

Although this quantitative monitoring gave the NPS a better understanding of the amount of time that oversnow vehicles were heard and how loud they were, it provided no qualitative information about visitors’ winter experience. In contrast, this 2008 research was intended to help inform park managers about the importance of natural soundscapes to visitors, visitors’ perception of sound from oversnow vehicles, and visitors’ acceptance of visitor management actions taken to protect natural soundscapes.

Methods

In this study, which was part of a larger winter use study (Freimund et al. 2009), we used a survey to characterize the visitor population, collect information about overall perceptions of natural soundscape experiences in the park, and assess visitors' perceived values of natural sounds and the values of those sounds to the park itself.

Of the 427 visitors in the Old Faithful area who were asked to complete a survey, 413 agreed to participate. Time of day, weather, and visible characteristics of the 14 visitors who declined participation in the survey were recorded and analyzed for non-response bias. No patterns explaining non-response were found, thus it is reasonable to conclude that the survey data are not subject to non-response bias. The interviews were conducted inside the Snow Lodge, outside near Old Faithful geyser, and both inside and outside the warming huts near Old Faithful geyser. Surveys were conducted between 10:00 AM and 3:00 PM on eleven weekdays and nine weekend days from January 2, 2008, to March 9, 2008. Potential respondents for the survey were all visitors at least 18 years old who stopped at the Snow Lodge and/or Old Faithful geyser on those 20 days. Visitor contacts occurred based upon a pre-designed systematic schedule, starting with the first available group during the sample time.

Winter visitors

Respondents ranged in age from 18 to 87 years old, with an average age of 51 years old. Just over half of the respondents (53%) were male. Close to half (45%) of the visitors participating in the survey visited the park with family, 30% with friends, 27% with an outfitter or guide group, and 6% visited the park alone. These groups are not mutually exclusive,

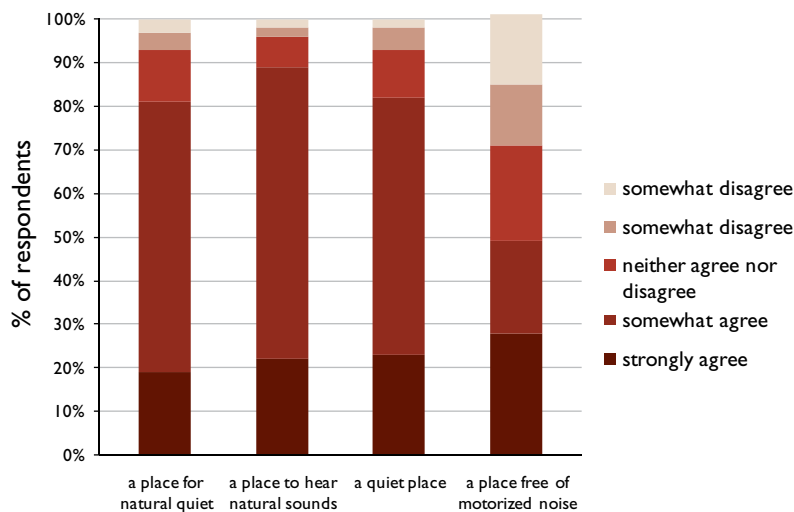


Figure 1. Question wording: "Please indicate for each of the following, how much you agree or disagree that they are important to the overall value of YNP?"



Fifty-seven percent of visitors to the Old Faithful area surveyed during January through March 2008 toured the park in a snowcoach.

as some visitors may have been in mixed groups or participated in guided activities during a portion of their park visit. Survey respondents spent anywhere from one to ten days in the park, with 37% spending one day, 14% spending two days, 20% spending three days, and 14% spending five days in the park. Eighty-five percent of visitors surveyed spent between one and four days in the park.

Fifty-seven percent of visitors surveyed toured the park in a snowcoach, 41% snowmobiled in the park, while 26% of visitors cross-country skied, and 25% went snowshoeing. Again, these categories are not mutually exclusive; 58% of respondents participated in multiple activities in the park during their visit.

The role of natural sound

The majority of respondents agreed that Yellowstone National Park (YNP) is particularly important as "a place for natural quiet" (81%; fig. 1) and as "a place to hear natural sounds" (22% strongly agreed, 67% somewhat agreed).

