

THE EFFECT OF HUMAN-CAUSED VISUAL IMPACTS
ON RESTORATIVE CHARACTER OF AN ARID
WILDLAND RECREATION SETTING

by

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ABSTRACT

The purpose of this study is to examine the effects of visible visitor-caused impacts as characterized by user-created campsites on judgments about the perceived restorative character in natural areas. User-created campsites were inventoried using mapping-grade mobile Geographic Information Systems (GIS) technology and photography. Photography of user-created campsites was accomplished by collecting high-resolution spherical panoramic imagery at select user-created campsites. Collected data were postprocessed and added to a GIS. This technique not only overcomes the challenge of locating and approaching potential research subjects in the field, but also enables the researcher a potentially broader public sampling by affording the ability to engineer and represent field conditions with computer simulation. Research participants were obtained through undergraduate and graduate classes in the Department of Parks, Recreation, and Tourism, the Department of Geography at the University of Utah, and employees of the United States Department of Agriculture (USDA) Forest Service. Photo elicitation was used for data collection. Each participant ($n=60$) viewed 360-degree panoramic imagery of user-created campsites exhibiting different degrees of visible visitor-caused impact ($n=5$). While viewing the image set, participants completed the Perceived Restorative Scale. Resulting data were analyzed using linear modeling techniques. Results supported the hypothesis that perceived restorativeness declines with increased landscape scarring. Results of this

study can assist land managers who set Limits of Acceptable Change (LAC) on public lands.

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CHAPTER I

INTRODUCTION

Judgments about the perceived restorative character in natural areas are an important aspect to understanding how the person environment transaction is affected in a *restorative environment*. Natural environmental settings typically have an optimal combination of aesthetic beauty and restorative qualities (Herzog, Maguire, & Nebel, 2002). A restorative environment is one that contains elements and characteristics that make escape, recovery, and rest from mental fatigue possible. Among the more well-accepted theories in the restorative environments literature is Attention Restoration Theory (Kaplan & Kaplan, 1989). Attention Restoration Theory (ART) states that there are four concepts or components that are required for human restoration in a natural environment: Being Away, Fascination, Coherence/Extent, and Compatibility. Being away refers to the idea that one seeks a sense of escape physically and mentally from everyday routines that a natural environment can offer. Fascination refers to the idea that a setting can effortlessly capture the attention of an individual such that the individual's attention is voluntary rather than forced. Coherence refers to the idea that a given setting is easy to understand, that is, not chaotic. A setting lacking coherence would be devoid of stimuli intrinsically significant for the individual. Compatibility refers to the properties of a setting that support the goals of the individual. For the purpose of this study, the construct restorative environment is based on concepts

identified in ART. ART also identifies that prolonged mental effort leads to Directed Attention Fatigue (DAF). When one immerses one's self in a restorative environment where the four restorative components are present and operating, this will promote recovery and restoration within the individual thus reducing DAF. Recent research based on Attention Restoration Theory has addressed questions of seascape features (Bennett, n.d.), the effect of fascination and coherence on tranquility (Splan, n.d.), and the search for satisfaction in outdoor recreation settings (Manning, 1999). Because people seek restoration from DAF in natural environmental settings on public lands, when properly understood, these judgments about the perceived restorative character of a natural setting can help visitors think about and how their actions affect the natural surroundings.

A significant challenge of many public agencies that are entrusted with stewardship of public lands is management of those resources for visitor experiences. Recreation resource managers are understandably concerned with ecological impacts because many of them have the responsibility of maintaining the quality of recreation resources and experiences (Hammitt & Cole, 1998). The USDA Forest Service, for example, endorses a multiple use and ecosystem management perspective that includes attention to recreation use. As such, visitors to forests and grasslands managed by the Forest Service are provided campgrounds, hiking and equestrian trails, fishing opportunities, interpretation services, and a wealth of additional opportunities for natural resource-based recreation. The National Park Service is even more explicit in its commitment to visitor experiences. The Organic Act (August 25, 1916), which

established the National Park Service, points specifically to visitor enjoyment as a fundamental purpose of the National Park Service:

The Service thus established shall promote and regulate the use of Federal areas known as national parks, monuments and reservations . . . by such means and measures as conform to the fundamental purpose of the said parks, monuments and reservations, which purpose is to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations. (Department of the Interior, 1916)

Similar levels of commitment to quality visitor experiences are evident in mission statements, programs, and services provided by state park systems, state forestry departments, and divisions of local governments that manage forest, grassland, desert, and water resources. For instance, the mission statement of the Forest Service clearly states the commitment the agency has for assuring quality visitor experience and managing the land: “caring for the land and serving the people” (USDA Forest Service, 1905).

Thus, awareness of features of environments that impact visitor experiences is important for natural resource managers. With knowledge of those features, managers can employ a variety of techniques to optimize visitor experiences. Indeed, knowledge of features of environments that are pivotal to visitor experiences can inform management actions. Some examples include trail design, interpretation, controlling visitor density, and formulation of policies related to development and limits of acceptable change (Stankey, Cole, Lucas, Peterson, & Frissell, 1985). More generally, these variables can be classified into three groups: setting attributes, natural factors (e.g., ecological impacts), and social and managerial aspects (Lynn & Brown, 2003). A substantial body of research has been directed toward understanding factors that affect

visitor experiences. Among the topics that have been the focus of those investigations are recreation experience preferences (Manning, 1999), landscape scarring (Hammit & Cole, 1998), malicious vandalism (Christensen, Johnson, & Brookes, 1992) and landscape preference (Manning, 1999). Previous research has not, however, comprehensively addressed visible visitor-caused impacts on judgments about the perceived restorative characteristics of landscapes.

