THESIS

# AN EXPLORATION OF VISITOR MOTIVATIONS:

# THE SEARCH FOR SILENCE


Submitted by

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ABSTRACT

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This research aims to study the relationship between visitor motivations for experiencing solitude, sounds of nature, and quiet and a visitor's soundscape experience. This relationship will improve managers' ability to provide satisfying and diverse experiences for their visitors and "protect" something that is increasingly rare outside of national parks and other protected natural areas; natural sounds and quiet. Chapter 1 focuses on the effect motivation for a quiet setting can have on acceptability of natural or human-caused sound in Muir Woods National Monument. This study used a dose-response methodology where visitors listened to five audio recordings varying in the percentage of time that human-caused sound was louder than natural sound (percent time above). Visitors were then asked to rate the acceptability of each recording. Three sound-related motivations for visiting Muir Woods were examined: "enjoying peace and quiet", "hearing sounds of nature" and "experiencing solitude." Cluster analysis was used to identify discrete groups with similar motivational profiles (i.e., low, moderate and high motivation for quiet). Results indicated that as percent time above natural sound increased, visitor ratings of human-caused sound decreased. Tolerance for human-caused sound also decreased as motivation for quiet increased. Consensus regarding the

acceptability of sound was greatest when the percent time above natural sound was lowest (i.e., quietest sounds).

Chapter 2 describes a study of the ability of motivations to predict which of three locations a visitor would most likely choose for recreation. Particular focus was given to sound-related motivations. Data for this study were collected at three sites with varying visitation levels within two national parks; Sequoia National Park–backcountry (low visitation), Sequoia National Park–frontcountry (moderate visitation), and Muir Woods National Monument –frontcountry (high visitation). Survey respondents were asked to rate the importance of six items in their decision to visit the particular park; (a) scenic beauty; (b) experience solitude; (c) time with family and friends; (d) get exercise; (e) experience the sounds of nature; and (f) peace and quiet. Results showed that, of the three study sites, those visitors more motivated to spend time with family and friends and experience the sounds of nature were more likely to visit a frontcountry site, while those motivated for experiencing solitude and getting exercise were more likely to visit a backcountry site.  The experience of peace and quiet was not a significant predictor of park location chosen, suggesting that respondents were similarly motivated for quiet across all three sites.

Both chapters in this thesis reveal interesting results that may cause managers to consider soundscape management differently in frontcountry and backcountry areas of national parks. For example, these results imply setting acoustic standards, designating management zones, and using education programs to manage for and meet varying levels of motivation for experiencing natural sounds and quiet.

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# INTRODUCTION

The National Park Service is charged with preserving outstanding natural and cultural areas for the enjoyment of present and future generations (National Park Service, 1916; 1970; 1978). In order to ensure this is achieved, land managers work to provide their visitors with a quality visitor experience. Quality is defined as the “degree to which each opportunity satisfies the experiences for which it is managed” (Manning, 1999, p. 13). Managers can improve their success in providing opportunities for higher quality experiences by considering the extent to which an experience satisfies the motivations that led to that visitor’s participation (Manfredo, Pierce, Vaske, & Whittaker, 2002). By incorporating the concept of motivation, managers can address why people recreate and how management can provide quality experiences that align with management objectives (Manfredo & Driver, 2002). Specifically, managers can develop programs and recreational opportunities that have the greatest probability of being consistent with visitor reasons for visiting an area and minimizing conflicts among users (Manfredo, Driver, & Tarrant, 1996).

Visitors are motivated to recreate in national parks for many reasons, but among some of the most important are to experience solitude, peace and quiet, and the sounds of nature (Driver, Nash, & Haas, 1987; Kaplan, 1995). Despite this desire for quiet environments, anthropogenic noise continues to increase as a result of growing road and aircraft traffic (Barber, Crooks, & Fristrup, 2009), intruding upon the few quiet and pristine natural areas that we have left. The National Park Service determined that noise was audible for more than 25% of the time at 55 sites within 14 parks studied (NPS, unpublished). Researchers have focused on understanding visitor perceptions of natural and human-caused sound in Muir Woods National Monument, Yosemite, Grand Teton, and Hawaii Volcanoes National Parks. Managers are realizing how important data for more than just the physical measures of sound are when attempting to regulate or mitigate noise in their parks (Mace, Bell, & Loomis, 2004). Research in Muir Woods National Monument has defined indicators and standards for "soundscape" (Pilcher, Newman, & Manning, 2008) and explored the effectiveness of particular actions (i.e., quiet zone and a quiet day) in managing sounds in the park (Stack, Newman, Manning, & Fristrup, in press). To date, however, no research has explored the role motivations play in a visitor's soundscape experience. This thesis builds upon previous research by forming a link between motivation and soundscape in a way that will improve managers' ability to provide satisfying and diverse experiences for their visitors. This research not only provides evidence for why incorporating motivations in soundscape management is important, but also presents the steps, skills, and information necessary to succeed in doing so.

## Soundscape

In comparison to other natural resource topics, soundscape is still a relatively new concept for many park managers. They are continually realizing how critical natural sounds and quiet are to visitor experience and the power they possess in protecting some of the last truly quiet areas. The National Park Service (NPS) Natural Sounds Program defines soundscape as the human perception of acoustic resources. The NPS works to protect natural (e.g., wildlife, wind, water) and cultural (e.g., cannon fire, battle reenactments, cultural ceremonies) sound resources. Noise is often used as a synonym for sound, but should be distinguished as undesired or extraneous sound (Morfey, 2001). In the case of national parks, Pilcher et al. (2008) found that visitors sought natural sounds and became annoyed by human-caused noise masking those sounds and detracting from their experience. NPS Management Policies mandate the restoration of natural conditions wherever park soundscapes have become degraded by noise and the protection of natural soundscapes from unacceptable impacts (National Park Service, 2006). The NPS also strives to protect this “endangered” resource (Jensen & Thompson, 2004) for the many visitors that treasure it. Seventy-two percent of Americans find opportunities to experience the sounds of nature as important for protecting national parks (Haas & Wakefield, 1998).

Research has shown that various non-acoustical factors (e.g., visitor motivations) influence responses to noise (Berglund, Lindvall, & Nordin, 1990; Tarrant, Haas, & Manfredo, 1995). Research has found psychological factors are often as important as physiological noise exposure when determining reactions (Hatfield, Job, Peploe, Carter, Taylor, & Morrell, 2001; Job & Hatfield, 1998). Prolonged exposure to noise has been linked to “stress symptoms” (i.e., fatigue, headaches, mild depression) (Stansfield, Clark, Jenkins, & Tarnopolsky, 1985), hearing disorders, and negative impacts to the cardiovascular and endocrine systems (Aydin & Kaltenbach, 2007; Babisch, 2003; Gramann, 1999). Anthropogenic noise exposure can also affect one’s performance of an “immediate serial recall task” (Beaman, 2005) such as the ability to remember information learned from interpretive programs (Benfield, Bell, Troup, & Soderstrom, 2010a). The presence of anthropogenic noise negatively impacts natural landscape assessment and can detract from the visitors' natural soundscape and overall park experiences (Benfield, Bell, Troup, and Soderstrom, 2010b). Due to higher expectations for quiet, natural settings are more sensitive to acoustic stimuli than developed settings (Anderson, Mulligan, Goodman, & Regen, 1983), and consequently, psychological effects are more prominent in natural environments (Mace, Bell, & Loomis, 1999, 2004). All of the literature supports the idea that loudness (Kariel, 1990) is not the only predictor of visitors' response to sound and that visitor characteristics, such as motivations, must be considered in order to get a complete picture of a visitor's soundscape experience.

## Motivation

People are motivated to participate in recreation to satisfy certain needs (Driver & Toucher, 1970). Motivation refers to psychological mechanisms that control the direction and intensity of behavior (Kanfer, 1994). The Experience-Based Management (EBM) model views motivation as the expectation that efforts will lead to onsite performances and the expectation that those performances affect valued psychological outcomes (Manfredo et al., 2002). People recreate when a particular state exists and another state is preferred (Knopf, Driver, & Bassett, 1973). In other words, the EBM model posits that visitors are engaging in a particular activity, in a particular place, because of their own intrinsic motivation to satisfy certain needs or meet certain goals (Tinsley & Tinsley, 1986). The EBM model proposes that people choose to participate in a recreation activity and a specific type of setting to attain a desired experience (Manfredo et al., 2002).

The theoretical basis behind EBM stems from the Expectancy-Valence Model (Lawler, 1973; Vroom, 1964). This model proposes that the motivational force behind engagement in a behavior is the function of the expectancies that the individual holds about the behavior's outcomes and the valence or desirability of those particular outcomes. Similar to the concept of motivation described above, this model only applies to behaviors that are under voluntary control or free for choice (Porter, Lawler, III, & Hackman, 1975). Expectancies are defined as the beliefs about whether an activity can be performed to some level to bring about particular outcomes (Feather, 1992; Vroom, 1964) and the positive and negative consequences that may result from those outcomes (Feather, 1992). Valence refers to one's orientations towards the outcomes. Positive valence would mean that the outcomes are attractive to the individual, while negative valence would result in an individual trying to avoid those outcomes (Feather, 1992; Vroom, 1964). The valence of outcomes depends ultimately on an individual's personal and subjective values (Feather, 1988), difficulty of the task, the amount of personal control one has on the activity, and causes attributed to that outcome (Feather, 1992). The Expectancy-Valence Model was most often applied to work settings (Vroom, 1964), but was later adapted to models like EBM for explaining recreation motivation in natural settings.

Prior to the development of EBM, recreation management techniques focused on activity-based management, where managers attempted to provide as many activity opportunities at a given area as possible, rather than provide experience opportunities that were most appropriate for that area (Driver & Brown, 1978). Under activity-based management, a quality experience is measured in terms of the number of activities and participants, while under EBM quality is measured in terms of the diversity of experience opportunities offered. By only focusing on the activity opportunity, management would limit itself to only one of the four types of demand for recreational opportunities. Level one represents the activity or activities the individual chooses to engage in (Pierskalla et al., 2004); level two refers to the environment in which the recreational opportunity occurs (includes resource, social, and managerial attributes); level three refers to the psychological outcomes or states of mind that motivate an individual to participate in recreation (i.e., experiences, motivations) (Manfredo et al., 2002; Manning, 1999); and, level four refers to the short-term and long-term benefits that result from an experience (Driver & Brown, 1978). With activity-based management, the manager will only focus on providing the visitor facilities and infrastructure needed to offer various activity opportunities (Pierskalla et al., 2004), rather than the activities and setting needed to attain a desired experience.

