# FROM LANDSCAPES TO SOUNDSCAPES: UNDERSTANDING AND MANAGING NATURAL QUIET IN THE NATIONAL PARKS

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**Abstract.—**Research at Muir Woods Natural Monument suggests that soundscapes are an important component of parks and outdoor recreation, that human-caused noise is a potentially important indicator of quality for park soundscapes, and that visitors have normative standards for the maximum acceptable level of human-caused noise in parks. Formulating indicators and standards of quality may be a useful way of understanding and managing park soundscapes.

## 1.0 INTRODUCTION

A growing body of research and management experience documents the potential impacts of outdoor recreation in national parks and related areas. For example, visitors can trample fragile vegetation, erode soils, pollute water, and disturb wildlife (Hammitt & Cole 1998). Moreover, there are often aesthetic implications of these impacts that can degrade the quality of the visitor experience (Manning et al., 2004).

Research and management attention is now being extended to include aural impacts of outdoor recreation. "Natural quiet"—the sounds of nature undisturbed by human-caused noise—is now being recognized as an important and endangered resource in parks and related areas. In particular, human-caused noise can mask the sounds of nature and detract from the quality of the visitor experience. The U.S. National Park Service has recently created a Natural Sounds Program to help manage soundscapes in national parks, and has revised its management policies to address the importance of this resource:

> The National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks. Natural soundscapes exist in the absence of human-caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting sounds. The Service will restore degraded soundscapes to the natural condition whenever possible, and will protect natural soundscapes from degradation due to noise (undesirable human-caused noise). (National Park Service Management Policy 4.9).

One way to understand and manage soundscapes in parks and related areas is to adapt the framework of indicators and standards of quality (Manning 2004). Indicators of quality are measurable, manageable variables that can be used to help define the condition of park resources and the visitor experience. Standards of quality define the minimum acceptable condition of indicator variables. Once indicators and standards of quality have been formulated, indicator variables are monitored and management actions are taken to ensure that standards of quality are maintained. This approach is central to contemporary park and outdoor recreation management frameworks, including Limits of Acceptable Change (Stankey et al. 1985) and Visitor Experience and Resource Protection (National Park Service 1997, Manning 2001). The objective of this study was to help formulate soundscape-related indicators and standards of quality.

## 2.0 THE STUDY

The study was conducted at Muir Woods National Monument, California. Muir Woods was established as a unit of the national park system in 1908 to preserve an impressive stand of 1,000-year-old coast redwood trees. The park is small by national park standards (just over 500 acres), but is visited very intensively, accommodating over a million visits annually. The park offers six miles of trails, and visitors are required to stay on trails to help protect fragile soils, vegetation, and other resources. The park's main trail network, along Redwood Creek on the floor of the canyon, is hardened with paving or wooden boardwalks.

## 3.0 PHASE 1 RESEARCH

An initial phase of research was conducted in August 2003. The primary objective of this phase of research was to identify potential indicators of the quality of the visitor experience at Muir Woods. An exit survey of a representative sample of 406 visitors was conducted. A series of open- and close-ended questions was asked, including "What did you enjoy the most about your visit to Muir Woods?" and "What did you enjoy the least about your visit to Muir Woods?" Many respondents reported that soundscape-related issues were important in affecting the quality of their experience. For example, many respondents reported that they enjoyed the "quiet" and "peacefulness" of the park and "hearing the sounds of nature." Many respondents also reported that hearing human-caused noise in the park was the least enjoyable aspect of their experience. These findings suggest that soundscape-related issues are potentially important indicators of quality for Muir Woods.

### 3.1 Phase 2 Research

A second phase of research was conducted in July 2005. The primary objective of this phase of research was to identify indicators of quality for the soundscape of Muir Woods. A purposive sample of 280 visitors to Muir Woods was asked to participate in a "listening exercise." Visitors were asked to sit at selected locations in the park and, using a checklist provided, record the types of natural and human-caused sounds they heard. For each type of sound heard, respondents were asked to rate on a nine-point scale how pleasing (+4) or annoying (-4) they found these sounds.

Study findings are summarized in Figure 1, which plots the percentage of respondents who heard each type of sound by how pleasing or annoying that sound was evaluated. This figure is analogous to an importance-performance framework (Mengak et al. 1986, Hollenhorst and Stull-Gardner 1992, Hollenhorst et al. 1992, Hollenhorst and Gardner 1994). Sounds heard by large percentages of visitors and that are evaluated as highly annoying are good potential indicators because they can be important in influencing the quality of the visitor experience. Likewise, sounds heard by a large percentage of visitors and that are evaluated as highly pleasing are also good potential indicators. Data from Figure 1 suggest that sounds constituting the former group include visitor-caused noise such as strangers talking, conversations within large groups, and loud children. Sounds constituting the latter group include wind blowing through the trees, water rushing in Redwood Creek, and bird songs.