Eighty-nine percent of visitors responding to the survey agreed that the park was particularly important as "a place to hear natural sounds." Only 11% of visitors surveyed were either neutral or in disagreement with the claim. Eighty-two percent of visitors surveyed stated that YNP was particularly valuable as "a quiet place." Summarizing across these three questions, 80%–90% of visitors stated that natural sounds play a particularly important role in the overall value of Yellowstone.

In contrast, just less than half of the visitors surveyed (49%) stated that Yellowstone was particularly valuable as "a place free from motorized noise" (28% strongly agreed, 21% somewhat agreed, 22% neutral, 14% somewhat disagreed, 16% strongly disagreed). Agreement levels were more evenly distributed on this question, which addressed the necessity of some existent motorized sounds in the park.

Soundscape Monitoring in Yellowstone National Park

Shan Burson

NATURAL SOUNDSCAPES are a valued resource of national parks. The 2006 National Park Service Management Policies define natural soundscapes as “the unimpaired sounds of nature” and state that they are to be preserved or restored as is practicable. Natural soundscapes are intrinsic elements of the environment and are necessary for natural ecological processes to continue. In this way, soundscapes align with park purposes. The focus of soundscapes monitoring at Yellowstone National Park has been to understand winter soundscapes in order to assist with ongoing winter use planning efforts, and to begin the development of a comprehensive year-round soundscape inventory.

Systematic soundscape monitoring has been underway in Yellowstone National Park since 2003. Soundscapes have been monitored at 25 different locations around the park, for periods ranging from one week to one year. Many of the monitoring locations are near road corridors; however, backcountry locations well removed from travel corridors have also been sampled. For example, a site near Fern Lake was monitored year round in 2007, providing an understanding of what soundscapes in a setting deep in the park’s backcountry are like through all four seasons. Two sites have been monitored almost from the beginning of the program: along the West Entrance road, west of Madison Junction and near the west parking lot in the Old Faithful developed area.

During the winter of 2008, monitoring occurred at these two sites and another winter-long site between Lewis Lake and Grant Village on the South Entrance road. Monitoring also occurred for shorter periods at backcountry monitoring sites at DeLacy Creek (east of Old Faithful towards Craig Pass), along the Mary Mountain Trail (off of the Madison to Old Faithful road), and in the Shoshone Geyser Basin (south of Old Faithful).

The existing winter soundscape at Yellowstone consists of both natural and non-natural sounds. Common natural sounds include bird calls, mammal vocalizations, flowing water, wind, and thermal activity. Non-natural sounds include motorized sounds of snowmobiles, snowcoaches, snow grooming, wheeled vehicles, aircraft, and the sounds associated with facility utilities and other human activity in areas of development.

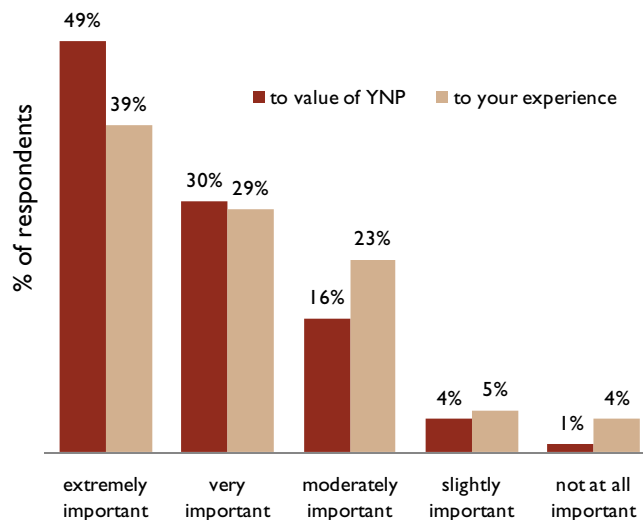


Figure 2. Question wording: “Please rate how important the opportunity to experience natural sounds in YNP is to the overall value of the park. Please rate how important it is to your experience today to have the opportunity to experience natural sounds in YNP.”

Almost all (99%) visitors stated that the opportunities to experience natural sounds were important to the overall value of the park (fig. 2). Ninety-six percent of visitors stated that opportunities to experience natural sounds were important to their experience on the day they were surveyed in the park. A minority of visitors (less than 10% for each question) stated that the value and opportunities to experience natural sounds were “slightly or not at all important” to their experience of the park on the day they were surveyed.