With the development of EBM, managers no longer focus solely on the inputs (e.g., activity, setting), but rather consider how the inputs can lead to different outputs or types of experiences. Overall, EBM aims to look at the relationship between the first three levels of recreation demand in order to increase the likelihood that individuals will participate in desired activities and experiences by providing the necessary setting (Manfredo, Driver, & Brown, 1983). Simply, managers can provide the setting needed to suit the desired psychological outcomes an individual is motivated to obtain. When the manager defines the various types of experience/motivation opportunities, a differentiation can be made between the activities offered (Driver & Brown, 1978) and the settings in which the activity is conducted. Particularly, an understanding of visitors' motivation with regards to a quiet setting can aid managers in developing programs and recreational opportunities that meet a diversity of visitor expectations (Manfredo et al., 1996).

One approach to provide a variety of visitor opportunities is the Recreation Opportunity Spectrum (ROS). ROS includes a diversity of activity and experience opportunities that vary from one end of the spectrum to the other, and a range of environmental settings that allows for different activities and experiences (Driver & Brown, 1978). A product of the EBM approach, this spectrum is typically defined in terms of the relationships between the first three levels of recreation demand (Driver & Brown, 1978), but can also include the consideration of benefits to the visitor (Manning, 1999). In using ROS, managers acknowledge that the attainment of experiences depends on the availability of particular combinations between activities and settings (Driver, Brown, Stankey, & Gregoire, 1987). By taking into account visitor motivation, ROS can be used by managers to provide a variety of recreational opportunities that fulfill certain motivations. For example, a manager can zone different areas of the park to meet standards for varying levels of motivation to experience natural sounds or quiet (Manning, 1999). As our knowledge of the relationship between activities, settings and motivation for psychological outcomes improves, so will a manager's ability to create opportunities for quality visitor experiences (Manning, 1999).

## Organization of Thesis

Chapter 1 focuses on the effect motivation for a quiet setting can have on acceptability of natural or human-caused sound in Muir Woods National Monument. Visitors were asked to rate the acceptability of five recordings, ordered by increasing percentages of time (ranging from 0 - 100%) that human-caused sound was louder than natural sound (percent time above). A cluster analysis was used to identify discrete groups with similar motivations (i.e., low, moderate, and high motivation) to "enjoy peace and quiet”, “hear sounds of nature” and “experience solitude”. A Repeated Measures Analysis of Variance (ANOVA) and one-way ANOVA were conducted to study how the amount of human-caused noise and level of motivation would affect visitor acceptability of the recordings. Potential for Conflict Index ($PCI_2$) was used to estimate consensus regarding the acceptability of the different recordings for the entire sample and among the motivation groups.

Chapter 2 describes a study of the ability of motivations to predict which of three locations a visitor would most likely choose. Data for this study were collected at three sites within two national parks; Sequoia National Park–backcountry (low visitation), Sequoia National Park–frontcountry (moderate visitation), and Muir Woods National Monument–frontcountry (high visitation). Survey respondents were asked to rate the importance of six items in their decision to visit the particular park; three related to soundscape. Random Forest analysis (Breiman, 2001) was used to split the respondents into groups based on their motivations. The motivation-based respondent groupings were then used in a multinomial logit model to predict park location choice as a function of visitor motivations.

In the conclusion, we offer managers a set of recommendations for incorporating soundscape into overall management, particularly with regards to park planning efforts. An important component of a park’s General Management Plan is the designation of management zones that will guide resource and visitor management for the next 15-20 years. We recommend the use of motivations to establish “acoustic zones” during such planning processes and encourage parks to consider the development and implementation of more detailed soundscape management plans.

# CHAPTER 1. MOTIVATION AND ACCEPTABILITY NORMS OF HUMAN-CAUSED SOUND IN MUIR WOODS NATIONAL MONUMENT

## Introduction

As noise increases throughout the United States as a result of growing road and aircraft traffic (Barber, Crooks, & Fristrup, 2009), the protection of pristine and quiet natural areas becomes more difficult (Mace, Bell, & Loomis, 2004). Silence, relaxation, escaping noise, and experiencing tranquility are important motivations for visiting natural areas (Driver, Nash, & Haas, 1987; Kaplan, 1995). Despite this desire for quiet environments, anthropogenic noise continues to intrude upon natural areas and has become a source of concern. The National Park Service determined that noise was audible for more than 25% of the time at 55 sites within 14 parks studied (NPS, unpublished). With the growth of transportation increasing faster than human population (Barber et al., 2009), the potential for noise intrusions into our national parks increases. Researchers have focused on understanding visitor perceptions of natural and human-caused sound in Muir Woods National Monument, Yosemite, Grand Teton, and Hawaii Volcanoes National Parks. Managers are realizing how important data for more than just the physical measures of sound are when attempting to regulate or mitigate noise in their parks (Mace et al., 2004). Research in Muir Woods National Monument has defined indicators and standards for “soundscape” (Pilcher, Newman, & Manning, 2008) and explored the effectiveness of particular actions (i.e., quiet zone and a quiet day) in managing sounds in the park (Stack, Newman, Manning, & Fristrup, in press). To date, however, no research has explored the role motivations play in determining a visitor's acceptability of differing sounds. This article builds upon previous research by incorporating the concept of motivation into visitor acceptability of natural and human-caused sound in Muir Woods National Monument.

The National Park Service (NPS) defines soundscape as the human perception of acoustic resources. Acoustic resources include natural (e.g., wildlife, wind, water) and human-caused (e.g., aircraft, vehicles, talking) sounds. Noise is often used as a synonym for sound, but should be distinguished as undesired or extraneous sound (Morfey, 2001). In the case of national parks, Pilcher et al. (2008) found that visitors sought natural sounds and became annoyed by human-caused noise masking those sounds and detracting from their experience. NPS Management Policies mandate the restoration of natural conditions wherever park soundscapes have become degraded by unnatural sounds (noise) and the protection of natural soundscapes from unacceptable impacts (National Park Service, 2006). The NPS also strives to protect this "endangered" resource (Jensen & Thompson, 2004) for the many visitors that treasure it. Seventy-two percent of Americans find opportunities to experience the sounds of nature as important for protecting national parks (Haas & Wakefield, 1998). Nine out of 10 NPS visitors "consider enjoyment of natural quiet and the sounds of nature as compelling reasons for visiting national parks" (McDonald, Baumgartner, & Iachan, 1995).

Research has examined individual responses to human-caused sound, such as aircraft (Bell, Mace, & Benfield, 2009; Krog & Engdahl, 2005; Mace, Bell, Loomis, & Haas, 2004; Miller, 1999). Non-acoustical factors (e.g., visitor motives) influence responses to aircraft noise (Berglund, Lindvall, & Nordin, 1990; Tarrant, Haas, & Manfredo, 1995). Research has found psychological factors are often as important as physiological noise exposure when determining reactions (Hatfield, Job, Peploe, Carter, Taylor, & Morrell, 2001; Job & Hatfield, 1998). Prolonged exposure to noise has been linked to “stress symptoms” (i.e., fatigue, headaches, mild depression) (Stansfield, Clark, Jenkins, & Tarnopolsky, 1985), hearing disorders, and negative impacts to the cardiovascular and endocrine systems (Aydin & Kaltenbach, 2007; Babisch, 2003; Gramann, 1999). Anthropogenic noise exposure can also affect one’s performance of an “immediate serial recall task” (Beaman, 2005) such as the ability to remember information learned from interpretive programs (Benfield, Bell, Troup, & Soderstrom, 2010a). The presence of anthropogenic noise negatively impacts natural landscape assessment and can detract from the visitors’ natural soundscape and overall park experiences (Benfield, Bell, Troup, and Soderstrom, 2010b). Due to higher expectations for quiet, natural settings are more sensitive to acoustic stimuli than developed settings (Anderson, Mulligan, Goodman, & Regen, 1983), and consequently, psychological effects are more prominent in natural environments (Mace, Bell, & Loomis, 1999, 2004). Loudness (Kariel, 1990), the source of sound (e.g., natural vs. human-caused) and visitor characteristics (e.g., motivation) also influence visitors’ acceptability of sound.

**Motivation**

People are motivated to participate in recreation to satisfy certain needs (Driver & Toucher, 1970). Motivation refers to psychological mechanisms that control the direction and intensity of behavior (Kanfer, 1994). The search for some optimum or preferred condition underlies most psychological motives. By incorporating the concept of motivation, managers can address why people recreate and how management can best accommodate their needs (Manfredo & Driver, 2002)

Experience-Based Management (EBM) emphasizes that recreation experiences are psychological outcomes or states of mind that are realized in particular settings during recreation activities (Pierskalla, Lee, Stein, Anderson, & Nickerson, 2004). The EBM model proposes that people choose to participate in a recreation activity and a specific type of setting to attain a desired experience (Manfredo, Pierce, Vaske, & Whittaker, 2002). In this model, motivation is viewed as the expectation that efforts will lead to onsite performances and the expectation that those performances affect valued psychological outcomes (Manfredo et al., 2002).

Prior to the development of EBM, recreation management techniques focused on activity-based management, where managers attempted to provide as many activity opportunities at a given area as possible, rather than provide experience opportunities that were most appropriate for that area (Driver & Brown, 1978). By only focusing on the activity opportunity, management would limit itself to only one of the four types of demand for recreational opportunities. Generally, the four levels of demand for recreation include activities, setting, experience/motivations, and benefits (Driver & Brown, 1978; Manning, 1999). When the manager defines the various types of experience/motivation opportunities, a differentiation can be made between the activities offered (Driver & Brown, 1978).

Our research focuses on motivations for experiencing quiet in natural environments. An understanding of visitors' motivation for a quiet setting can aid managers in developing recreational opportunities that meet the visitors' desired psychological outcomes and minimize conflicts between users (Manfredo, Driver, & Tarrant, 1996).

