

How do Visitor Density and Anthropogenic Change in Frontcountry Wilderness Settings Affect Recreation Benefits?

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Abstract—Effects on recreation benefits were assessed using questionnaires and image sets depicting visitor density ranges and anthropogenic setting changes at two heavily-visited wilderness sites. Visitor benefits were less affected by high visitor densities at the more accessible of the two sites. New age medicine wheels had a positive effect on visitor benefits, as did trail revegetation. Although wilderness visitor density guidelines are frequently exceeded at both sites, wilderness designation is defended as acceptable, because frontcountry wilderness borders buffer less accessible backcountry areas from excessive impacts, and provide inexperienced and casual visitors with non-mechanized recreation experience opportunities, and exposure to wilderness.

Research summarized in Driver and others (1991) and applied using a research and management framework called benefits-based management, or BBM (Lee and Driver 1999) has demonstrated the wide variety of benefits humans receive from interaction with amenity resources, such as experiences in wilderness areas. Recreation benefits are defined as the “realization of desired and satisfying on-site psychological experiences; changes that are viewed to be advantageous or improvements in condition (psychological and physiological) to individuals, to groups, to society...and the prevention of worse conditions” (Bruns and others 1994). Quantifiable physical fitness benefits are most strongly supported by empirical research, but restorative benefits, improved ecological awareness and learning, strengthened social bonds, spiritual and achievement benefits have also been consistently identified. The ability to attain benefits may be affected by recreation experience quality. Commonly used indicators and standards for quality are based on visitor density and anthropogenic change, such as biophysical impacts in wilderness recreation settings (Manning and others 1996).

The Sedona District of Coconino National Forest surrounds the town of Sedona, Arizona, and has one of the highest recreation uses of any district in the entire National

Forest System. Vistas of red sedimentary rock formations, unique plant communities, interesting prehistory and outstanding opportunities for primitive recreation characterize the district, which includes the Red Rock-Secret Mountain and Munds Mountain Wildernesses. Experienced by more than a quarter of million people each year, these are the two most visited wildernesses in Arizona (USDA Forest Service 1997a). Meeting the intent of the Wilderness Act is problematic for managers due to the proximity of wilderness boundaries to urban developments and roads, high numbers of visitors and the presence of a thriving tourism industry.

Background and Methods

We investigated the effects of increasing visitor density and a site-specific type of anthropogenic setting change on recreationists' ability to attain benefits at each of two heavily visited front country wilderness attraction sites near Sedona in summer and fall 1996 and spring 1997. *Devils' Bridge* is a large sandstone arch in the Redrock-Secret Mountain Wilderness accessed from a Sedona suburb via a 3 km dirt road and 1.5 km trail; the more easily accessed *Bell Rock* is a 100-meter tall sandstone formation located just inside the Munds Mountain Wilderness boundary only 200 meters from the main gateway highway into the Sedona area.

Site-specific sets of photograph-based images, digitally modified to portray a range of visitor densities and a pair of human-caused biophysical setting variables, were used with a written questionnaire in on-site visitor surveys. We used pictures to illustrate study variables because humans obtain most environmental information through visual perception (Gibson 1979). Photo-realistic portrayals provide better consistency in what visitors are responding to than verbal or written versions of the same information, facilitating more accurate and direct responses (Chenoweth and Gobster 1986). Pictures thus allow more direct relation of respondent assessments to actual features of the landscape than verbal descriptions, and manipulation of a single variable in images that are the same in all other aspects allows reliable attribution of causal affect to that variable (Vining and Stevens 1986). Our methodology was similar to that of Manning and others (1996), who used sets of computer-manipulated, photo-realistic portrayals to assess acceptability of a range of biophysical impacts and visitor density levels at principal attraction sites in Arches National Park.

To construct our image sets, 35mm slides of recreationists in the Sedona area and moderate wide-angle photos of Devil's Bridge and Bell Rock (for use as base or background

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images) were imported into image manipulation software. Individual and small groups of foot travelers in the images were masked and saved as separate clips, then digitally pasted in various numbers and combinations onto copies of the base image for each site, producing sets of photo-realistic visitor density scenarios with identical backgrounds. Digital files for each image were converted to 7"x 10" color photographic prints, mounted in random order on fabric-covered pieces of plywood (so they could be presented simultaneously) and re-randomized after approximately 30 respondents had looked at them. A similar method was used to prepare and display images of biophysical changes at Devil's Bridge and Bell Rock.