Ecological impacts are an undesirable change in environmental conditions (Hammit & Cole, 1998). Visible visitor-caused impacts are environmental disturbances to natural areas that are the direct result of recreation use. Individuals with greater levels of environmental concern are less accepting of visible visitor-caused impacts (Floyd, Jang, & Noe, 1997). When people see symbolic cues of urban ills that people bring to the backcountry, it detracts from their sense of being away, coherence, fascination, and compatibility with the natural area. Such impact may diminish restorative qualities and experiences visitors seek by adversely affecting the goal to experience recreation in an untrammelled natural area. Visitors who have negative experiences in the presence of large amounts of impact may come away feeling little or no restoration, a sense of sadness due to a trashed site, or even anger at the managing agency for inadequate management strategies resulting from the visible visitor-caused impacts. That is, as visible visitor-caused impact increases, judgments about the perceived restorative potential will decrease in natural areas. Dispersed camping is the term used for camping anywhere on public lands that are outside of designated campgrounds; that is, dispersed campsites are *user-created* by visitors and not the managing agency. Dispersed camping typically means there is no access to toilets,

treated water, fire grates, picnic tables, parking access, etc. (USDA Forest Service, 2007). Because user-created campsites are not designed by the managing agency for high use, they are subject to large amounts of visible visitor-caused impact. This may reduce restorative potential and increases the threat of more impact to the natural area by adversely affecting an individual's goal to experience recreation in an untrammelled natural area.

Other evidence would suggest that visible visitor-caused impacts may have little impact on judgments of perceived restorative character. Recent theoretical and empirical work has shown that people participate in outdoor recreation activities to satisfy certain motivations; that is, recreation activities are more a means to an end than an end in themselves (Manning, 1999). Evidence also suggests that visitors define natural areas in terms of what they used them for rather than the purpose for which the area may have originally been intended (i.e., a visitor painting a nearby barrier rock with graffiti with the intent to direct other campers to the campsite) (Manning, 1999). Along this line of argument is the notion that visitors might not actually see or perceive visible visitor-caused impacts caused by recreation activities in natural areas (Manning, 1999). In other words, for a visible-visitor-cause impact to have an affect, it must first be perceived as a noteworthy condition, and then be evaluated as somehow detrimental or unacceptable (Farrell, Hall, & White, 2001). A second line of argument is that though some people may notice the impact, they may not interpret these characteristics as impact. Several studies have shown that visitors to outdoor recreation areas tend not to be highly perceptive of environmental impacts caused by recreation activities (Manning, 1999). For example, user-created campsites that have components such as

established fire rings, flat bare ground, or nearby user-created latrines may be consistent with ART's compatibility notion. Further, perceptions of visible visitor-caused impacts among visitors differ from perceptions of resource managers. For example, a resource manager's own opinion of what visitors *should* prefer may well influence her or his view of what visitors *do* prefer (Manning, 1999).

Although the above reasoning should supply satisfactory warrant for exploratory analysis of the connections among being away, fascination, coherence, and compatibility while in the presence of or while viewing varying degrees of visible visitor-caused impacts, evidence should not be interpreted as absolute. To feel restored or recharged by a natural environment, the environmental setting must be free from elements that detract from one's sense of being away, fascination, coherence, and compatibility, that is, one's overall sense of comfort while in the natural setting. Therefore, the purpose of this study is to examine visible visitor-caused landscape impacts on judgments of the restorative character of backcountry user-created campsites as well as show spatial patterns of these locations of impact in natural areas.

CHAPTER II

LITERATURE REVIEW

The Setting

Natural environments have long been used for retreat, leisure, and restoration. Kaplan and Talbot (1983) in their study on the psychological benefits of a wilderness experience outlined several historical instances that support this claim. They claim that “Jewish, Roman, and Germanic traditions, found religious significance in wilderness surroundings and natural occurrences” (p. 164). They go on to say “Oriental traditions emphasize [that] wilderness encounters are instructive, and an understanding of natural processes is essential to the correct understanding of one’s role in society” (p. 164). A contrasting view of wilderness is offered by Kaplan and Talbot regarding Christian perspectives of wilderness, which states that “emerging Christian ideology came to see wilderness as an environment presenting earthly temptations, physical dangers, and spiritual confusion” (p. 164). They continue to say that “wilderness represented unfinished business; it was the proper function of Christians to cultivate such areas and to build the city of God” (p. 164). This cultural view seems to conflict with the notion that wilderness is a place that offers the opportunity to enrich one’s perspective through experience. Kaplan and Talbot offer the view that wilderness is a common cultural concern and that the need to explore issues relating to the ways in which individuals respond to wilderness experiences is a useful endeavor. Kaplan and Talbot claim that

psychologists are faced with two distinct issues regarding the meaning of wilderness: “first, what values are perceived in wilderness; and second, what lasting psychological impacts result from extended encounters with wilderness” (p. 164). It is this notion of *psychological impacts* in wilderness (i.e., natural areas) that is of interest in this investigation. If wilderness and other natural areas provide the opportunity to experience an enriching or restorative experience, what then occurs to this experience when visual cues of human-caused impact influence this experience—primarily where recreational activities in natural areas are concerned?