The importance of natural sound

Fifty-eight percent of visitors participated in more than one type of activity. However, when the types of activities engaged in were analyzed, there was a reasonable distribution among snowcoach touring (57%), snowmobiling (41%), cross-country skiing (26%), and snowshoeing (25%). Thus, to differentiate among user types, a chi-square analysis was used to determine statistical differences in responses from those who participated in a particular activity and those who did not. Due to a lack of independence among the activities (i.e., the same person doing multiple activities), we did not attempt to derive an interactive model among activity types.

As mentioned above, the dominant observation among these data is the agreement on the importance of natural sound. However, there are differences among groups. People who snowmobiled agreed less strongly that YNP is “a place for natural quiet” and “a place to hear natural sounds.” When evaluating YNP as a “quiet place,” those who rode snowmobiles were less likely to agree than those who did not ride a snowmobile. When asked if YNP is “a place free of motorized noise,” there were significant differences for each activity type: snowmobilers are less likely to agree with this statement



Providing increased opportunities for cross-country skiing might also provide access to more quiet zones of the park.

while snowshoers, snowcoach riders, and cross-country skiers were more likely to agree.

Satisfaction with natural sounds

In terms of visitors' actual experience of natural sounds during their visit to YNP, 81% of visitors surveyed stated that natural sounds had a positive effect on their visit. The remaining 19% stated that natural sounds had no effect on their visit to the park.

When visitors were asked to state the extent to which they were able to find the experience of natural sounds that they were looking for in YNP, 71% were able to find it half of the time or more (15% all of the time, 36% more than half of the time, 20% about half of the time; fig. 3). Three percent of visitors were unable to find the experience of natural

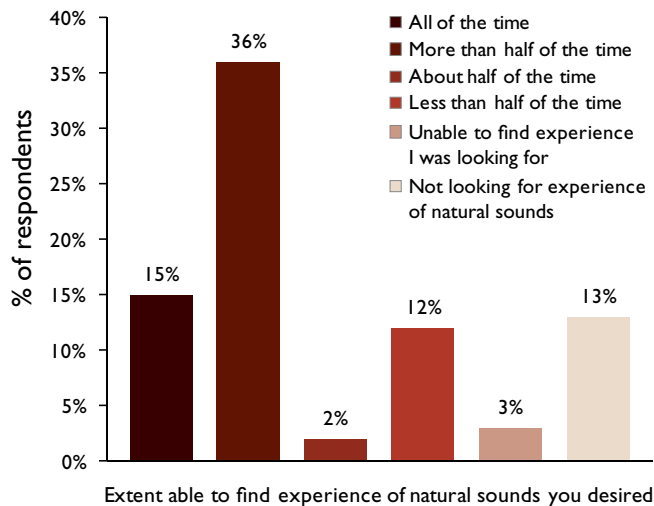
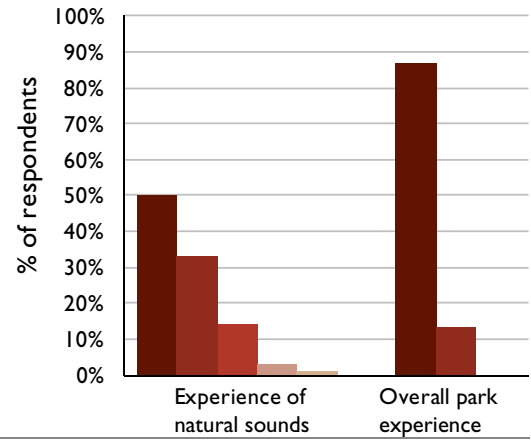


Figure 3. Question wording: "To what extent were you able to find the experience of natural sounds that you were looking for in YNP?"



	Experience of natural sounds	Overall park experience
Very satisfied	50%	87%
Somewhat satisfied	33%	13%
Neither	14%	0%
Somewhat dissatisfied	3%	0%
Very dissatisfied	1%	0%

Figure 4. Question wording: "How satisfied are you with your experience of the park's natural sounds? How satisfied are you with your overall experience of YNP?"

sounds they desired. A minority of respondents (13%) stated they were not looking for any experience of natural sounds.