The first kilometer of Devil's Bridge Trail (formerly used by off-road vehicles) is devegetated. Small-scale efforts to revegetate this portion of the wilderness access have been made in the past. We investigated potential effects of ecological restoration on ability to attain benefits at Devil's Bridge using a set of four images showing the roadsides incrementally more revegetated to a more trail-like condition.

At Bell Rock, we investigated the effect of seeing a 3m ring of stones called a medicine wheel on benefits. We used an image pair depicting an identical scene with, and without a medicine wheel visible. Originally part of Plains Indian culture, and possibly related to their knowledge of astronomy (Eddy 1974) medicine wheels have been adopted by the Sedona "new age" community and like-minded visitors as symbols of their own spiritual beliefs (Lee and Tainter 1996). Dismantling new medicine wheels when they are constructed in wilderness areas is a substantial and ongoing task for area managers.

For our survey questionnaire, specific benefits described by previous researchers (Bruns and others 1994; Driver and others 1991; Driver and Peterson 1986; Pierskalla 1996) were consolidated into seven benefit groups from which respondents were asked to choose one as most valuable:

RESTORATIVE BENEFITS

- feel more of a sense of freedom
- feel exhilaration/excitement
- reduce feelings of depression or anxiety
- reduce feelings of tension or stress

LEARNING

- learn more about the natural history of the area
- learn more about the cultural history of the area
- develop/express my creativity

STRENGTHEN SOCIAL BONDS

- feel closer to my friends
- bring my family closer together
- feel more independent
- spend time with people who share my values

SPIRITUALITY

- feel stronger spiritually
- gain a sense of peace and serenity
- experience a oneness with nature and the cosmos

RELATIONSHIPS WITH NATURE

- increase my understanding of the natural environment
- increase my awareness of the natural environment
- be in a wilderness area

PHYSICAL FITNESS/EXERCISE

- feel healthier
- improve my overall sense of wellness
- improve my cardiovascular condition

ACHIEVEMENT

- improve my skills and abilities
- challenge myself

Manfredo and others (1996) note the importance of assessing recreation experience preferences as closely as possible to the time of interest. We contacted visitors when benefits they were accruing (or expected to) were presumably very salient: upon their return to site access points from short-duration (usually two hours or less) excursions into wilderness areas. Respondents evaluated the conditions portrayed in each image on a seven-point Likert scale for *effect on their ability to attain their most valued recreation benefit*. Surveys were administered to one person per group of visitors, during all times of day and week over a several-month period, producing broadly representative samples.

Results

Aspects of respondents common to both sites were at least some college education and a 2 to 1 ratio of out-of-state to in-state residents. All respondents were foot travelers and most cited day hiking as their most enjoyable activity, although spiritual activities were also significant at Bell Rock.

Devil's Bridge

Devil's Bridge is a day use area; 75% of respondents stayed two hours or less and another 24% stayed between two and six hours. Eighty-four percent listed day hiking as their most enjoyable activity. Among benefits attained while recreating at Devil's Bridge (table 1), 36% of respondents valued relationships with nature most, followed by restorative benefits (25%) and physical fitness/exercise (22%).

Figure 1 shows mean ability to attain benefits at Devil's Bridge by number of visitors. Increasing visitor density was negatively correlated with ability to attain benefits.

Figure 2 shows effects on ability to attain benefits of trail width at Devil's Bridge. Trail 1 is an unmodified image of the trail as it currently exists; trail 2, trail 3 and trail 4 are the same image with progressively more vegetation added along the sides of the trail. Visitors were most able to attain benefits under the most revegetated, trail-like condition, indicating that ecological restoration efforts here would increase visitor benefits.

Table 1—Devil's Bridge site: benefit valued most, N = 107.

Benefit type	Percentage of total
Relationships with nature	35.5
Restorative	25.2
Physical fitness/exercise	21.5
Spirituality	9.3
Strengthen social bonds	6.5
Learning	1.9
Achievement	0
Total	100.0

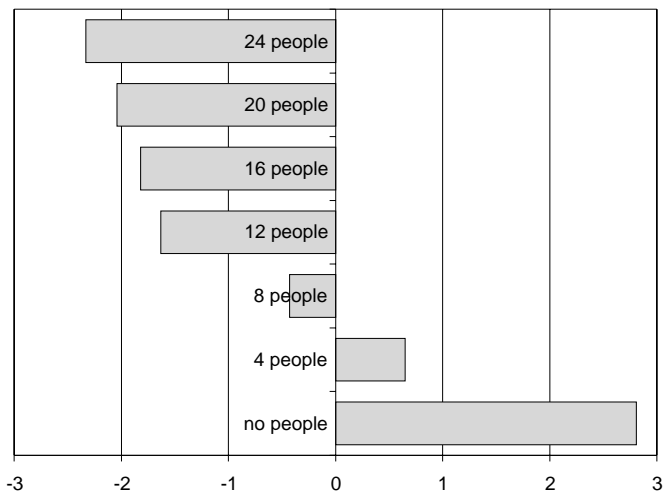


Figure 1—Devil's Bridge site mean effect on ability to attain benefits by visitor density^{1,2,3}, N = 107.