### 3.2 Phase 3 Research

A third phase of research was conducted in August 2005. The primary objective of this phase of research was to help identify standards of quality for soundscape-related indicators. Normative theory and related research methods were used for this purpose. Norms are a theoretical construct that have a long tradition and are widely used in sociology and the social sciences more broadly (Vaske and Whittaker 2004).

As the word suggests, norms represent what is considered "normal" or generally accepted within a cultural context (Johnson 2000). If visitors have norms about acceptable conditions in parks and related areas, then such norms can be used to help define standards of quality. Normative research in outdoor recreation has been widely used to study crowding in parks and related areas (Shelby and Heberlein 1986, Whittaker and Shelby 1988, Shelby et al. 1988, Patterson and Hammitt 1990, Williams et al. 1991, Vaske et al. 1996, Manning et al. 1996a, 1996b, Manning 1997, Manning et al. 1998, Jacobi and Manning 1999), and has also been used to study environmental impacts of outdoor recreation (Shelby et al. 1988, Manning et al. 2004), minimum stream flows (Shelby and Whittaker 1995), wildlife management (Zinn et al. 1998, Zinn et al. 2000, Wittmann et al.

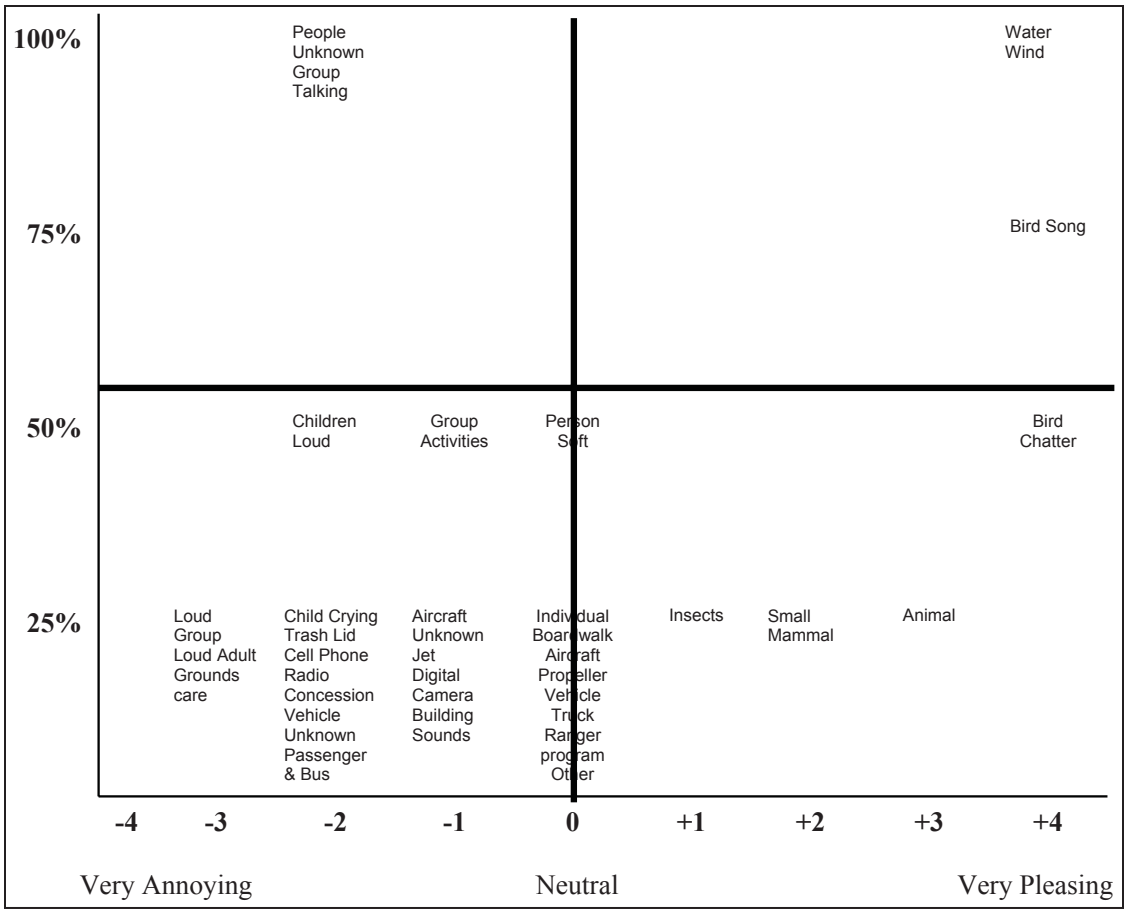


Figure 1.—"Importance-Performance" Analysis of Sounds Heard at Muir Woods.

1998. Whittaker 1997), and fire management policy (Bright et al. 1993, Kneeshaw et al. 2004).

To measure normative standards of quality for the soundscape-related indicators identified in Phase 2 research, a series of five 30-second tape recordings was prepared. These tapes were prepared using recordings of natural and human-caused sounds in the park. The first tape represented the park's natural soundscape of wind, water, and bird songs. The next four tapes overlaid tracks of increasing levels of visitor-caused sounds, including talking and boisterous behavior. These tapes were incorporated into a visitor survey by asking respondents to listen to each tape and evaluate their acceptability using a nine-point response scale anchored at "very unacceptable" and "very acceptable." The survey was administered to a representative sample of 298 visitors as they exited the park.