While just 15% of visitors were able to find the experience of natural sounds they desired all of the time while in the park, 83% were satisfied with their experience of the park's natural sounds (fig. 4). These results also suggest that visitors' satisfaction with the overall experience of the park was high, with 100% of visitors stating that they were either very satisfied (87%) or somewhat satisfied (13%).

Satisfaction with the natural sound experience

Looking at responses across visitor activity type in the park, it is clear that natural sounds had a dominantly positive effect on all activity types (table 1). There are, however, slight differences between those who did and did not participate in each activity. While natural sound was positive for almost all of the cross-country skiers and snowshoers, 28% of the snowmobilers identified natural sound as having a negative effect on their experience. Unfortunately, why these sounds were found as having a negative effect is not known.

The desired experience of natural sound was also quite accessible to the respondents regardless of activity type (table 2). Snowmobilers were most likely to find the natural sound they desired all the time. They were also the most likely to not be looking for natural soundscape in their experience. Cross-country skiers and snowshoers were more likely to experience natural soundscapes all or half of the time than those who did not ski or snowshoe in the park, and they were less likely to indicate that they were not looking for natural sounds in their experience.

Table 1. The effect of natural sounds on visitor satisfaction by primary activity

Activity	Positive effect	Negative effect	N*
Snowmobiling	71%	28%	170
Cross-country skiing	96%	4%	102
Snowshoeing	93%	7%	101
Snowcoach touring	88%	12%	233

*N=total number of respondents

Overall impressions

Respondents in this study were asked to provide their overall impression of the winter setting in YNP by indicating the extent to which they found the park to be “Pristine” or “Polluted,” “Loud” or “Quiet,” “Appropriate” or “Inappropriate,” and “Acceptable” or “Unacceptable.” The respondents predominantly found the Yellowstone environment pristine, quiet, appropriate, and acceptable (fig. 5). In addition, when asked about their satisfaction with the setting, 66% of the visitors found the setting “Very Satisfying,” and another 10% found it “Satisfying.” Four percent of the sample said that it was either somewhat or very dissatisfying.

Visitor support of current policies

Respondents were asked about their support for a variety of potential management actions “to protect opportunities to experience natural sounds.” Continuing to require best available technology, continuing to require guides, limiting the total number of snow machines in the park per day, and limiting group sizes to 11 per guide were each strongly supported by a minimum of 68% of the respondents (table 3). Closing the roads to snowmobiles or to all oversnow vehicles was “opposed” or “strongly opposed” by a majority of the respondents. Plowing the roads for automobile access was “strongly opposed” by 71% of the respondents and “opposed” by 9%.

Discussion

The winter experience at YNP is special and the natural sounds are an important element of that uniqueness. Winter

visitors to Old Faithful agree that YNP is a place for natural quiet, to hear natural sounds and a quiet place. Eighty-one percent of the respondents indicated that the park’s natural sounds had a positive effect on their experience. Satisfaction with the natural sounds experience was high and 71% of the visitors suggested that they found the level of natural sound they desired for half or more of the time they desired it. Eighty-seven percent of the respondents were “very satisfied” with their overall park experience and the remaining 13% were “satisfied.”

While the opportunity to experience natural sounds is perceived by winter visitors to be important to both the value of YNP and visitors’ experiences, there is less agreement among winter visitors that YNP is a place free of motorized noise. The presence of mechanized sounds is commonly identified for its negative effects on visitor experiences (Fidell et al. 1996; Mace et al. 2004). In this study, however, all of the visitors we sampled had used motorized equipment to access Old Faithful. While many also participated in cross-country skiing or snowshoeing, they were aware of their role in creating noise within the park. This illustrates that current visitors are in tune with many of the same tensions between park access and protection that managers are facing. While there are some variations in the importance of natural sound when activity type is considered, those differences are largely within the degree of support for YNP as a place for natural quiet, to hear natural sounds. No user group (e.g., snowcoach or snowmobile user) was dominantly negative about the value of natural soundscapes.

This level of visitor satisfaction and support is encouraging. However, there are a number of unanswered questions about the current visitation. During the 1990s, snowmobile numbers averaged 795 per day and snowcoaches about 15 per day (NPS 2007). In 2008–09, when the snowmobile and snowcoach limits were 720 and 78 per day, respectively; snowmobiles averaged 294 per day and snowcoaches about 35 (both figures include vehicles that originated at Old Faithful). Thus, visitor use dropped by approximately 64% in less than a decade.