## Indicators and Standards

The Visitor Experience and Resource Protection (VERP) framework (NPS, 1997) highlights the concepts of indicators and standards when making management decisions. Indicators are "specific, measurable, physical, ecological, or social variables that reflect the overall condition of a zone" (NPS, 1997, p. 58). Indicators consider visitor impacts on both the natural environment and the visitor experience (Manning, 1999). A standard is defined as the "minimum acceptable condition for each indicator variable" (NPS, 1997, p. 59). This article builds on research by Pilcher et al. (2008) that identified indicators and standards for soundscape. For example, a sound-related indicator is the percent of time that human-caused sound is louder than natural sound. The sound-related standard might specify that human-caused sound should be no louder than natural sound for more than 60% of a 12-hour day. The structural norm approach can help in developing such standards.

## Structural Norm Approach

The structural norm approach displays the characteristics of norms graphically (Shelby, Vaske, & Donnelly, 1996). Referred to as the impact acceptability curve (i.e., social norm curve), impacts are displayed on the horizontal axis and acceptability on the vertical axis (Vaske & Whittaker, 2004). Using this model, individuals' personal norms can be aggregated to reflect social norms (Manning, Valliere, & Wang, 1999). Personal norms represent an individual's own expectations (Schwartz, 1977); social norms are averages of evaluations made by individuals within a social group (Shelby et al., 1996).

The highest point on the curve represents the *optimal or preferred condition*. The *range of acceptable or tolerable conditions* includes points on the curve above the neutral point. The *minimum acceptable condition* represents the point at which the curve crosses the zero point of the acceptability scale (Manning et al., 1999). Variation among responses at each impact level refers to the amount of consensus or *crystallization* (Vaske & Whittaker, 2004). The distance of the curve above and below the zero point defines the norm intensity and provides an understanding of how important or salient the indicator is to respondents (Manning et al., 1999).

The structural norm approach facilitates formulating standards for management, but does not typically display norm crystallization (degree of dispersion). When consensus exists, management standards can be established (Shelby & Vaske, 1991). This paper incorporates the second generation of the Potential for Conflict Index ($PCI_2$) (Vaske, Beaman, Barreto, & Shelby, 2010)[1] into the structural norm methodology as a way to display consensus among respondents as well as other structural characteristics of norms.

[1] A description of $PCI_2$, as well as programs for calculating, graphing and comparing two PCI values can be found at http://welcome.warnercnr.colostate.edu/~jerryv

**Potential for Conflict Index ($PCI_2$)**

The $PCI_2$ was developed to facilitate understanding and applicability of human dimensions findings to managerial concerns. The $PCI_2$ ranges from 0 to 1. The least amount of consensus and greatest potential for conflict ($PCI_2 = 1$) occurs when responses are equally divided between the two extreme values on the scale (e.g., 50% very annoying and 50% very pleasing). A distribution with 100% at any one point on the response scale yields a $PCI_2$ of 0 and suggests complete consensus and no potential for conflict (Vaske et al., 2010).

$PCI_2$ results are displayed on graphs similar to the structural norm model. Consensus is reflected by bubbles. The size of the bubble depicts the magnitude of $PCI_2$ and indicates the extent of potential conflict (or consensus) regarding the acceptability of a particular topic (i.e., degree of dispersion). A small bubble represents little potential for conflict (i.e., high consensus) and a larger bubble represents greater potential for conflict (i.e., less consensus). The center of the bubble represents the mean rating as plotted on the *y*–axis (i.e., central tendency). The bubble's location relative to the neutral point identifies if visitor acceptability of an action is skewed (Vaske et al., 2010).

By using $PCI_2$ in combination with the structural norm approach, this article examines how the source of sound (i.e., human-caused vs. natural sound) and motivation can affect visitor acceptability and consensus regarding acceptability of sound. The following hypotheses are advanced:

$H_1$: As human-caused sound increases, average visitor acceptability of sound decreases.

$H_2$: As motivation for a quiet setting increases, average visitor acceptability of human-caused sound decreases.

$H_3$: Consensus (i.e., the $PCI_2$ values) regarding acceptability of sound will be greatest for the quietest sounds.

$H_4$: As motivation for a quiet setting increases, consensus (i.e., $PCI_2$ values) regarding acceptability of sound will be greatest for the quietest sounds.

## Methods

### Study Area

Muir Woods National Monument is a popular tourist area 15 miles north of San Francisco, CA. Established in 1908 and totaling 554 acres, the national monument receives approximately 780,000 visitors annually. The park is known for containing one of the last remaining redwood forests in the area. Our survey was conducted in Cathedral Grove, a forest approximately half of a mile from the visitor center, containing some of the oldest and largest trees in the park. Despite its "frontcountry" label, Cathedral Grove was chosen because of the reverence and quiet implied by its name as well as park objectives to manage the area as a primeval forest. Visitors come to the park to experience the sounds of nature with minimal noise intrusions (Pilcher et al., 2008).

### Study Design

A dose-response methodology was used to measure standards for soundscape quality. This methodology exposes listeners to a particular amount of sound (dose) and documents the individual's response to that dose (Fidell, Silvati, Howe, Pearsons, Tabachnick, Knopf, Gramann, & Buchanan, 1996). Five 30-second audio clips were recorded in Muir Woods. The sound recordings were ordered by increasing percentages of time (ranging from 0 - 100%) that human-caused sound was louder than natural sound (percent time above). For these recordings, the human-caused sound was human voices, while the natural sounds were wind, running water and bird calls. Previous research at Muir Woods found these to be the most common sounds heard at the park (Pilcher et al., 2008). Groups talking was heard 73% of the time, while natural sounds like birds, running water and wind were heard 60%, 81%, and 74% of the time, respectively (Pilcher et al., 2008). The recordings sought to compare differences in ratings between human-caused and natural sound, in general. They do not attempt to compare different human-caused sounds (i.e., aircraft, vehicles, people talking) or natural sounds (i.e., bird calls, wind, insects) to one another. A description of each recording is provided in Table 1. The actual recordings can be found at: *http://warnercnr.colostate.edu/psu-research-methods/.*

Table 1. Description of five audio recordings[1]

| | |
|---|---|
| Recording 1 | All natural sounds including wind, running water and birds calling. No human-caused sound (i.e., 0% time above). |
| Recording 2 | Included the baseline natural sounds from recording 1, but with the addition of one human-caused sound; human voices. The human-caused sound was above (or louder than) the natural sounds 30% of the time (i.e., 30% time above). |
| Recording 3 | Included the baseline natural sounds from recording 1, but with the addition of one human-caused sound; human voices. The human-caused sound was above (or louder than) the natural sounds 60% of the time (i.e., 60% time above). |
| Recording 4 | Included the baseline natural sounds from recording 1, but with the addition of one human-caused sound; human voices. The human-caused sound was above (or louder than) the natural sounds 90% of the time (i.e., 90% time above). |
| Recording 5 | Included the baseline natural sounds from recording 1, but with the addition of one human-caused sound; human voices. The human-caused sound was above (or louder than) the natural sounds 100% of the time (i.e., 100% time above). |

[1] The recordings did not control for decibel level

Visitors were randomly selected as they entered Cathedral Grove and asked to participate in the survey (*n* = 157, response rate = 54%). As a check on non-response bias, the study sample was compared to other sample populations from previous studies at the park that were representative of visitors to Muir Woods, in terms of race, ethnicity, and gender (Pilcher et al., 2008). No substantive differences in the sample populations were found. Each visitor was administered the listening portion of the survey in a sound booth wearing headphones that electronically cancelled exterior sounds.

**Variables Measured**

After listening to each of the five recordings, respondents rated the recording on a 9-point response scale ranging from -4 (very annoying) to +4 (very pleasing). Three sound-related motivations for visiting Muir Woods were examined: “enjoying peace and quiet”, “hearing sounds of nature” and “experiencing solitude.” Each motive was rated on a scale of 1 (not at all important) to 4 (extremely important).

**Analyses**

K-means cluster analysis was used to segment individuals into homogenous groups based on their motivations. A Repeated Measures Analysis of Variance (ANOVA) was used to test $H_1$ and $H_2$. The sound recordings represented the within subject factor while the different motivation groups (i.e., clusters) represented the in between subject factor. One-way ANOVAs were used to further examine differences in recording ratings among the motivation groups.

$PCI_2$ was used to estimate consensus regarding the acceptability of the different recordings for the entire sample ($H_3$) and among the motivation groups ($H_4$). The $PCI_2$ values were compared between the five recordings over the entire sample (10 comparisons total) and between the three motivation groups (3 comparisons per recording). Statistical differences between two observed $PCI_2$ values were calculated using the software available from *http://welcome.warnercnr.colostate.edu/~jerryv*.

## Results

### Cluster Analysis

Separate cluster analyses were performed for two, three, four, and five group solutions. The three-group solution provided the best fit for the data. To validate this solution, data were randomly sorted and a cluster analysis was conducted after each of three random sorts. All of these additional cluster analyses supported the initial three-group solution (Table 2); those who: (a) felt that experiencing solitude, enjoying peace and quiet, and hearing sounds of nature were somewhat important (cluster 1 “low motivation,” $n = 33$, 21%); (b) felt that experiencing solitude, enjoying peace and quiet, and hearing sounds of nature were moderately important (cluster 2 “moderate motivation,” $n = 58$, 37%); and (c) felt that experiencing solitude, enjoying peace and quiet, and hearing sounds of nature were extremely important (cluster 3 “high motivation,” $n = 66$, 42%). One-way ANOVAs revealed that the mean ratings were significantly different for all the sound-related motivations (i.e., experience solitude, enjoy peace and quiet, hear the sounds of nature) ($F \geq 125.63$, $p < .001$, $\eta \geq .68$ in all cases). In addition, mean ratings were statistically significant between all the cluster groups at $p < .05$.