Recreation has been one of the primary uses of wilderness and other natural areas (e.g., Forest Reserves, National Parks, and other public lands) in North America since the 1800s. Many natural areas have been set aside for their unique characteristics by the United States Government. In turn, several Government Agencies have been established to oversee the management, protection, and use of these natural areas. The Forest Reserves established in 1891 by the Forest Reserve Act were historically set aside for their physical resources such as timber, watershed, and various other uses (e.g., mining, grazing, etc.). These areas were also valued and used for their aesthetic characteristics where recreation uses take precedent. Before the establishment of the Forest Reserves, these natural areas were already being used by people for recreational activities such as camping and picnicking; however, recreation was not considered to be an important aspect of forest management (Nelson, 1997). In 1905, the Forest Service was established in the United States Department of Agriculture (USDA) to oversee the management of the Forest Reserves. The Forest Service dedicated its authority to the solving the greater problems such as timber, water, mining, and grazing. Lesser issues,

such as recreation uses, were left to take care of themselves (Nelson, 1997). In 1916, the National Park Service (NPS) was established in the Department of the Interior (DOI). One year after the creation of the NPS, the Forest Service began a movement to study recreation opportunities and identify recreation facilities to determine policies on how to best govern and develop these recreation opportunities and facilities.

Multiple use philosophy is key to the mission of the several land management agencies (e.g., the Bureau of Land Management and the Forest Service). As time progressed, recreation uses became increasingly important to multiple use philosophy. By the 1930s, the Forest Service provided recreation to four times as many people as the NPS (Nelson, 1997). As a result of the increased recreation, use planning for recreation uses became critical. Development of recreational plans and facilities was well underway by 1935. The construction of trail systems, campgrounds, and access roads by the Civilian Conservation Corps (CCC) led to the recreation infrastructure that is enjoyed by many today.

Presidential proclamation created the Uinta National Forest in 1897, the Wasatch National Forest in 1906, and the Cache National Forest in 1907. With the exception of the Cache National Forest, both the Uinta and Wasatch National Forests were contained within the State of Utah. The north division of the Cache National Forest boundary extends into the southern portion of the State of Idaho (see Figure 1). In 1973, the Utah division of the Cache National Forest was annexed to the Wasatch National Forest headquarters in Salt Lake City, thus creating the Wasatch-Cache

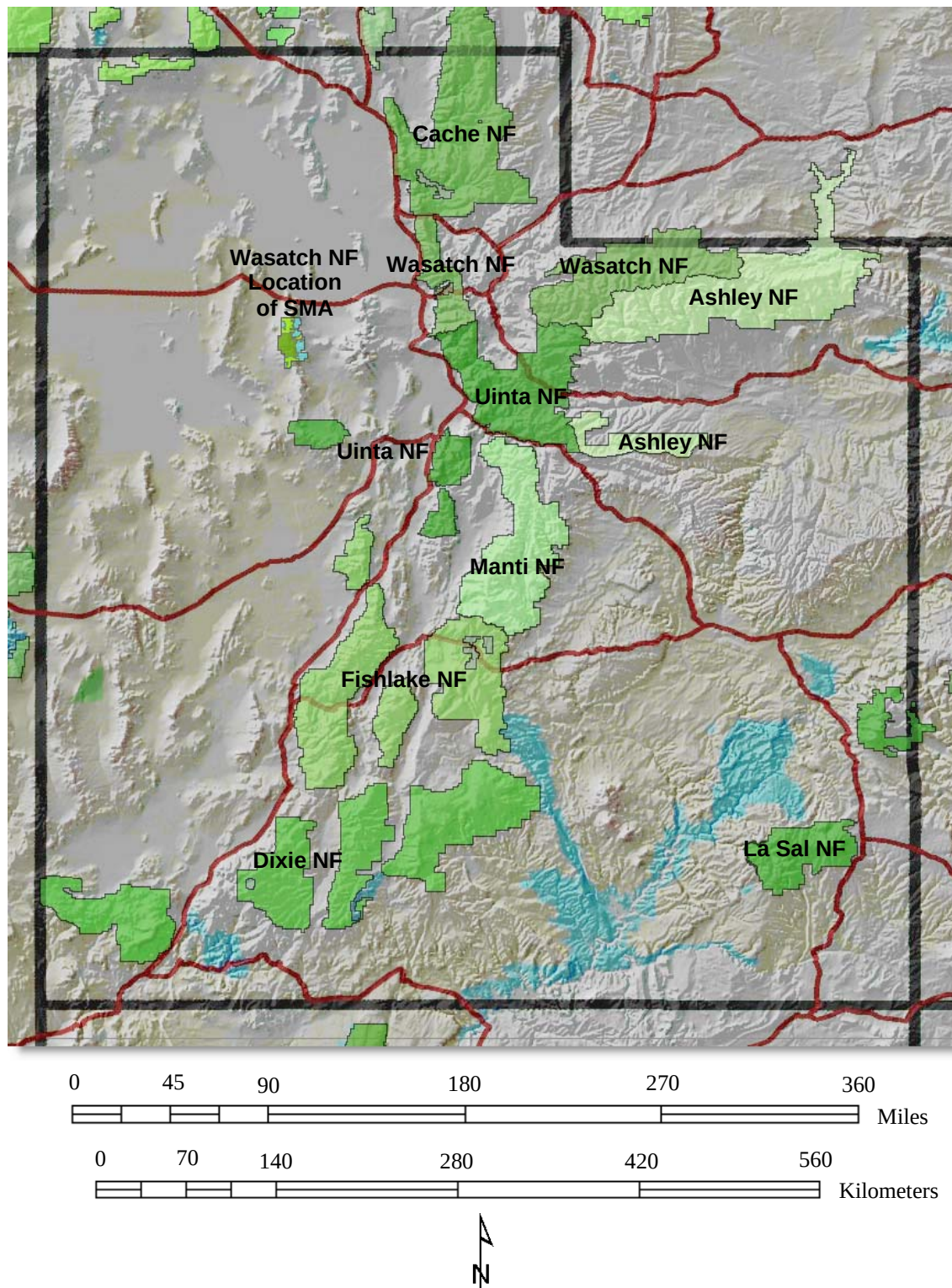


Figure 1. National Forest System Boundaries in the State of Utah

National Forest. In 2006, 1 year after the 100-year anniversary of the establishment of the Forest Service, management of the Uinta National Forest was annexed into the Wasatch-Cache headquarters creating the Uinta-Wasatch-Cache National Forest.