¹ Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

² Differences in ability to attain benefits were statistically significant at each increment of increasing visitor density, Wilcoxon signed rank tests, one-tailed $p < .01$.

³ Correlation (Kendall's *tau-b*) between visitor density and ability to attain benefits: -.62, one-tailed $p < .001$.

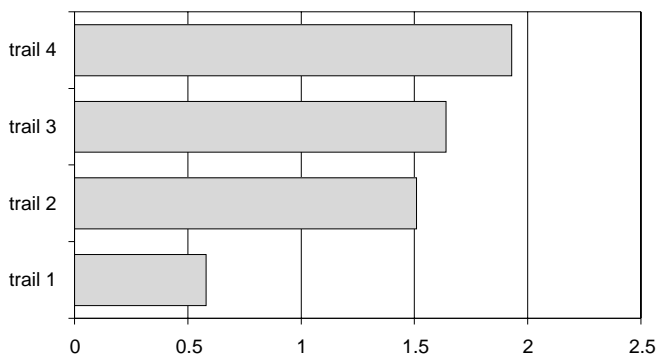


Figure 2—Devil's Bridge site mean effect on ability to attain benefits by trail width^{1,2,3}, N = 107.

¹ Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

² Differences in ability to attain benefits were statistically significant between trail 1 (unmodified image of jeep road) and trail 2 (first increment of revegetation), and between trail 3 (second increment of revegetation) and trail 4 (third increment of revegetation, the most "trail-like" condition). Wilcoxon signed rank tests, one-tailed $p < .01$.

³ Correlation (Kendall's *tau-b*) between amount of trail revegetation and ability to attain benefits: .23, one-tailed $p < .001$.

Bell Rock

Day hiking was the most enjoyable activity for 43 percent of respondents, followed by spiritual activities (26%) and photography (10%). Thirty-one percent of respondents cited restorative benefits as most valuable, followed by spiritual benefits (26%), relationships with nature (14%) and strengthened social bonds and physical fitness/exercise (11% each). See table 2.

Table 2—Bell Rock site: benefit valued most, N = 80.

Benefit type	Percentage of total
Restorative	31.3
Spirituality	26.3
Relationships with nature	13.8
Strengthen social bonds	11.3
Physical fitness/exercise	11.3
Learning	5.0
Achievement	1.3
Total	100.0

Figure 3 shows mean ability to attain benefits at Bell Rock by number of visitors. Respondents were less able to attain benefits at each increment of increasing visitor density. Figure 4 shows mean effect on benefits for the medicine wheel image pair. Respondents were significantly more able to attain recreation benefits when they did not see a medicine wheel than when they saw one, although both scenarios were evaluated positively.

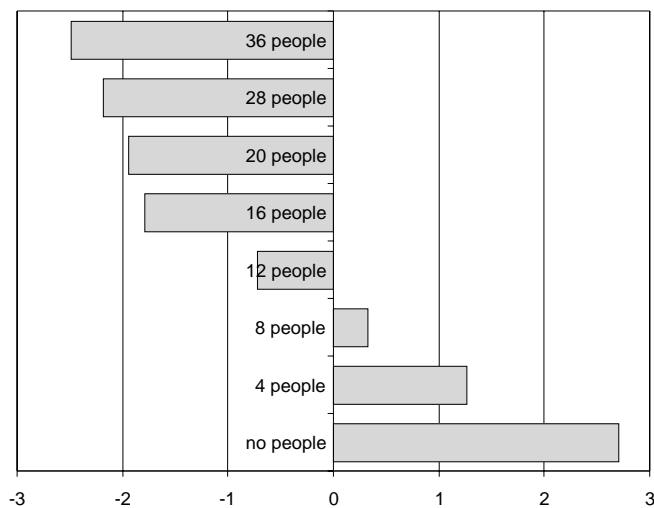


Figure 3—Bell Rock site mean effect on ability to attain benefits by visitor density^{1,2,3}, N = 80.