Table 2. Levels of motivation for a quiet setting for three clusters of visitors in Muir Woods National Monument

| | Motivation for a quiet setting[1] | | | | | |
|---|---|---|---|---|---|---|
| | Cluster 1 | Cluster 2 | Cluster 3 | | | |
| | Low Motivation | Moderate Motivation | High Motivation | | | |
| Cluster – Sample size | 33 | 58 | 66 | | | |
| Cluster – Percent | 21% | 37% | 42% | *F*-value | *p*-value | Eta ($\eta$) |
| Importance of the following for visiting Muir Woods: | | | | | | |
| Experience solitude | 1.79 [a] | 2.29 [b] | 3.73 [c] | 125.63 | <.001 | .79 |
| Enjoy peace and quiet | 1.97 [a] | 3.09 [b] | 3.92 [c] | 181.68 | <.001 | .84 |
| Hear sounds of nature | 2.00 [a] | 3.33 [b] | 3.82 [c] | 162.96 | <.001 | .68 |

[1] Cell entries are mean scores coded on a 4-point scale from 1 “not at all important” to 4 “extremely important.”
Means with different superscripts across each row are significantly different at $p < .05$ using LSD post-hoc tests.

**Comparison of Visitor Acceptability Ratings ($H_1$ and $H_2$)**

The mean ratings for the recordings varied significantly with percent time human-caused sound was louder than natural sound (percent time above). The Repeated Measures ANOVA revealed that percent time above (as represented in each recording) had an effect on the mean ratings ($F = 338.55$, $p < .001$, $\eta = .86$). Although motivation (represented by the clusters) was not significant ($F = .05$, $p = .95$, $\eta = .03$), it did have an interaction effect with percent time above ($F = 5.68$, $p < .001$, $\eta = .30$) on the mean ratings. Visitors became more annoyed (i.e., mean ratings decreased) as the percentage of human-caused sound above natural sound (percent time above) increased (Figure 1).

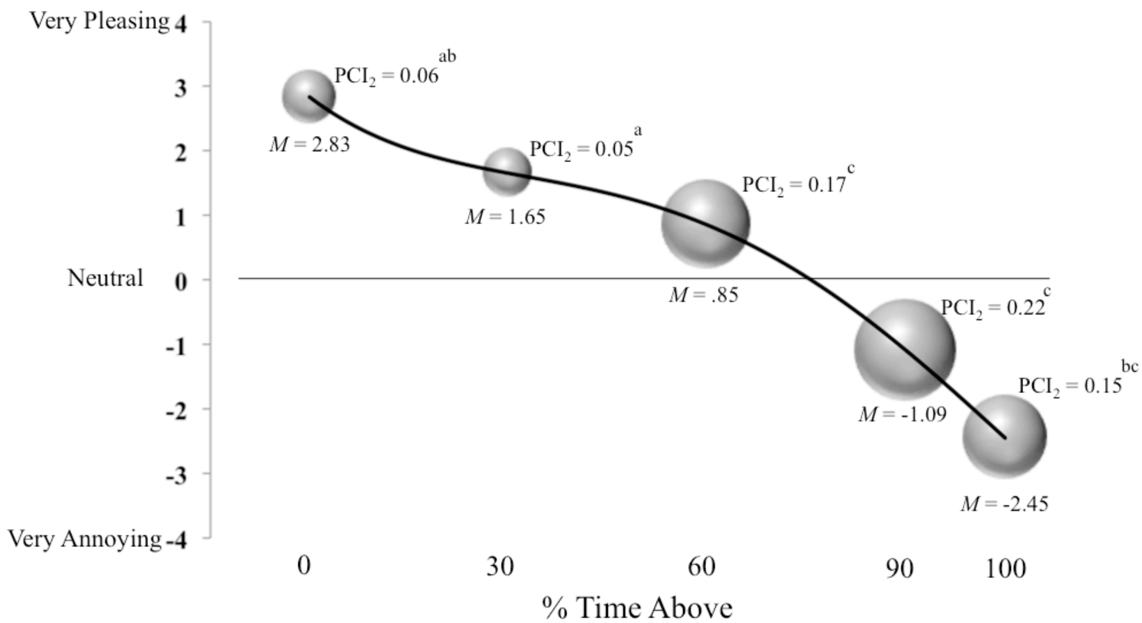


Figure 1. Visitor acceptability of sound recordings

After Bonferroni adjustment, all pair-wise mean comparisons are significant at $p$ <.001.
$PCI_2$ values with different letter superscripts are significant at $p < .05$ level (based on $PCI_2$ difference test).

The norm curve crossed the neutral point at 75% time above, in between the recordings with 60% and 90% time above. Overall, this inverse relationship between ratings and percent time above supports our first hypothesis.

The one-way ANOVA showed the three motivation groups differed statistically on two of the five recordings: 0% and 100% time above (Table 3). At 0% time above, differences in the means occurred between the low and moderate motivation groups, and the low and high motivation groups ($p < .05$). These differences were substantial ($\eta$ = .43). At 100% time above, statistical differences in the means occurred between the low and high motivation groups ($p < .05$; $\eta = .23$). The largest difference in the means between the three motivation groups was observed at 0% time above ($F = 15.97$, $p < .001$; $\eta = .43$). Across the three motivation groups, ratings at 0% time above *increased* from 1.76 (low motivation) to 3.02 (moderate motivation) to 3.31 (high motivation). At

100% time above, the ratings *decreased* from -1.84 (low motivation) to -2.38 (moderate motivation) to -2.84 (high motivation). This inverse relationship between motivation for a quiet setting and acceptability of human-caused sound supports our second hypothesis.

Table 3. Comparison of acceptability ratings for three motivation groups

| Recording: [2] | Motivation Level [1] | | | | | |
|---|---|---|---|---|---|---|
| | Low | Moderate | High | *F*-value | *p*-value | Eta (η) |
| 1 (0%) | 1.76[a] | 3.02[b] | 3.31[b] | 15.97 | <.001 | .43 |
| 2 (30%) | 1.27 | 1.73 | 1.89 | 1.77 | .175 | .16 |
| 3 (60%) | 1.06 | .83 | .81 | .26 | .770 | .06 |
| 4 (90%) | -.59 | -1.06 | -1.42 | 2.14 | .121 | .17 |
| 5 (100%) | -1.84[a] | -2.38[ab] | -2.84[b] | 3.56 | .031 | .23 |

[1] Motivation refers to how important a quiet experience is to the visitor. *Low motivation* = quiet experience not very important; *Moderate motivation* = quiet experience somewhat important; *High motivation* = quiet experience very important. Responses ratings were coded on a 9-point scale ranging from -4 (very annoying) to +4 (very pleasing).

[2] Percentages refer to the percent of time that human-caused sound is louder than (or above) natural sound in each recording.
Means with different letter superscripts are significant at the p < .05 level, accounting for multiple tests using LSD.

**Potential for Conflict Index ($H_3$ and $H_4$)**

The $PCI_2$ values for the entire sample indicated that consensus regarding the acceptability of sound varied with percent time above. Whether or not the variation was significant depended on the particular recordings that were compared (Figure 1). Statistical differences in $PCI_2$ values for the entire sample were observed for 5 of the 10 comparisons ($PCI_{2\ \text{difference test [d]}} \geq 2.24$, $p < .05$). These statistical differences occurred for the comparisons between 0% and 60% time above ($PCI_{2d} = 3.05$), 0% and 90% time above ($PCI_{2d} = 3.77$), 30% and 60% time above ($PCI_{2d} = 4.24$), 30% and 90% time above ($PCI_{2d} = 4.71$), and 30% and 100% time above ($PCI_{2d} = 2.24$). No statistical differences were observed when the recordings with 60-100% time above were compared to each other. In other words, statistical differences only occurred when the recordings with 0%

or 30% time above were part of the comparison. The lowest $PCI_2$ values (i.e., most consensus) were observed at 0% ($PCI_2 = .06$) and 30% ($PCI_2 = .05$) time above (Figure 1). The highest $PCI_2$ values (i.e., least consensus) were observed at 60% ($PCI_2 = .17$) and 90% ($PCI_2 = .22$) time above. For the entire sample, the most consensus occurred at the quietest (0% & 30% time above) recordings. This supports our third hypothesis.

The $PCI_2$ values for each motivation group indicated that consensus regarding the acceptability of the recordings varied with both motivation level and percent time above. Whether or not the variation was significant depended on the particular recording and motivation levels that were compared (Figure 2). Statistical differences were observed at 0% and 30% time above ($PCI_{2d} > 2.00$, $p < .05$). At 0% time above, there were statistical differences between the low and moderate ($PCI_{2d} = 2.00$) and the low and high ($PCI_{2d} = 2.00$) motivation groups. At 30% time above, a statistical difference was observed between the low and moderate ($PCI_{2d} = 2.50$) motivation groups. No differences were observed between the moderate and high motivation groups (i.e., $PCI_2$ values for these two motivation groups were similar).

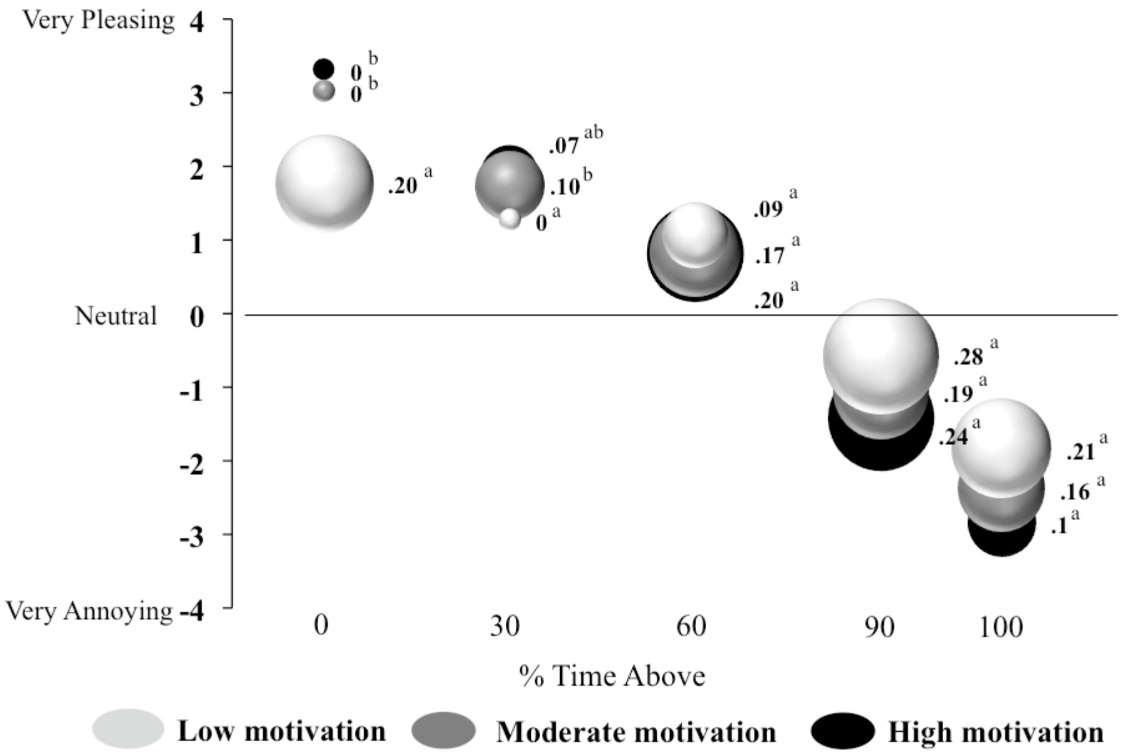


Figure 2. Visitor acceptability of sound recordings at three motivation levels

$PCI_2$ values with different letter superscripts between motivation groups are significant at the $p < .05$ level (based on $PCI_2$ difference test).