The Uinta-Wasatch-Cache National Forest is subdivided into 8 Districts that are responsible for implementing direct management strategies in their respective areas. The Districts typically manage recreation facilities and activities among other management objectives (e.g., special use permits, range, fire management, interpretive programs, etc.). Each District is unique and often reflects the character of nearby communities. The Salt Lake Ranger District (SLRD) is comprised of 216, 000 acres (i.e., ~ 874 square kilometers). The SLRD provides recreation opportunities for more than a million people within a short 30-minute drive. The SLRD is often referred to as an *urban forest* due to its relative proximity to large metropolitan areas (USDA Forest Service, 2008). An urban forest is similar in many ways to city parks; they are typically characterized by intense recreational activity primarily in the form of day-use with severe competition for open space, recreation opportunities, and recreation amenities (Larson, Molzahn, & Spencer, 1993). Urban residents are drawn to the interfaces of cities and forest for recreation opportunities, self-renewal, and respite from daily stresses (Pigram & Jenkins, 1999). There are very few places that have such rich and diverse recreation opportunities so near a large urban area. An abundance of summer recreational activities such as hiking, mountain biking, Off Highway Vehicle (OHV) use, and camping are common recreation uses on the SLRD. Winter recreational activities such as skiing, snowshoeing, snowmobiling, and ice fishing are popular in the winter months on the SLRD. Because the SLRD is managed for multiple uses as

defined by the Multiple Uses Sustained Yield Act of 1960 (16 U.S.C. §§ 528.531, June 12 1960), it is prone to many uses in accordance with this Act. Of primary importance to this study is the variety and extent to which user-created recreation features (e.g., dispersed or user-created campsites and user-created OHV trails) is impacting not only the landscape, but also the overall judgments of the perceived restorative potential in these natural areas.

The 1985 Wasatch-Cache Forest Master Plan included forest-wide standards and guidelines that were developed under the Visual Management System (VMS) of 1974. The VMS relies on the *natural landscape* as the reference point for establishing an aesthetic value for the acceptable degree of alteration of the landscape (USDA Forest Service, 2003). Measurements of the degree of alteration was in terms of visual contrast with the surrounding natural landscape; however, in 1995, the Forest Service adopted the Scenery Management System (SMS) (USDA Forest Service, 2003). The SMS provides a framework for the systematic inventory, analysis, and management of the natural scenery on the resource (USDA Forest Service, 2003). SMS incorporates terms and concepts of Ecosystem Management and improves the ability to integrate landscape aesthetics with other resource values (e.g., recreation uses). A key component of SMS is incorporating public values and human influences (e.g., recreation uses and impacts) when developing a description of the character of a landscape and its perceived integrity (USDA Forest Service, 2003). In contrast to the VMS, SMS acknowledges human influences on the landscape and moves toward developing a *sense of place* by encompassing positive cultural influences and ideals as part the of landscape character (USDA Forest Service, 2003).

The physical setting for this study is a management area that contains many recreation opportunities and several landscape characteristics that support recreation activities. The project area for this study is located in the Stansbury Mountains, which are located due west of Tooele Valley in the State of Utah (Figure 2).

The Stansbury Management Area (SMA) is directly managed by the SLRD for the Uinta-Wasatch-Cache National Forest. This area was selected due to its unique natural characteristics and diverse recreation opportunities and its instances of user-created recreation features. The SMA is approximately 69,180 acres (i.e., 280 square kilometers) in size. The project area is host to a variety of physical characteristics that make it suitable for many uses, including recreation uses. Terrain characteristics, vegetation characteristics (alpine, montane, semi-arid pinion-juniper, sage brush littered with grass and forbs) open basins, rocky ridges, and several waterscape features (lakes, streams, and springs) offer a wide variety of recreation opportunities. Among these recreational opportunities are a 25,000 acre (i.e., ~101 square kilometers) wilderness area for backpacking, backcountry, equestrian, range, OHV use, hiking, mountain biking, picnicking, rock climbing, and camping (dispersed and developed).

Substantial changes to recreation use patterns over the years have required the need to define and implement the range of recreation experiences present in the SMA, thus providing for a growing population while sustaining natural resources (USDA Forest Service, 2003). It is important that natural or natural-appearing conditions are maintained to sustain recreation opportunities in the SMA—recreation use always disturbs the natural conditions in a given area (Hammit & Cole, 1998). Human-caused impacts that affect visitor enjoyment, especially those that impair the functionally or