¹ Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

² Differences in ability to attain benefits were statistically significant at each increment of increasing visitor density (Wilcoxon signed rank tests, one-tailed $p < .01$) except for 16 by 20 people, and 20 by 28 people comparisons, $p = .013$ and $.011$ respectively.

³ Correlation (Kendall's *tau-b*) between visitor density and ability to attain benefits: -.58, one-tailed $p < .001$.

Discussion

Devil's Bridge

Results for visitor density at Devil's Bridge show that increases in negative effect on ability to attain benefits were greatest between 8 and 12 people visible at one time (fig. 1). Mean Likert-scale ratings dropped below negative one (a moderately negative effect on ability to attain benefits) at a

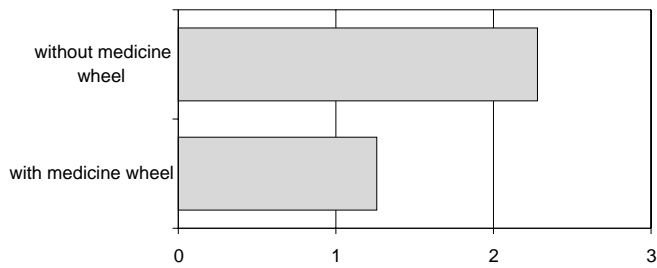


Figure 4—Bell Rock site mean effect on ability to attain benefits for medicine wheel image pair^{1, 2}, N = 80.

¹ Ratings on a 7-point Likert scale, -3 = very negative effect, 0 = no effect, +3 = very positive effect (on ability to attain most valued recreation benefits).

² Difference in ability to attain benefits for scenarios with and without a medicine wheel visible was statistically significant. Wilcoxon signed rank test, one-tailed $p < .01$.

density of about 10 people, which we propose as a potential management standard. This density was rated well above the lowest rating of *very negative* for effect on benefits and was also the point beyond which ratings became significantly *more negative*. The Sedona District's proposed group size limit is 12 in designated wilderness areas (USDA Forest Service 1997a).

Greater ability to attain benefits under trail-width than road-width conditions at Devil's Bridge is consistent with Kaplan and Kaplans' (1989) findings of higher preference for natural scenes in general, and for trees in particular. Preference for outdoor scenes is related to the presence and amount of human artifacts in them (Peron and others 1998), and although scenes described as natural are not restricted to wilderness, people are more likely to respond to a scene as natural if human-built features are absent or not prominent (Ulrich 1983). The most positively rated image in this set (trail 4) also contains the informational factor *mystery*, which has been found to often be a significant predictor variable for preference of natural scenes. Mystery is defined as "...the promise of further information if one could walk deeper into the scene," such as a "...bend in a path and a brightly lit area that is partly obscured by foreground vegetation." (Kaplan and Kaplan 1989).

Bell Rock

Bell Rock is adjacent to Sedona's principal gateway highway, making the site easy to find and attractive to casual, inexperienced visitors. In contrast, locating Devil's Bridge Trail requires good directions and willingness to drive 3 km on a rough dirt road, making it more of a destination for visitors consciously seeking a primitive setting, and less subject to spontaneous, unplanned visits. Results for visitor density at Bell Rock show that increase in negative effect on benefits was largest between 12 and 16 people visible at one time (figure 3). Mean Likert-scale ratings dropped below negative one at around 14 people visible at one time. This is our suggestion for a management standard, and is a substantially higher density of visitors than was considered acceptable by the Devil's Bridge respondents, presumably because the more accessible and easy-to-locate Bell Rock site attracts less experienced visitors. As Hall and Shelby (1996) note, experienced visitors are more likely to have established

encounter norms and to make the effort to avoid areas of high visitor density, and are generally less tolerant of encounters than inexperienced visitors.

The construction of medicine wheels at Bell Rock is a phenomenon related to the romanticization and cooptation of Native American cultures by some Sedona residents, visitors and tourism businesses, and conflation of native beliefs with tenets of the so-called "new age" movement. Over the past 15 years, Sedona has acquired a reputation as a new age center, enhanced through marketing by local merchants and tour operators. One local guidebook lists Bell Rock as a particularly strong *vortex*, "...a place where the very fabric of the Universe is distorted in a manner that allows power from the dimension of pure energy to 'leak through' into our dimension." The guidebook provides direction maps and detailed instructions on how to access this "...dynamo of cosmic energy..." at Bell Rock, as well as an interpretation of the medicine wheel ceremony and how to choose a spot to build one (Dannelley 1989).