The lowest $PCI_2$ value (i.e., most consensus) for the low motivation group was observed at 30% ($PCI_2 = 0$) time above, while the highest $PCI_2$ value (i.e., least consensus) was observed at 90% ($PCI_2 = .28$) time above (Figure 2). For the moderate motivation group, the lowest $PCI_2$ value was observed at 0% ($PCI_2= 0$) time above, while the highest $PCI_2$ value was observed at 90% ($PCI_2 = .19$) time above. For the high motivation group, the lowest $PCI_2$ value was observed at 0% ($PCI_2 = 0$) time above, while the highest $PCI_2$ value was observed at 90% ($PCI_2 = .24$) time above. A $PCI_2$ value of 0 indicates full consensus that the sound was pleasing to some degree (i.e., extremely pleasing, very pleasing, moderately pleasing). When comparing $PCI_2$ values over all three motivation groups, the greatest variation in consensus occurred at 0% time above. The smallest variation in consensus, as well as the highest $PCI_2$ values (i.e., least consensus) for the three motivation groups, was observed at 90% time above. As motivation for a quiet setting increased, consensus with regards to acceptability of sound increased. This relationship supports hypothesis four.

## Discussion

This study showed that sound-related motivations influence a visitor's response to different sound sources. The results discussed above provide park managers with information for evaluating the quality of opportunities offered to visitors. Overall, this study shows that motivation, in combination with a particular sound condition, can make a difference in a visitor's sensitivity to noise in a park or natural area. These data provide managers with empirical information to prescribe and manage for a diversity of acoustic experiences.

### Management Implications

The VERP process emphasizes the use of indicators and standards when attempting to manage for a diversity of experiences (NPS, 1997). The indicator used in this study was the percent time human-caused sound was above natural sounds. By aggregating acceptability norms of survey respondents, our findings suggest a standard no higher than 75% time above (managers may wish to create more restrictive standards based on acoustic data, ecological parameters, and park management objectives, in combination with social science survey information). A park's current conditions could be evaluated using this potential standard to ensure a quality soundscape experience. To use this standard, a park's current acoustical conditions would need to be monitored. The acoustic data collected provides the means to calculate the current percent time above in a park. Using this calculated metric, park staff can determine whether or not additional management strategies should be implemented to meet the suggested standard.

Different standards might be established based on visitor motivation. In this study, the norm curves for the three motivation groups crossed the neutral point at different locations, and suggested standards no higher than: 80-85% time above for low motivation, 75-80% time above for moderate motivation, and 75% time above for high motivation (Figure 3). By understanding visitor motivation for experiencing natural sounds, a manager can minimize the amount of conflict between user groups that are seeking different soundscape experiences (Manfredo et al., 1996).

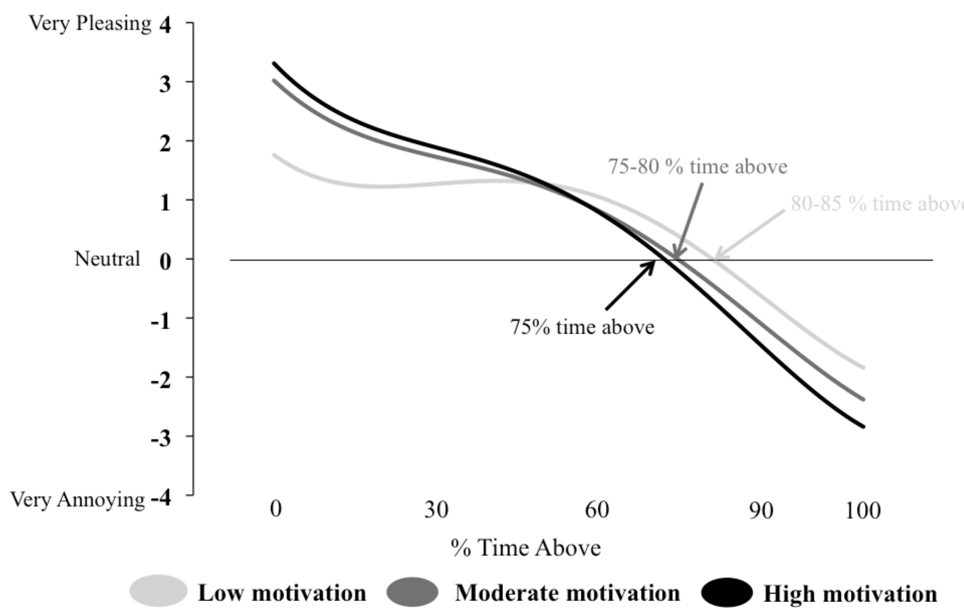


Figure 3. Norm curves showing visitor acceptability ratings for three motivation levels

One approach to mitigate possible user conflict is the Recreation Opportunity Spectrum (ROS). The spectrum includes a diversity of activity and experience opportunities that vary from one end of the spectrum to the other, and a range of environmental settings that allows for different activities and experiences (Driver & Brown, 1978). This spectrum coincides well with the EBM approach since it recognizes benefits to the visitor (Manning, 1999).

By taking visitor motivation into account, ROS can be used by managers to provide a variety of recreational opportunities that fulfill certain motivations (i.e., quiet setting, solitude, connection with nature). Managers can zone different areas of the park to meet standards for varying levels of motivation to experience a quiet setting (Manning, 1999). Muir Woods, for example, has implemented this type of zoning strategy for soundscape management in the park. Since 2008, Cathedral Grove has been permanently zoned as a quiet zone. Through education programs and informational pamphlets, the park is able to reach visitors of varying motivation levels and inform them of the diverse soundscape experiences offered at the park. In the case of Muir Woods, staff could direct those visitors with high motivation for a quiet setting to Cathedral Grove. The "high" motivation (quiet) zone would be managed to the most restrictive of the three suggested standards; no higher than 75% time above. The "moderate" and "low" motivation zones would be managed to more lenient standards; no higher than 75-80% time above and no higher than 80-85% time above, respectively. To manage each zone to the desired standards, managers could use a variety of techniques including signage, maps with locations of quiet areas, educational materials about how to reduce noise during one's visit, and/or interpretive programs about the importance of soundscape. A manager may not have to implement any of these management strategies for the “low” motivation zone, while implementing a combination of these strategies for the “high” motivation zone. We recommend that managers begin with implementing indirect management strategies (e.g., signage, outreach materials) before implementing direct management (e.g., sanctions, fines).

We also suggest that when managers designate different zones, they consider their proximity to one another. For example, if the “low” motivation zone is located near the “high” motivation zone, there is potential for sounds from the louder zone to travel and perhaps intrude upon the quieter zone. Using this example, a manager could use the “moderate” motivation zone as a buffer or transition zone between the other two. While all parks cannot be zoned in this linear (i.e., “low” to “moderate” to “high” motivation) fashion, we encourage all park managers to consider encroaching sound when designating park zones. By considering this issue, park managers have the opportunity to reduce user conflict even further.

The results from this study also reveal information about visitors’ consensus regarding acceptability of different sound sources. Ratings of particular sound conditions are more similar when the acoustical environment is inundated by a higher percentage of natural sound sources. We assume this is the reason behind the difference in the level of consensus between the 0% and 100% time above recordings. This study revealed that as human-caused sound increases, consensus regarding acceptability generally decreases. One exception to this pattern was observed; consensus increased in the change between the 90% and the 100% time above recordings. We can conclude this resulted not from the change in percent time above, but rather the change in the number of sound sources.

Since the 90% time above recording includes both natural and human sounds, visitors must consider two sources of sound when determining their ratings, as opposed to the single human sound source in the 100% time above recording. If a visitor is listening to a recording with two sound sources, they are forced to compare the two, while perhaps considering the pros and cons of each (i.e., a trade-off). If the recording only contains one sound source then a comparison is unnecessary and a rating of the condition becomes a simpler task. The level of consensus is affected by not only the number of sound sources, but by the type of sound source as well. Both the 0% and 100% time above recordings had only one sound source, but it was the presence of only natural sound that results in a higher level of consensus.

**Future Research**

Several avenues for future research are suggested by our findings. First, as described in the methods, the percent time above natural sounds changed with each recording. With varying levels of percent time above, we also varied the sound (decibel) level as well. In future research, the decibel level should be controlled throughout each recording. In other words, vary the amount of percent time above natural sounds while holding the sound level constant.

Second, the order of the recordings should be considered in future studies. With each recording, going in order from 1 to 5, the percent time above natural sounds increased gradually. A listener may have noticed this increase, compared one recording with another, and rated them accordingly. For example, if a respondent was listening to recording 4, they may have noticed the slight increase in human-caused sound from recording 3, and thus rated it as more annoying than the previous recording. Future research should randomize the order of the recordings. This would allow listeners to focus solely on each recording, rather than compare one recording to another. Respondents would be less reliant on their previous ratings, and more dependent on their reactions to a particular recording.