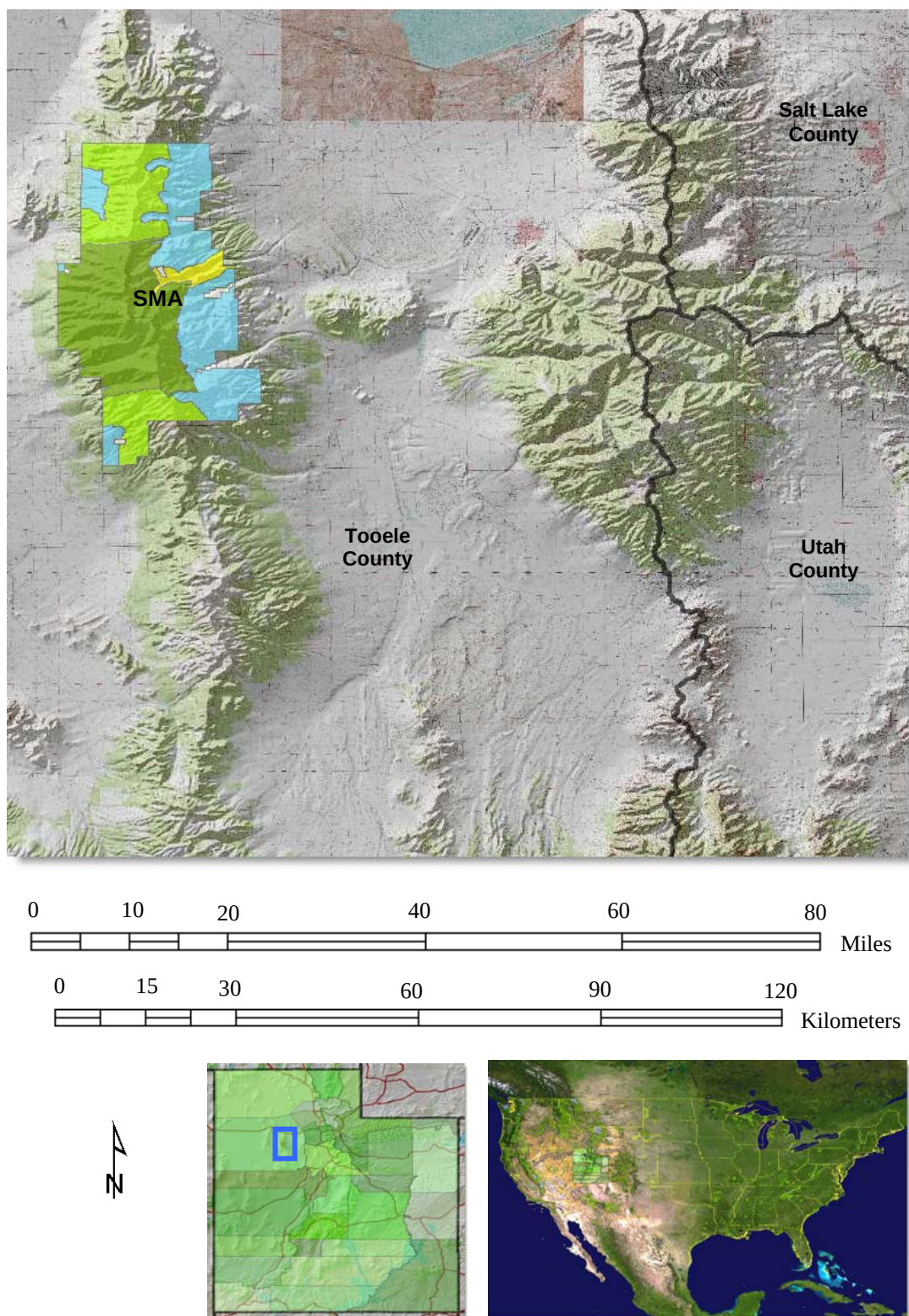


Figure 2. Study Area

desirability of a given site are of particular concern (Hammitt & Cole, 1998). Networks of user-created OHV trails and locations of user-created campsites have increased in the SMA as a direct result of recreation use; however, society and policy have made the SMA available for recreational uses. As such, the use of the SMA for recreational purposes must be accepted. An effort to maintain the naturally occurring conditions, and thus the desirability in the SMA where human impact and influences are present, while still allowing for recreational use, is important for the continued support of recreation opportunities in the area. When dealing with recreation impacts, resource managers must balance the concerns of ecology, recreation, and the social environment (Hammitt & Cole, 1998).

The social environment is conceptualized as the matrix of social relationships and situations with which behavior takes place (Adamopoulos, 1982). The SMA offers a rich and diverse social setting and a wide array of recreation opportunities. The unique terrain provides a multitude of recreation opportunities to the Intermountain West's largest and fastest growing population of more than a million people within a 60-minute drive (USDA Forest Service, 2008). The SMA provides a backdrop to the expanding urban development in Tooele County. The SMA also serves to enhance quality of life for residents as well as visitors from outside Tooele County. Partnerships among members of the community in the county regarding management provides for enjoyment of the SMA while assisting with local land stewardship. However, the growing community, changes in recreation uses and technology (e.g., OHVs), and the relatively easy access to the SMA have presented significant management challenges where depreciative social behaviors are concerned. Opposing interests come in conflict,

leaving resource managers with the task of balancing recreation use with the preservation of natural conditions. Recreation uses that manifest as depreciative behaviors (e.g., vandalism, intentional resource damage, *unmanaged recreation*, etc.) are not in line with current wildland management practices in the SMA. These depreciative recreation uses are prevalent in the physical and social settings of the SMA.

Landscape in the SMA has been altered by human-caused activities (e.g., range use, fire activities, mining, etc.) over the years—specifically by recreation activities. It is important for resource managers to understand how visitor judgments about human-caused impacts affect the quality of dispersed camping recreation opportunities in the SMA. This understanding will help to continue to sustain desirable recreation opportunities in the SMA. The SMA (Figure 3) was selected as the project area for this study due to its access to dispersed camping variety and opportunities. Observations derived from the recreation use defined as dispersed camping (i.e., user-created campsites) and varying levels of human-caused impacts at these sites will be the focus of this study. The SMA described by the setting will comprise the setting of interest in this study.