Resulting data were graphed as shown in Figure 2. This "social norm curve" plots the average acceptability rating for the sample for each of the five study tapes. Average ratings fall out of the acceptable range and into the unacceptable range between tapes 2 and 3, and this point may represent a threshold or minimum standard of quality. Selected sound metrics associated with each study tape are also plotted on the X axis of the graph.

A final question asked respondents to indicate which of the study tapes best represented the soundscape conditions experienced in the park. Findings are shown in Table 1 and suggest that human-caused noise in the park is approaching the threshold of normative acceptability identified in Figure 2.

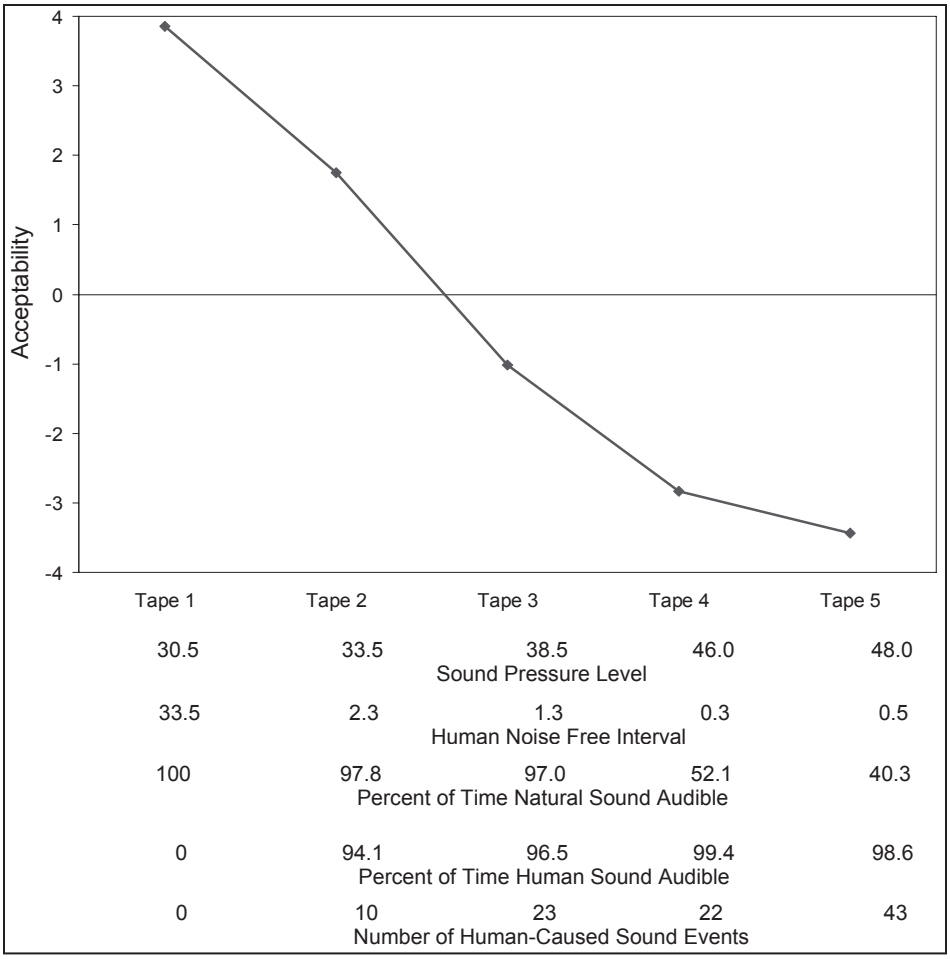


Figure 2.—Social Norm Curve for Sounds at Muir Woods.

## 4.0 CONCLUSIONS

"Natural quiet" is increasingly being recognized as an important and scarce resource in parks and related areas. Moreover, the ability to hear the sounds of nature without distractions of human-caused noise can affect the quality of the visitor experience.

Thus, soundscapes may be an important component of managing parks and outdoor recreation, and human-caused noise may be an important indicator of quality of park soundscapes. Study findings suggest that visitors have normative standards regarding the maximum acceptable level of human-caused noise in parks and that such measures may be useful in formulating soundscape-related standards of quality. Data from Muir Woods suggest that current levels of human-caused noise are approaching normative standards of acceptability.

**Table 1.—Study tape that most closely represents the conditions experienced in the park**

| | Frequency | Percent |
|---|---|---|
| Tape 1 | 50 | 17.9 |
| Tape 2 | 189 | 67.5 |
| Tape 3 | 35 | 12.5 |
| Tape 4 | 6 | 2.1 |
| Tape 5 | 0 | 0.0 |

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