Third, Cathedral Grove was chosen because of the quiet experience its name implies. When coming to Cathedral Grove, visitors desire an opportunity to enjoy the park's natural soundscape. With this desire for quiet, even in a frontcountry site, the variance in terms of visitor reactions may have been reduced. Future research should be conducted in a variety of locations. Motivations for a quiet setting, for example, are likely to be lower in an urban park when compared to a wilderness area. This type of research would allow for examining the effects that expectation can have on visitor ratings of differing sound conditions, and how the variation in responses can differ with location.

Fourth, some research (e.g., Gramann, 1999) suggests that urban residents feel uncomfortable with an all-natural sound environment. Results from this and other soundscape-related studies should be compared with demographic information (e.g., urban vs. rural residents). Urban residents may have a higher tolerance for human-caused sound than rural residents. Such information could help managers target education programs and informational material and ensure that a variety of experiences are offered to meet the needs of all visitors.

By building upon previous research, we have provided park managers with additional variables and techniques that should be considered in the management of park soundscapes. Pilcher et al. (2008) found that visitor reactions depend largely on the loudness or decibel level of a particular sound. This research emphasizes that the source of sound (human-caused vs. natural) and visitor motivation can potentially affect responses to sound heard in natural areas. To provide a variety of high quality visitor experiences, managers should consider all of these factors (i.e., loudness, source of sound, motivation) when managing soundscape in a park.

# CHAPTER 2. EXPLORING THE IMPORTANCE OF SOUNDSCAPE MOTIVATIONS IN PREDICTING PARK LOCATION CHOICE

## Introduction

The National Park Service is charged with preserving natural areas for the enjoyment of present and future generations (National Park Service, 1916; 1970; 1978). In order to ensure this is achieved, land managers work to provide their visitors with a quality visitor experience. Quality is defined as the "degree to which each opportunity satisfies the experiences for which it is managed" (Manning, 1999, p. 13). Managers can improve their success in providing opportunities for higher quality experiences by considering the extent to which an experience satisfies the motivations that led to that visitor's participation (Manfredo, Pierce, Vaske, & Whittaker, 2002). By incorporating the concept of motivation, managers can address why people recreate and how management can provide quality experiences that align with management objectives (Manfredo & Driver, 2002). Specifically, managers can develop programs and recreational opportunities that have the greatest probability of being consistent with visitor reasons for visiting an area and minimizing conflicts among users (Manfredo, Driver, & Tarrant, 1996).

Previous research has linked setting to visitor motivations (Driver & Brown, 1978; Manfredo, Pierce, Vaske, & Whittaker, 2002; Pierskalla, Lee, Stein, Anderson, & Nickerson, 2004; Schreyer, Knopf, Williams, 1984). The Experience-Based Management model proposes that people are motivated to recreate in a specific type of setting (or activity) to obtain a desired experience (Manfredo et al., 2002). This article builds upon previous research by looking at the effects that setting (i.e., three park locations of varying visitation levels) has on motivations. In addition to researching general motivations, this study takes a closer look at three sound-related conditions that visitors are often motivated to experience in national parks; solitude, natural sounds, and peace and quiet (Haas & Wakefield, 1998). To date, the only research on sound-related motivations has focused in one park location with rather high visitation (Marin, Newman, Manning, Vaske, & Stack, 2011). With this study, we have the opportunity to build upon that research by expanding to three park locations with varying visitation levels.

**Motivation**

People are motivated to participate in recreation to satisfy certain needs (Driver & Toucher, 1970). Motivation refers to psychological mechanisms that control the direction and intensity of behavior (Kanfer, 1994). The Experience-Based Management (EBM) model views motivation as the expectation that efforts will lead to onsite performances and the expectation that those performances affect valued psychological outcomes (Manfredo et al., 2002). People recreate when a particular state exists and when another state is preferred (Knopf, Driver, & Bassett, 1973). In other words, the EBM model posits that visitors are engaging in a particular activity, in a particular place, because of their own intrinsic motivation to satisfy certain needs or meet certain goals (Tinsley & Tinsley, 1986). The EBM model proposes that people choose to participate in a recreation activity and a specific type of setting to attain a desired experience (Manfredo et al., 2002).

Prior to the development of EBM, recreation management techniques focused on activity-based management, where managers attempted to provide as many activity opportunities at a given area as possible, rather than provide experience opportunities that were most appropriate for that area (Driver & Brown, 1978). Under activity-based management, a quality experience is measured in terms of the number of activities and participants (Pierskalla et al., 2004), while under EBM quality is measured in terms of the diversity of experience opportunities offered. By focusing on the activity opportunity, management would limit itself to only one of the four types of demand for recreational opportunities. Generally, the four levels of demand for recreation include activities, setting, experience/motivations, and benefits (Driver & Brown, 1978; Manning, 1999). When the manager defines the various types of experience/motivation opportunities, a differentiation can be made between the activities offered (Driver & Brown, 1978) and the settings in which the activity is conducted.

The Recreation Experience Preference (REP) scales were developed to measure the dimensions of a visitor's recreation experience (Manfredo, Driver, & Tarrant, 1996). Specifically, the REP scales were designed to study visitors' desired goal states (Driver, 1983). The REP scales (Driver, 1983) are grouped into domains that comprise scales shown by hierarchical clustering methods to be related (Manfredo et al., 1996). The REP scales consist of 21 domains. Representing six of the REP scale domains, our research considers motivations for scenic beauty, experiencing solitude, spending time with family and friends, getting exercise, experiencing the sounds of nature, and peace and quiet. Particular attention is given to those motivations related to soundscape. An understanding of visitor motivations can provide guidance in understanding what people want from recreation and offers insight into how it might benefit them (Manfredo et al., 1996).

**Soundscape**

Seventy-two percent of Americans find opportunities to experience the sounds of nature as important for protecting national parks (Haas & Wakefield, 1998). It is with this in mind that we felt it important to take a closer look into sound-related visitor motivations. Some of the most important reasons for visiting natural settings are escape from noise and crowding and the experience of tranquility and solitude (Driver, Nash, and Haas, 1987; Kaplan, 1995; Mace, Bell, and Loomis, 2004). Those in search of rest and relaxation are driven to natural environments for the peace and silence they offer (Kaplan, 1995). The National Park Service 2006 Management Policies mandate the restoration of natural conditions wherever park soundscapes have become degraded by noise and the protection of natural soundscapes from unacceptable impacts (National Park Service, 2006). The National Park Service (NPS) Natural Sounds Program defines soundscape as the human perception of acoustic resources. The NPS works to protect natural (e.g., wildlife, wind, water) and cultural (e.g., cannon fire, battle reenactments, cultural ceremonies) sound resources. Pilcher, Newman, and Manning (2008) found that visitors sought natural sounds and became annoyed by human-caused noise (e.g., people talking, aircraft) masking those sounds and detracting from their experience.

Research has shown that various non-acoustical factors (e.g., visitor motivations) influence responses to noise (Berglund, Lindvall, & Nordin, 1990; Tarrant, Hass, & Manfredo, 1995). Marin et al. (in press) found that motivation in combination with a certain sound conditions can affect a visitor's acceptability of noise in a national park. They also recommended the use of zoning to provide for a diversity of motivations for a quiet experience. Research determined that the presence of anthropogenic noise negatively impacts natural landscape assessment and can detract from the visitors' natural soundscape and overall park experiences (Benfield, Bell, Troup, and Soderstrom, 2010b). Due to higher expectations for quiet, humans in natural settings are more sensitive to acoustic stimuli than they are in developed settings (Anderson, Mulligan, Goodman, & Regen, 1983), and consequently, psychological effects (i.e., stress, annoyance) are more prominent in natural environments (Mace, Bell, & Loomis, 1999, 2004). All of the research discussed supports the idea that visitor characteristics, such as motivations, must be considered in order to get a complete picture of a visitor's soundscape experience.

**Setting**

As one of the four levels of recreation demand, setting is often associated with visitor motivations. With the development of EBM, managers no longer focus solely on the inputs (e.g., setting), but rather consider how the inputs, can lead to different outputs or types of experiences (Driver & Brown, 1978). Specifically, EBM stresses that experiences are the ultimate goal and motivation of recreationists, while the setting (and activities) influence that goal (Manfredo & Larson, 1993). Schreyer, Knopf et al. (1984) found that certain environments may be sought for a given recreation activity because they allow the conditions necessary to provide the psychological outcomes desired by a visitor. In other words, visitors search for the environment that will provide the social, environmental, and management characteristics that will facilitate the experience they desire.

This idea is implemented using approaches such as the Recreation Opportunity Spectrum (ROS). ROS allows for establishing criteria that vary the characteristics of opportunities along a spectrum. The spectrum includes a diversity of activity, setting, and experience opportunities, which vary in nature from one end of the spectrum to another. A range of environmental settings would allow for the different activities and experiences along that spectrum (Driver & Brown, 1978). A product of the EBM approach, this spectrum is typically defined in terms of the relationships between the first three levels of recreation demand (Driver & Brown, 1978). ROS can be used by managers to provide a variety of recreational opportunities that fulfill soundscape motivations (Marin et al., 2011).

The article takes a closer look at the relationship between setting and motivation. Specifically, this research aims to build upon previous literature by determining if motivations can predict which national park setting (of the three included in the study) a visitor is most likely to choose. With this type of information, managers will have increased knowledge about a potential factor contributing to a visitor's decision to visit their park.

## Methods

### Study Area

Our surveys were conducted in two U. S. National Park units; Sequoia National Park and Muir Woods National Monument. Both parks are located in California with Sequoia National Park located 225 miles north of Los Angeles and Muir Woods National Monument located 15 miles north of San Francisco.

Established in 1890 and totaling 400,000 acres, Sequoia National Park receives approximately 965,000 visitors annually (NPS Public Use Statistics Office, 2010). Surveys were conducted in two sites within Sequoia National Park; Crabtree Meadow and Giant Forest. Located along the John Muir Trail, Crabtree Meadow represents a backcountry/wilderness site. Approximately 4,400 visitors visit this site during the summer season (July–September) on their way to summit Mount Whitney (E. Jostad, personal communication, November 15, 2010). For the purposes of our study, Crabtree Meadows serves as our low visitation site. Giant Forest represents a frontcountry site, visited by approximately 192,000 visitors during the summer season (May–September) (A. Esperanza, personal communication, November 17, 2010). Nicknamed the "land of the giants," this site is visited for the opportunity to view the giant sequoias. Giant Forest serves as our moderate visitation site.