Restorative Environments

A restorative environment is one that contains qualities that support physical, mental, and spiritual restoration and recovery. Physical exhaustion can be attributed to physical exertion such as hiking. Mental fatigue can be caused by many demanding factors that one encounters including studying for a test, heavy traffic conditions, and emotional turmoil. Familiar sources of mental fatigue and exhaustion are situations in

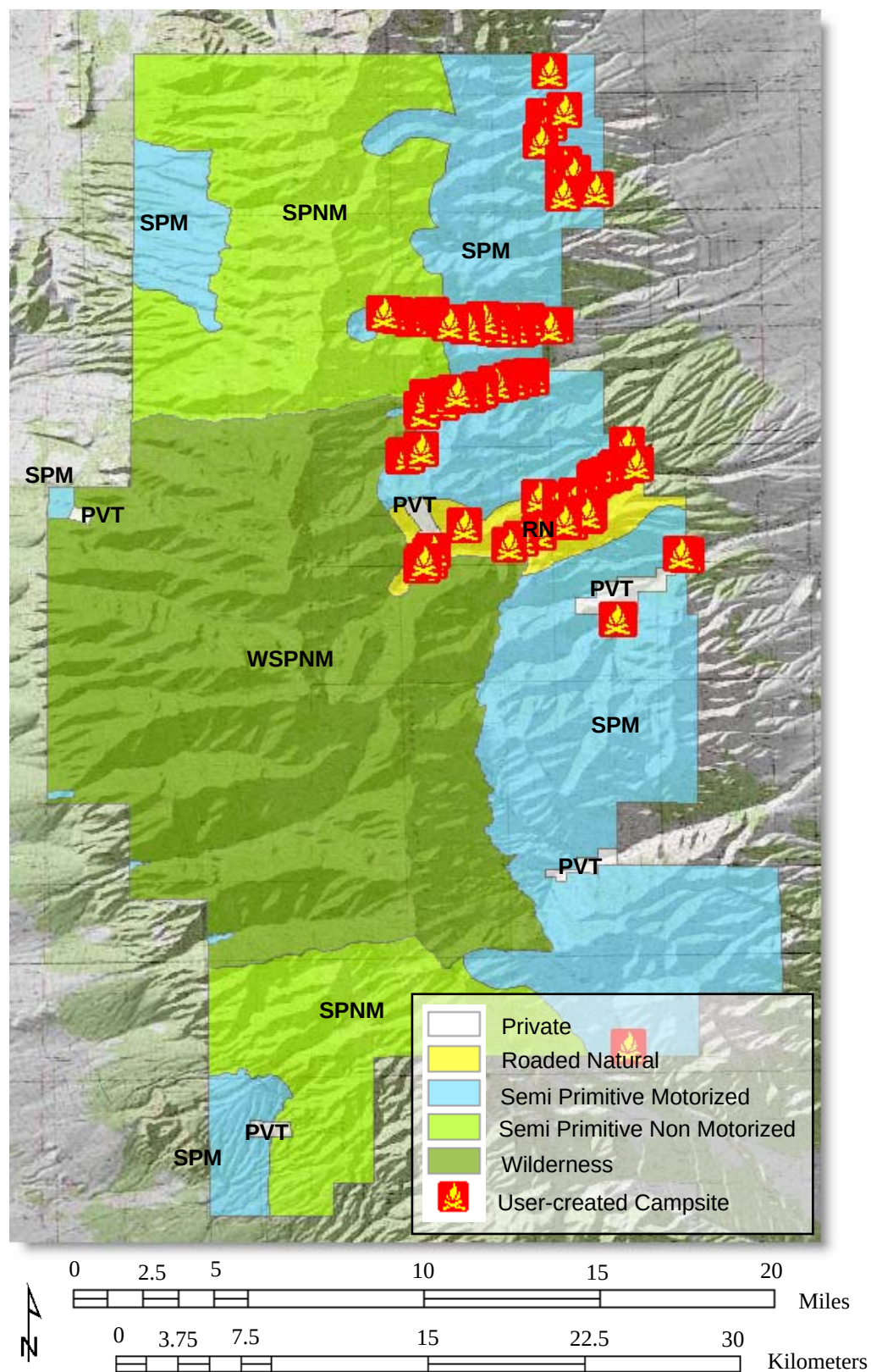


Figure 3. Mapped user-created campsite locations in the SMA

which mental energy is consumed by demands on an individual. These situations often require individuals to focus their mental energy on a particular task; however, external distractions (e.g., loud noises, bright lights, etc.) can levy a heavy toll on one's mental energy level. Mental fatigue is also caused by internal distractions (e.g., stress over tuition costs, emotional problems, etc.). When focus is required over long periods of time in the presence of multiple and oftentimes competing distractions, the ability to maintain mental focus is diminished. When this mental energy reserve reaches very low levels, a person's ability to cope and effectively block out distractions is reduced. The effects of mental exhaustion often manifest as irritability, grumpiness, and impatience in a person. Once an individual experiences directed attentional fatigue, a period of restoration is needed to recharge one's mental attention. One method to restore one's mental attention is to remove oneself from surroundings of clutter, distraction, and demands on attention and into a place where the environment offers opportunities to disengage from the demands on mental attention. Often, these types of environments support the intrinsic goals and senses of freedom of the individual. Kaplan and Talbot (1983) describe this type of setting as a restorative environment.