So what happened to two thirds of the visitation? Some potential visitors may have been deterred by the new requirements for guiding, group sizes, and best available technology

Table 2. Visitor ability to find their desired experience of natural sound by respondent activity type

Activity	All the time	More than half the time	About half the time	Less than half the time	Unable to find the experience of natural sound	Not looking for any experience of natural sound	N
Snowmobiling	22%	28%	16%	12%	2%	20%	165
Cross-country skiing	16%	51%	21%	6%	1%	6%	103
Snowshoeing	14%	46%	24%	11%	1%	4%	100
Snowcoach touring	12%	43%	23%	12%	2%	9%	230

The winter experience at Yellowstone is special and the natural sounds are an important element of that uniqueness.

requirements, or the continued presence of snowmobiles. If so, it is also likely that those visitors went to other areas in the region or chose different destinations. The inverse of this is also possible, that people who had been displaced by the former unmanaged nature of the experience in the area are now more likely to visit. Those people may now have self-selected into a management regime that they see as appropriate for the setting. What we are confident about from this study is that the winter use policies that were put into place in 2004 are generally supported by the 2008 visitors we surveyed.

Maintaining and improving high levels of satisfaction

Maintaining high quality visitor experiences is a continuing challenge for YNP and other parks. The results of this study indicate that visitors do not generally expect to have uniform silence in their experiences. Rather, they highly value natural soundscapes and need them to be present for substantial portions of their experience. As mentioned earlier,



NPS/E. HIRSCHMAN

Results show that visitors highly value natural soundscapes.