Many Native American people view building medicine wheels out of their original context as disrespectful to indigenous cultures (LaDuke 1990, Laxson 1991). Since they are not part of the natural landscape and are not genuine artifacts of native habitation or related to present-day native ceremonial practices, local Forest Service and volunteer personnel expend considerable effort dismantling medicine wheels, particularly in wilderness areas.

Our results for the medicine wheel image pair suggest that seeing a *single* medicine wheel may not strongly detract from ability to attain benefits at Bell Rock. However, if Forest Service personnel didn't actively dismantle medicine wheels, visitors to Bell Rock might easily encounter several over the course of a recreational experience. About 14% of respondents thought the medicine wheel portrayed either was, or may have been constructed by Native Americans, and rated seeing the medicine wheel as having a more positive effect on benefits than not seeing it, understandable if they thought it was a genuine Native American artifact. When these respondents are excluded from the sample, differences in ability to attain benefits with and without the medicine wheel visible are somewhat more pronounced, although effects on benefits were still positive in both cases.

This issue needs to be treated carefully by area managers. In our survey at Bell Rock, the scenario with a visible medicine wheel was rated as having a positive effect on benefits, and several respondents interpreted the questions concerning medicine wheels as evidence that local managers were misguided about, blind or even hostile to native land ethics. In this regard, Laxson (1991) observes that many Americans, faced with the excesses of modern society, are curious about native spiritual beliefs, which are perceived to encompass less destructive relationships with the natural world (Callicott 1982). Cartwright and Burns (1994) state that implementation of sustainable ecosystem management will require a much more ecologically knowledgeable population, and numerous authors (for example, Booth and Kessler 1996, Jostad and others 1996) have cited the potential of Native American land ethics to provide guidance for moving toward more ecologically attuned wildland management and decision-making.

The linkage between environmental sensitivity and interest in Native American land ethics is admittedly complex.

However, by speaking directly to the commonalities many visitors see here, managers could further the cause of greater ecological literacy, increase visitor knowledge of Southwestern native cultures and mitigate potentially adverse public reaction to removal of medicine wheels.

Conclusions

Restorative, relationships with nature, physical fitness and spiritual benefits were most valued by respondents. Increases in visitor density had a progressively more negative effect on ability to attain these benefits. For each site, the density of visitors in images producing mean evaluations of -1 (analogous to a moderately negative effect on ability to attain most valued benefits) was suggested as a management threshold. Although the two sites were ecologically and aesthetically similar, our suggested maximum visitor density thresholds for them differed significantly: 10 people at one time for Devil's Bridge versus 14 people at Bell Rock. Location differences between the sites in relation to gateway roads in the area, and consequent variation in visitor types, help explain this discrepancy.

Sedona area managers acknowledge the shortage of primitive settings (using a standard ROS classification) across the forest, despite great demand for them, but they are forced to manage more intensively because visitation at both Devil's Bridge and Bell Rock greatly exceeds the standard for primitive designation (USDA Forest Service 1997b). Thus, landscape settings are managed for primitive qualities, but managerial settings are more consistent with a rural classification. Even under these conditions, we argue that wilderness designation has merit. Although desired density standards are commonly exceeded, providing largely natural settings free of motorized and mechanized travelers allows many inexperienced, less discriminating visitors to gain the benefits of interaction with wilderness and more of an appreciation for it. Moreover, allowing wilderness borders to be designated near heavily traveled front country settings buffers core areas of wilderness from more intensive use. Permitting visitation standards to be exceeded at these sites may attenuate ecological degradation of less disturbed areas, by not displacing visitors to them. The actions necessary to bring visitation standards within primitive classification at Devil's Bridge, and especially at Bell Rock, would be restrictive and costly, using resources perhaps better allocated to less used and impacted places more likely to benefit from managers' attention (Cole and McCool 1997).

Efforts to mitigate anthropogenic changes would augment visitor benefits at both sites. The most revegetated condition had the most positive effect on benefits at Devil's Bridge, and visitors to Bell Rock would rather not see medicine wheels, supporting the current policy of dismantling them. However, failure to acknowledge the positive aspects of visitor interest in native culture, ritual and land ethics could stifle acquisition of this potentially important type of visitor benefit. Thus, we suggest on-site visitor education that includes: 1) an explanation of the inappropriateness of building medicine wheels in wilderness areas; 2) a discussion of differences between Southwestern and Midwestern Native cultures, and 3) acknowledgement of certain commonalities between Native American land ethics and ecosystem approaches to land management.

Finally, our study supports the use of computer-manipulated, but photo-realistic images to assess human perceptions and opinions about environmental variables. Visual presentation of alternative scenarios holds great promise for generating usable information about perceptions of wilderness visitors.

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