Attention Restoration Theory

Attention Restoration Theory (ART) is a conceptual framework that seeks to explain why select environments support recovery from directed attentional fatigue. ART maintains that prolonged mental effort leads to Directed Attention Fatigue (DAF); however, DAF can be reduced or alleviated by immersion in a setting that promotes a sense of restoration. Settings that tend to best promote restoration or recovery from DAF are settings that contain four components: Being Away, Fascination, Coherence,

and Compatibility (Kaplan & Kaplan, 1989). Directed attention is reflected in one's ability to concentrate on relatively uninteresting information or tasks for an extended period of time. Directed attention is synonymous with the concept of *voluntary attention* identified by William James (1894). According to James, humans have two attentional capacities—voluntary and involuntary. Voluntary attention is used when one is required to focus on relatively uninteresting tasks. It is effortful and thus subject to fatigue. Involuntary attention is used when tasks or events are inherently interesting. It is effortless and less subject to fatigue than is voluntary attention. Shifting from directed or voluntary attention to involuntary attention allows directed attention to rest. Environments that support such an attentional shift and offer restoration are called restorative environments.

Physical rest such as sleep will aid this rest and replenishment; however, the extent of DAF can exceed what physical rest can replenish. Resting while awake is essential for this replenishment. As such, this replenishment or recovery is likely to occur in a restorative environment.

Origins of Attention Restoration Theory

The origins of Attention Restoration Theory (ART) lie in a series of studies that began in the early 1980s. The purpose of these studies was to examine psychological benefits of recreating in wilderness settings. A backpacking program for youth called Outdoor Challenge provided the elements necessary to conduct the studies. The studies involved research participants engaged in a backpacking trip to compile their trip experiences in hand-written journals during the expedition. Trips were approximately 2 weeks long. During the trips research participants were instructed to record their

experiences, perceptions, and thoughts. At the conclusion of each trip, the research participants' journals were analyzed to identify common themes in the experiences. As the journals were analyzed, themes related to the comfort levels of the research participants began to emerge. At the beginning of the wilderness trip, several observations made by the research participants indicated that "nervousness" and "anxieties" about backpacking were felt by the group. Other early-trip themes were that the research participants had difficulties in keeping their thoughts from being distracted due to common every-day worries and day-to-day uncertainties. As the trip progressed, participants began noting more comfort with the wilderness surroundings. The journal entries seemed to indicate that the day-to-day cares and worries began to disappear as the group began to adjust to the surrounding wilderness. Approximately 5 days into the trip, feelings of anxiety and worry changed to feelings of tranquil, calm, and contemplative reflection about life objectives and purpose. Toward day 7 of the trip, several of the emerging themes indicated that the research participants had developed strong connections with the surrounding wilderness and that contemplation about the remarkable power of the natural environment seemed to inspire a sense of awe and wonderment.

The researchers identified emerging patterns among the research participants that showed reactions to environmental stimuli that seemed to promote a sense of restoration and recovery while engaged in the wilderness trip. The researchers became interested in investigating the possible causes and reasons for restorative experiences that were associated with human reactions to environmental properties. They identified

several components, rather than a single property of the surrounding environment, that seem to contribute to this restoration.

There are relatively few studies preceding the Outdoor Challenge study that examine the restorative environments concept. However, the body of research that has grown out of ART over the past several decades has increase substantially.

Four Characteristics of a Restorative Environment

The first and perhaps most necessary condition for an environment to provide recovery from directed attentional fatigue is its ability to foster a sense of “Being Away.” Being Away involves more than changing one’s location. It involves disengaging oneself from one’s daily routines and cognitive activities. At deeper levels, it may also involve removing oneself from one’s normal goals and priorities.

The second characteristic that should exist in a restorative environment is fascination. Environments that are fascinating easily capture attention. An important characteristic of fascination is that the attention of the individual, once captured, is not so demanding that it requires the individual to “work at liking it”; that is, the experience of fascination is effortless to maintain (Kaplan & Talbot, 1983). Fascination varies in intensity from moderate to intense. In other words, moderate fascination is allowed to occur in the presence of aesthetically pleasing stimuli (e.g., a small clearing filled with green grass and pleasant fragrances, fire, caverns, etc.). Stimuli that are inherently fascinating attract people because they allow people to function without having to use direct attention (Kaplan & Kaplan, 1989). Furthermore, fascination is not accomplished by a sequence of random events; rather, human fascination revolves around issues of process as well as content (Kaplan & Kaplan, 1989). The existence of some larger

pattern is required in order to facilitate fascination; however, connection or relatedness to the larger pattern is also required (Kaplan & Kaplan, 1989). Thus, fascination and extent are mutually supportive (Kaplan & Kaplan, 1989).

A third characteristic of a restorative environment is “Extent.” In content and in process, a setting with extent is one that suggests a domain of large enough scope to anticipate, explore, and contemplate (Kaplan & Talbot, 1983). At the same time, the environment must have enough coherence to make sense to the viewer. Coherence gives connectedness and scope extends interest. Together, coherence and scope (that is, extent) create a sense of “otherworldliness” (Kaplan & Kaplan, 1989).

A fourth characteristic of a restorative environment is Compatibility. Compatibility is the idea that the environment supports one’s goals and inclinations. This may be accomplished in two ways. First, an environment may support goals one immediately brings into the setting. Second, over time, one’s goals may shift to match the demands the environments offers. Perhaps compatibility as a component of a restorative environment is best seen in environments that frustrate goal attainment. In such settings, one must shift from involuntary attention to directed attention to satisfy ones goals, thus leading to increased mental fatigue.