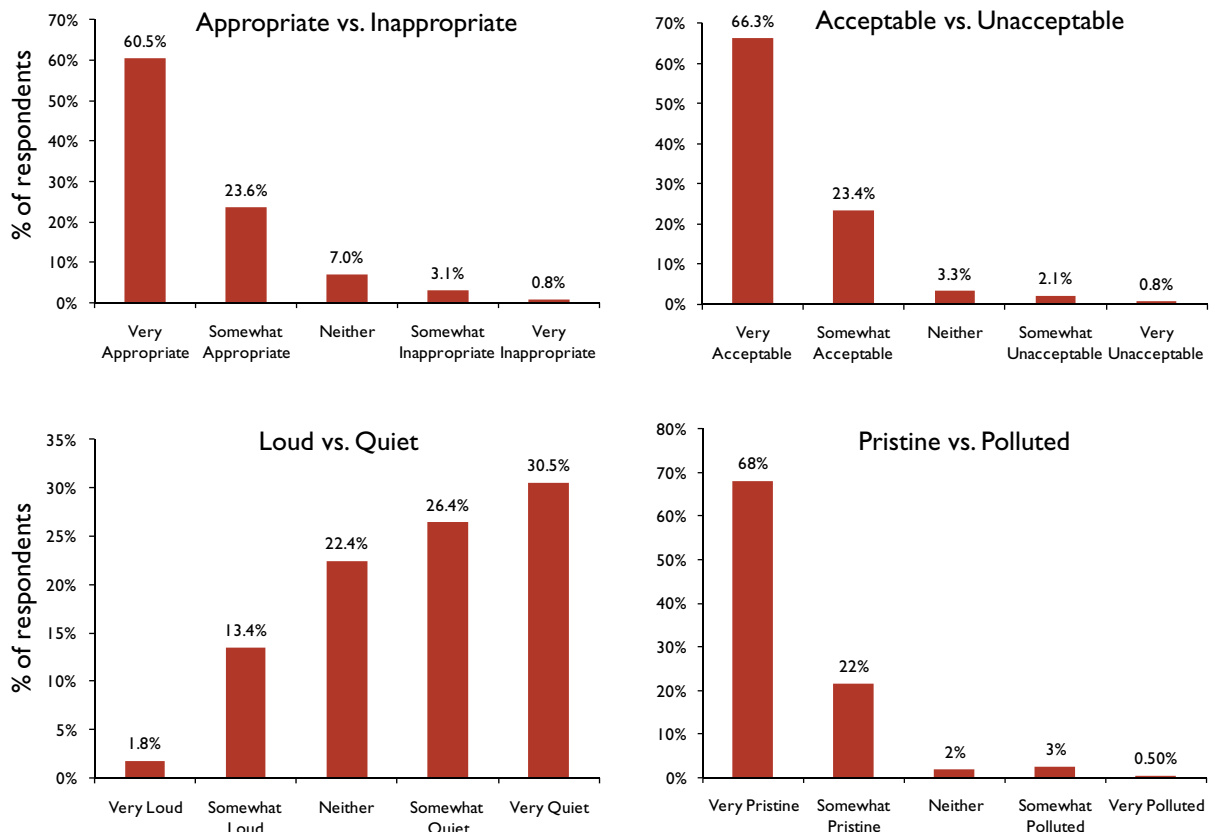


Figure 5. Question wording: “For each of the word pairs below, please check the box that best represents your impression of the winter setting at YNP!”

Table 3. Visitor support for management actions by primary activity

Primary activity	Strongly support	Somewhat support	Neither	Somewhat oppose	Strongly oppose	N
<i>Continue to require best available technology</i>						
Cross-country skiing	91%	5%	2%	0%	2%	103
Snowshoeing	91%	7%	1%	0%	1%	102
Snowmobiling	70%	18%	7%	4%	2%	166
Snowcoach touring	86%	10%	2%	0%	2%	231
Total sample	80%	13%	4%	2%	3%	400
<i>Continue to require guided tours for snowmobiles and snowcoaches</i>						
Cross-country skiing	80%	13%	4%	1%	3%	104
Snowshoeing	83%	12%	2%	2%	2%	103
Snowmobiling	57%	21%	6%	7%	8%	166
Snowcoach touring	77%	13%	3%	3%	3%	232
Total sample	71%	15%	5%	5%	5%	401
<i>Continue to limit total number of snowmobiles and snowcoaches entering the park per day</i>						
Cross-country skiing	89%	5%	3%	2%	2%	104
Snowshoeing	85%	7%	2%	6%	1%	103
Snowmobiling	52%	24%	7%	11%	7%	166
Snowcoach touring	80%	10%	3%	4%	4%	231
Total sample	71%	14%	4%	6%	5%	400
<i>Continue to limit snowmobile group sizes to a maximum of 11 per guide</i>						
Cross-country skiing	85%	7%	5%	0%	3%	103
Snowshoeing	81%	11%	4%	2%	2%	102
Snowmobiling	52%	23%	12%	6%	7%	166
Snowcoach touring	75%	13%	6%	1%	5%	229
Total sample	68%	15%	9%	3%	5%	398
<i>Close roads to all oversnow vehicles</i>						
Cross-country skiing	4%	9%	9%	26%	53%	101
Snowshoeing	3%	5%	11%	27%	55%	102
Snowmobiling	7%	4%	10%	17%	62%	166
Snowcoach touring	4%	4%	11%	21%	60%	229
Total sample	6%	5%	11%	20%	57%	395
<i>Close roads to snowmobiles and allow snowcoach tours</i>						
Cross-country skiing	22%	21%	14%	17%	26%	104
Snowshoeing	25%	14%	18%	18%	24%	103
Snowmobiling	6%	5%	13%	14%	62%	166
Snowcoach touring	19%	12%	15%	19%	35%	230
Total sample	15%	11%	14%	17%	42%	397
<i>Plow all roads and allow automobile access (no oversnow vehicles)</i>						
Cross-country skiing	5%	5%	3%	5%	83%	104
Snowshoeing	3%	3%	1%	9%	85%	103
Snowmobiling	9%	6%	12%	12%	62%	165
Snowcoach touring	5%	7%	4%	9%	76%	230
Total sample	7%	6%	7%	9%	71%	398

87% of visitors were “very satisfied” with their overall Yellowstone experience and the remaining 13% were somewhat satisfied. No visitor registered even the slightest “dissatisfaction” with their experience. Eighty-three percent of the respondents gave positive evaluations of their experience of natural sounds.