Muir Woods National Monument was established in 1908 and totals 554 acres. The national monument receives approximately 780,000 visitors annually. The park is known for containing one of the last remaining redwood forests in the area. Our survey was conducted at one site within the national monument: Cathedral Grove. Receiving approximately 426,000 visitors during the summer season (May–September), this area is approximately half of a mile from the visitor center and contains some of the oldest and largest trees in the park (NPS Public Use Statistics Office, 2010). Cathedral Grove serves as our high visitation site.

**Study Design**

Surveys at Sequoia National Park were conducted in the summer 2009, while surveys were conducted in Muir Woods in summer 2007. An intercept survey method was used to conduct all of the surveys at the two parks. Visitors were randomly selected as they entered each site and asked to participate in the survey. They were asked to answer questions about their motivations for visiting the parks.

Crabtree Meadow ($n$ = 268) and Giant Forest ($n$ = 269) received response rates of 73% and 71%, respectively, while Cathedral Grove ($n$ = 157) received a response rate of 54%. As a check on non-response bias, visitors declining to participate in the survey were asked if they had visited the park before, a question included on the survey. Their responses were then compared with those individuals who had participated in the survey. No substantive differences in the sample populations were found.

**Variables Measured**

**Motivations for visiting the study sites**. Respondents were asked to rate the importance of each of the items in their decision to visit the particular park. Six items were similar over the three park locations and were thus used in the analysis. These included: (a) scenic beauty; (b) experience solitude; (c) spend time with family and friends; (d) get exercise; (e) experience the sounds of nature; and (f) peace and quiet. Responses from the Sequoia surveys were coded on a 5-point scale ranging from 1 "not at all important" to 5 "extremely important". The scale used in the Muir Woods survey was originally a 4-point scale (1 "not at all important" to 4 "extremely important"), but was converted to a 5-point scale to match the scales in the Sequoia surveys. First, any response values of 1 in the Muir Woods survey remained a 1(in both the Muir Woods and Sequoia surveys a 1 represented "not at all important"). Then, response values of 4 in the Muir Woods survey were converted to 5's to match the "extremely important" rating in the Sequoia surveys. Finally, any 2's or 3's from the Muir Woods results were converted to 2.333 and 3.667, respectively, to provide values equidistant between 1 and 5.

**Park locations.** This variable was coded on a scale of 1 to 3. If the respondent conducted the survey in Sequoia National Park – backcountry (low visitation), Sequoia

National Park – frontcountry (moderate visitation), or Muir Woods National Monument (high visitation) they were coded with a 1, 2, or 3, respectively.

### Analyses

Random Forest analysis (Breiman, 2001) was used to split the respondents into groups based on their motivations. It was implemented in R using the randomForest package. Random Forest is a form of classification and regression tree (CART) that grows a "forest" of trees based on proximities between cases. Final motivation-based groupings were derived from cut-point values used in growing the "tree". These groups were then used in a multinomial logit model to predict park location choice as a function of visitor motivations. Sequoia backcountry (low visitation) was used as the reference condition.

## Results

### Random Forest

The Random Forest resulted in the creation of a "moderate motivation" group and a "high motivation" group for each of the six motivation items. For scenic beauty, spending time with family and friends, experience sounds of nature, and peace and quiet, proximities were found between respondents who rated this motivation from 1–4 and those who gave a rating of 5. Therefore, those who gave a rating of 1–4 became the "moderate motivation" group, while those who gave a rating of 5 became the "high motivation" group. For the experience of solitude and getting exercise, proximities were found between respondents who rated this motivation from 1–3.667 and those who gave a rating of 4 or 5. Therefore, those who gave a rating of 1–3.667 became the "moderate motivation" group, while those who gave a rating of 4 or 5 became the "high motivation" group. Overall, the Random Forest model correctly predicted 62% of the respondents.

**Comparison of Motivations Predicting Park Location**

The multinomial logit model revealed that four of the six motivation items (experience solitude, time with family and friends, getting exercise, and experience the sounds of nature) acted as significant predictors in determining a visitor's choice of park location ($\chi^2 > 9.67$, $p < .008$) (Table 4). Overall, the motivation to experience solitude best predicted which of the three locations a visitor would most likely choose ($\chi^2 > 47.59$, $p < .001$). When predicting visitation between Sequoia backcountry (low visitation) and Sequoia frontcountry (moderate visitation), experiencing sounds of nature served as the best predictor (*B* = -.76, Wald = 10.37, p = .001). The odds ratios revealed that as motivation for experiencing solitude (*OR* = .50) and getting exercise (*OR* = .51) increased, the odds of choosing Sequoia backcountry (low visitation) over Sequoia frontcountry (moderate visitation) increased. Additionally, as motivation for time with family and friends (*OR* = 1.85) and experiencing the sounds of nature (*OR* = 2.13) increased, the odds of choosing Sequoia frontcountry over Sequoia backcountry increased.

When predicting visitation between Sequoia backcountry (low visitation) and Muir Woods (high visitation), experiencing solitude acted as the best predictor (*B* = -1.79, Wald = 43.74, p < .001). The odds ratios revealed that as motivation for experiencing solitude (*OR* = .17) and getting exercise (*OR* = .18) increased, the odds of choosing Sequoia backcountry (low visitation) over Muir Woods (high visitation) increased. Additionally, as motivation for experiencing the sounds of nature (*OR* = 3.61) increased, the odds of choosing Muir Woods over Sequoia backcountry increased.

Table 4. Comparison of motivations predicting a visitor's park location

| Motivations predicting visitation between Sequoia backcountry and: | *B* | *OR* | Wald Statistic | *p*-value | $\chi^{2a}$ |
|---|---|---|---|---|---|
| Scenic beauty | | | | | .29 |
| *Sequoia frontcountry* | -.15 | .86 | .289 | .591 | |
| *Muir Woods* | -.08 | .93 | .060 | .806 | |
| Experience solitude | | | | | 47.59** |
| *Sequoia frontcountry* | -.70 | .50 | 9.93 | .002 | |
| *Muir Woods* | -1.79 | .17 | 43.74 | <.001 | |
| Time with family and friends | | | | | 9.67* |
| *Sequoia frontcountry* | .61 | 1.85 | 9.52 | .002 | |
| *Muir Woods* | .40 | 1.49 | 2.81 | .094 | |
| Getting exercise | | | | | 45.76** |
| *Sequoia frontcountry* | -.68 | .51 | 10.57 | .001 | |
| *Muir Woods* | -1.71 | .18 | 41.80 | <.001 | |
| Experience sounds of nature | | | | | 22.04** |
| *Sequoia frontcountry* | .76 | 2.13 | 10.37 | .001 | |
| *Muir Woods* | 1.28 | 3.61 | 19.17 | <.001 | |
| Peace and quiet | | | | | 1.32 |
| *Sequoia frontcountry* | -.08 | .93 | .11 | .736 | |
| *Muir Woods* | .24 | 1.27 | .68 | .411 | |

Note. Nagelkerke $R^2$ = .22

% correctly classified - Sequoia frontcountry = 53%; Sequoia backcountry = 49%; Muir Woods = 50%

[a] The chi-square statistic is the difference in -2 Log likelihoods between the final model and the reduced model for each motivation item.

* $p < .05$. ** $p < .001$

With a Nagelkerke $R^2$ of .22, one can conclude that this model explained approximately 22% of the variance for which park location would be selected. This model was able to correctly classify 53%, 49%, and 50% of the visitors to Sequoia frontcountry, Sequoia backcountry, and Muir Woods, respectively.

## Discussion

With an understanding of how visitor motivations can vary between park locations, managers can create a variety of recreational opportunities that can fulfill certain motivations. Managers can not only provide a more quality visitor experience, but also minimize the amount of conflict between user groups that are seeking different experiences (Manfredo et al., 1996). This study revealed the potential for managers to use motivations to predict visitation to different park settings. Particularly, we found those visitors most motivated to experience solitude and get exercise are most likely to visit backcountry/wilderness settings with low visitation, while those driven to spend time with family and friends and experience the sounds of nature are most likely to visit a frontcountry setting with moderate to high visitation. Although our study does not include all possible setting types, we do believe that our findings can be generalized to locations with characteristics similar to these three locations (i.e., visitation levels, ease/difficulty of accessing sites).

Our results showed that motivation to experience peace and quiet was not a good predictor of park location. From this we can conclude that visitors are similarly driven to experience peace and quiet throughout all three sites. This is an important finding, considering the National Park Service's endeavors to protect park soundscapes. Whether visiting a low, moderate, or high visitation site, visitors are generally motivated to enjoy peace and quiet. Furthermore, the multinomial logit model showed that those motivated to experience the sounds of nature were more likely to visit a frontcountry site of moderate to high visitation over a backcountry site. Defying some managers' preconceived notions, our results show that despite the frontcountry nature and increased visitation of Sequoia–Giant Forest and Muir Woods, visitors are still highly motivated to experience natural sounds in those areas. A possible explanation for this result is that visitors to Sequoia backcountry were focused on a higher priority motivation than the experience of natural sounds; summiting Mount Whitney.  For many, this was their final challenge after hiking many days along the John Muir Trail. Almost every survey respondent was on his or her way to summit Mount Whitney. Their long trek to Mount Whitney also provides possible evidence as to why backcountry respondents rated getting exercise higher than experiencing natural sounds. In addition, experiencing solitude may have been rated higher due to visitor knowledge about the Wilderness Act (U.S. Congress, 1964).  The Wilderness Act specifically lists "outstanding opportunities for solitude" within the definition of wilderness, and thus, those visitors familiar with this Act may have desired solitude as part of their wilderness experience in Sequoia. Of course we can not assume that all backcountry visitors had knowledge of the Wilderness Act, but considering that hikers in that area were required to have permits (including language that encouraged reading of wilderness regulations), we can presume that visitors had some knowledge about wilderness characteristics.

Another possible explanation is the fact that more first time visitors in our sample visited frontcountry sites than backcountry sites. In our sample, 27% of Sequoia backcountry visitors were first time visitors, while 54% of Sequoia frontcountry and 63% of Muir Woods visitors were first time visitors. Nine out of ten NPS visitors "consider enjoyment of natural quiet and the sounds of nature as compelling reasons for visiting national parks" (McDonald, Baumgartner, & Iachan, 1995). Therefore, visitors coming to a park for the first time and having no prior experience with that park, may simply expect that natural sounds would be present no matter the type of site. Perhaps, they are not focused on the fact that they are visiting a “frontcountry” site, but rather a national park setting where they would expect to hear the sounds of nature. Although speculative, this idea warrants future research. If the experience of natural sounds is not protected in frontcountry areas, managers could turn away some of their first time visitors. Our explanation is not in anyway saying that managers should protect soundscapes in the frontcountry while letting the backcountry become loud, but rather that natural soundscapes need to be protected in both frontcountry and backcountry sites.

Given that it might be difficult to protect soundscapes at a similar level in frontcountry and backcountry sites, considering the increased visitation and facilities associated with the frontcountry, we recommend using the Recreation Opportunity Spectrum approach. The spectrum includes a diversity of activity and experience opportunities that vary from one end of the spectrum to the other, and a range of environmental settings that allows for different activities and experiences (Driver & Brown, 1978). Managers can zone different areas of a park to meet varying levels of motivation to experience the sounds of nature (Manning, 1999). In those smaller areas, like Giant Forest, where it maybe difficult to divide it into several zones, the manager may choose to zone that entire area to meet a particular motivation level. They can then zone adjacent or nearby areas to meet other levels of motivation for experiencing natural sounds. Through education programs and informational pamphlets, the park could reach visitors of varying motivation levels and inform them of the diverse soundscape experiences offered within an area. Those that are highly motivated for experiencing the sounds of nature could be directed to those areas free of human-caused noise intrusions, while those less motivated could be directed to less quiet areas (e.g., those not as distant from roadways, parking areas, and/or visitor facilities). To manage those areas zoned for highly motivated visitors, managers could implement a variety of techniques including signage, maps with locations of quiet areas, educational materials about how to reduce noise during one's visit, and/or interpretive programs about the importance of soundscape.

By providing information to visitors about the types of experiences offered in a given park, visitors can make better decisions about which settings would more likely meet their motivations (Williams, Schreyer, & Knopf, 1990). For those that don't have any previous experience in a park, we can use well-targeted outreach and education materials to provide them with the type of knowledge they might gain through a prior experience. Although first time visitors might be motivated to hear the sounds of nature, they may not have the experience to know the types of sounds present in a particular park or where to go to experience them. By providing this type of information, managers can improve the ability of visitors to have an experience more consistent with their motivations, while reducing any potential within-site conflict between users (McFarlane, Boxall, & Watson, 1998).

**Limitations and Future Research**

This research takes an important step toward answering some crucial management questions with regards to the relationship between motivation and visitor experience. Our study resulted in some interesting findings. In fact some were incongruous with preconceived notions (i.e., frontcountry visitors were more motivated to experience natural sounds than backcountry visitors). Thus, it is important for us to discuss some of the study's limitations that may have influenced our results and offer recommendations for future research to account for them.

First, as described in the methods, the survey questions measuring motivations asked only about the importance of an item related to visiting the particular *park* (i.e., Sequoia National Park, Muir Woods National Monument), rather than the specific *site* (Sequoia-Crabtree Meadow, Sequoia-Giant Forest, Muir Woods). So while our analysis compared motivations across the three sites, the survey questions were not as specific. To address these limitations, we would recommend that future research include survey questions that are site specific. Second, we made the assumption that visitors to all three of the sites were drawn from a common population of potential park visitors and that the generic features of each site (i.e., primeval forest, giant sequoias, Mount Whitney) were the primary criteria affecting their decision to visit.

Finally, future research should study the reason behind why frontcountry users are more motivated to experience the sounds of nature than backcountry users. We offered a few possible explanations (i.e., higher priority motivations of backcountry users, knowledge of the Wilderness Act, perceptions of first time visitors to frontcountry areas), but feel it is important to study those and other explanations further. The implications of the findings are essential for directing soundscape management in the future, so should be tested in more detail.

By building upon previous motivation research, we have provided park managers with information that can aid them in providing experiences that align better with visitors' desired outcomes. This research emphasizes that soundscape motivations can be used to predict which site an individual is more likely to visit. This research revealed that a dichotomous (i.e., frontcountry versus backcountry) management style might not be as appropriate for soundscape. Although frontcountry areas may more developed and have higher visitation, we encourage park managers to consider more carefully the importance of soundscape in those areas. Through the use of acoustic zoning and education managers can provide for a diversity of high quality soundscape experiences in all areas of their park.

# CONCLUSION

Although visitor motivations have been incorporated into park management before, it has never been in the context of soundscape. This thesis introduces managers to the link between a visitor's desired outcomes and their soundscape experience. With an understanding of visitor motivations to experience solitude, natural sounds, or peace and quiet, managers can create a variety of recreational opportunities that can fulfill those motivations. Managers cannot only provide a more quality visitor experience, but also minimize the amount of conflict between user groups that are seeking different experiences (Manfredo et al., 1996).

Chapter 1 showed that motivation, in combination with a particular sound condition, can make a difference in a visitor's sensitivity to noise in a park or natural area. This conclusion was reached by using the indicator percent time human-caused sound was above natural sounds (percent time above). By aggregating acceptability norms of survey respondents, our findings suggest a management standard no higher than 75% time above. Additionally, different standards might be established based on visitor motivation. In this study, the norm curves for the three motivation groups crossed the neutral point at different locations, and suggested standards no higher than: 80-85% time above for low motivation, 75-80% time above for moderate motivation, and 75% time above for high motivation. Managers can zone different areas of the park to meet these standards for varying levels of motivation for a quiet setting (Manning, 1999).

Chapter 2 revealed that managers can use motivations to predict which of the three park locations a visitor is most likely to choose. Additionally, we found that motivation to enjoy peace and quiet was a poor predictor of park location choice. From this we could conclude that peace and quiet was similarly rated over the three locations. When choosing between the three sites, visitors most motivated to experience solitude and get exercise were most likely to visit backcountry/wilderness settings with low visitation, while those driven to spend time with family and friends and experience the sounds of nature were most likely to visit a frontcountry setting with moderate to high visitation. Our finding that frontcountry users are more motivated than backcountry users to experience the sounds of nature defies most managers' preconceived notions. This does not mean that frontcountry areas should be managed to a stricter soundscape standard, but rather that natural soundscapes are important and need to be protected in all areas of a park.

Both of these chapters provide recommendations that will help managers address one of their most difficult tasks; balancing the desires of different visitor use groups. A manager hopes to provide high quality, satisfying experiences for as many visitors as possible, without degrading natural resources. By using our understanding of visitor motivations to manage for a diversity of soundscape experiences, managers have the best chance of satisfying the greatest amount of visitors. To achieve this desired balance between users, we recommend using the Recreation Opportunity Spectrum (ROS) to zone different areas of the park to meet standards for varying levels of motivation to experience natural sounds or quiet (Manning, 1999). For example, a manager would be able to provide areas that are better suited for visitors with low motivation as well as high motivation to experience natural sounds or quiet.

To meet the desired acoustical standards for each zone, a manager could use a variety of techniques including signage, maps with locations of quiet areas, educational materials about how to reduce noise during one's visit, and/or interpretive programs about the importance of soundscape. The level of management required to meet those standards would vary depending on the current acoustical conditions at their park. A manager may not have to implement any of the suggested management strategies for the "low" motivation zone, while implementing a combination of these strategies for the "high" motivation zone. In order to determine current acoustical conditions, the park would have to conduct acoustical monitoring. The data collected during monitoring could be used not only for meeting standards, but also for other park planning efforts.

Currently, park management zones are designated in NPS General Management Plans (GMPs), which represent a park's overall management strategies for the next 15-20 years. The good news is that park planners and managers are beginning to incorporate soundscape into these zone designations. The bad news is that the number incorporating soundscape is relatively few. This research provides a manager with evidence for why integrating soundscape into management zoning and other strategies is so important. This thesis not only shows how motivated individuals are to experience the sounds of nature, solitude, and peace and quiet, but also that soundscape provides another tool for effectively managing visitors. Just as visitors may differ in the types of facilities they hope to see in a park, they can differ in their motivations to experience a park's soundscape. For some, the experience of natural sounds and quiet might be even more important to their experience than what facilities are provided. Therefore, there is no reason to leave soundscape out of such crucial planning efforts.

For those parks that have already completed GMPs that don't integrate "acoustic zoning," there is another avenue for ensuring the protection of a range of soundscape conditions for visitors; Soundscape Management Plans. Even if a park's GMP included soundscape, this plan can assist in providing a more detailed description of management strategies to protect and maintain a park's desired zones. In this type of planning, managers cannot only designate zones and management standards, but identify appropriate and inappropriate sounds for each zone and mitigation techniques for preserving those "high motivation" zones. With a detailed Soundscape Management Plan, managers have a better chance of meeting their desired acoustical standards for each zone.

In addition to recommending the implementation of "acoustic zoning" in parks, this thesis brought a common assumption about frontcountry users' soundscape motivations into question. In Chapter 2, results showed that individuals visiting a frontcountry area, whether moderate or high visitation, were more motivated to experience the sounds of nature than those visiting a backcountry site. Some managers may be quick to dismiss the importance of protecting the soundscape experience in frontcountry zones due to the increased visitor activity and infrastructure in these areas. Our results not only show the potential error in this management technique, but the possibility that we could be turning frontcountry visitors away because of our willingness to disregard the importance of soundscape in those areas. Perhaps managers need to move away from a dichotomous (i.e., frontcountry versus backcountry) management style and embrace a strategy that would allow for a continuum of acoustical conditions throughout the entire park.

Similar to the work of Pilcher et al. (2008) and Stack et al. (in press), this research emphasizes the importance of protecting a park's acoustical resources for the enjoyment of our visitors. Although it's not a resource we can see, it deserves the same protection as any other park resource. This thesis provides the skills and knowledge to do just that. As long as we have visitors motivated to experience natural sounds and peace and quiet, we have the public support needed to protect these resources, now and in the future.

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