Yellowstone park staff monitor soundscapes at two sites (see sidebar) and four additional sites were monitored in winter of 2007–2008, while the survey was being conducted. Oversnow vehicles were heard between 8:00 AM and 4:00 PM 68% of the time at Old Faithful and 54% of the time at Madison. This percent of time that oversnow vehicles are audible can vary considerably throughout the day. For example, at the Madison site, when in-bound traffic from West Yellowstone is at its peak, from 9:00 AM to 10:00 AM, oversnow vehicles were heard 81% of the time; from noon to 1:00 PM, 31% of the time. These oversnow vehicles include visitor snowcoaches and snowmobiles as well as administrative (NPS and concessions) vehicles. Administrative oversnow vehicles comprise 32% of the groups along road corridors and 68% of the groups in developed areas, so their contribution to soundscapes can be significant (Burson 2008, 2009; NPS 2008).

Given those auditory conditions, respondents tended to view the park as dominantly pristine vs. polluted, quiet vs. loud, acceptable and appropriate (fig. 5). Even given the personal recognition of the noise required for visitor access, however, there is room for improvement in increasing quiet and the acceptability and appropriateness of the soundscape. Seventeen percent of the visitors were able to find the soundscape conditions they desired half or less than half of the time they desired, and most of those visitors valued natural sounds highly. Thus,

alternative management approaches that would increase visitor access during the quiet intervals that exist should be considered. Given the use pattern of the park (much of the day is needed to get to and return from Old Faithful and is modulated by the geyser eruptions) there are limited opportunities for day visitors to experience those intervals in which natural sounds were undisturbed. Small adjustments to entrance time might maximize opportunities for access. Providing increased opportunities for cross-country skiing might also provide access to more quiet zones of the park. Finally, dedicating sections of the season to maximize opportunities for quiet access may also be an option.

Conclusion

Winter use in YNP has been transformed to a managed and controlled visitor experience. Most monitoring metrics indicate significant improvement in resource indicators, and this study demonstrates that visitor satisfaction is also at a high level. Questions remain, however. For example, what is an appropriate level of satisfaction? In achieving a higher level for some visitors, are we purposefully or inadvertently excluding other visitors? Another question might be: if we determine an appropriate level of satisfaction, does that level become a floor of experience quality or also a ceiling—never exceeded because there is no remaining incentive for managers to continue learning and attempting to improve upon? Finally, should the level of satisfaction be based on an absolute measure, or on a dynamic measure associated with learning and adaptation, focused on understanding and improving rather than on rigid goals?

Soundscapes, and especially visitor satisfaction in relation to soundscapes, is a fledgling science (as recently as 2008 Saxen reported only 12 studies explicitly linking these issues in national parks), making setting standards even more challenging. This speaks for an adaptive management approach, framing a park

as a “learning organization” (Freimund and Nicholas 2009) that acknowledges the uncertainty associated with science and ensures that lessons learned are internalized into the organization.

The debate about winter use over the past decades has required considerable learning for Yellowstone National Park and the National Park Service. Great progress has been made addressing previous issues, and visitors are, for the most part, quite satisfied with the park soundscapes. Yet disagreement by some members of the public and some groups remains, ensuring that the debate will continue. Thus, the continuing questions when addressing satisfaction and visitor access: are we just addressing satisfaction for the visitor or are we attempting to satisfy society as a whole? For the long-term sake of the national parks, we must address both.

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COURTESY OF THE AUTHOR

Wayne Freimund is Arkwright Professor of Protected Area Management at the University of Montana, Department of Society and Conservation. He has a long-standing interest in understanding national park visitor experiences and the meaning of national parks both in the US and abroad. He has conducted research on winter visitors to Yellowstone for more than 15 years.

John Sacklin received his MBA from Humboldt State University and has more than 30 years of planning and compliance experience with the federal government. Sacklin worked on winter use planning in Yellowstone National Park from 1992 until his retirement in May 2011.

Mike Patterson is a professor of wildlife and recreation management at the College of Forestry and Conservation, University

of Montana. His research program centers on human experiences with wildlife and wildland resources; the social constructions, meanings, and values that these experiences reflect and create; and social conflict that occurs as a consequence of differences in social constructions and meanings.

Keith Bosak is an assistant professor of nature-based tourism at the University of Montana. His research centers on human–environment interactions and the intersection of conservation and development, particularly in mountainous areas and developing countries.

Shelley Walker Saxen received her PhD in forestry from the University of Montana, Missoula in 2008.

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