Themes Derived from the Restorative Environments Literature

Research regarding restorative environments is relatively new. However, following from Kaplan (1984), three themes can be identified. Each can be turned into a theoretical proposition. First, environments vary greatly in restorative potential. Second, the visual and spatial arrangement of an environment will affect how an individual will evaluate and perceive the environment (e.g., chaotic versus coherent

spatial arrangements) and thus affect an individual's judgments about the perceived restorative potential. Third is the concept that understanding the sense of place can lend itself to support one's goals while in a given setting; that is, the setting is "compatible" or "congruent" with the visitor's goals. As Kaplan indicates, the second characteristic mentioned above can be used to study perceptual categories in a setting.

Environments Have Varying Levels of Restorative Potential

A critical component of an experience is the setting in which the experience takes place. An environment's restorative potential will change with the type of environment an experience takes place in. A setting can be a natural setting (e.g., wilderness) or a built setting (e.g., urban). Research that seeks to explain the varying levels of restorative potential in different types of settings proposes that natural environmental settings tend to better promote restorative experiences than do built environmental settings. The literature also suggests that the presence of the four restorative components (being away, fascination, coherence, and compatibility) will lend themselves well to the notion that the type of setting will also affect the level of restorative potential. Studies that compare restorative potential between built and natural settings show that natural settings tend to be more "well endowed" with restorative potential than built environments (Kaplan, Bardwell, & Slakter, 1993; Ouellette, Kaplan, & Kaplan, 2005). Natural settings that possess the four components identified by ART (being away, fascination, coherence, and compatibility) in abundance will have high restorative potential.

Natural environments tend to have a higher restorative potential than do built environments as they allow for escape from the normalcy of life's daily routines.

Natural environments support many outdoor recreation goals (e.g., hunting, fishing, bird watching) for humans. Natural environments accomplish this by possessing qualities and processes that support outdoor recreational goals and activities, thus allowing the opportunity for individual's to more easily engage their involuntary attention. These qualities and natural processes range from a summer thunder storm echoing across the landscape to a bright sunny day at a lake to a green grove of trees nourished by a mountain stream to a field of aromatic flowers swaying in the breeze. Furthermore, natural environments tend to better offer a coherent atmosphere by way of natural condition (i.e., they tend to "seem right" or "hang together"). Natural environments also possess more profound qualities such as depth, scope, and extent allowing for contemplative and reflective introspection. Humans, however, generally spend most of their time in urban environments, which tend to lack these qualities. Thus, urban environments have a tendency to be more demanding on attentional capacity, thereby increasing the potential for DAF.

There are differences among environments and those differences affect the levels of restorative potential offered by them. Much of the data presented in the research exhibits a consistent pattern that supports this claim. Research that seeks to explain why there are varying levels of restorative potential among environments attempts to address different types of restoration. Studies that examine the increase of attention capacity (Hartig, Mang, & Evans, 1991; Tennessen & Cimprich, 1995), improving mood (Bodin & Hartig, 2001), or reducing anger (Kuo & Sullivan, 2001) support the claim that natural environments are more restorative than are urban environments. Several studies conducted to compare the different restorative potential

between urban settings and natural settings have been carried out. Kaplan et al. (1993) sought to explain the restorative effects of a museum. They found that though museums tend to have a high restorative potential, people who were already comfortable in museums were more likely to experience restorative benefits than those who are may not be comfortable in museums (Kaplan et al., 1993). In a similar study, Ouellette et al. (2005) examined the restorative effects of a monastery. They found that although a retreat experience was evident among all participants, the reactions of first time visitors compared with repeat visitors are very different, particularly where visitors sought to experience beauty and spirituality (Ouellette et al., 2005). A study that examined the affects of recreation impacts on hiking experience in natural areas found that visible recreation use impacts (e.g., tree and plant damage, litter, trail erosion, etc.) had negative effects on hiking experience in natural areas (Lynn & Brown, 2003). This leads to a question that seeks to answer what, if any, are the effects of urban cues (e.g., loud human noises, ATV tracks, etc.) in a natural setting?

In the case of a restorative experience in a natural environment, the condition of the natural setting will affect the potential or the lack of the restorative experience. Consider a natural setting where camping activities will take place. If the setting requires effort to support camping activities (e.g., cleaning up garbage left by previous visitors), then the experience of camping may have less of a restorative potential. In a study seeking to explain conditions of a natural setting, Herzog, Maguire, and Nebel, (2002) found a negative correlation between perceived effort and perceived restorative potential (Herzog, Chen, & Primeau, 2002). This implies that traces or cues of urban life (e.g., an uncovered latrine) will negatively affect a natural area's restorative

potential. When scenic beauty is replaced or disturbed by common human activities, restorative potential will decrease.

Themes implicit in the research regarding the differing levels of restorative potential among different environments (e.g., urban verses natural) support the notion that compatibility is key to high restorative potential, especially in natural environments. Reasons that support this claim may be due to a natural environment's restorative potential and an individual's proclivity to engage in activities that are in line with that individual's goals that promote restoration. Moreover, natural environments may seem less inhibiting than urban environments, thus allowing an individual to align their goals to the demands of the natural setting, therefore, providing an escape from the normal routines of daily life for the individual.

Environmental Perceptions Depend on Visual and Spatial Characteristics

Well-defined geographical objects are essentially created by human beings to order the world they occupy and therefore perceive. Environmental preference is the assumption that humans are genetically programmed to prefer certain environments for potential survival characteristics. That is to say, from a very early time in human history, environments that offer characteristics that promote survival of the species became preferred for these characteristics. Humans evolved in environments where spatial information was essential for survival. These preferred environments tend to exhibit characteristics such as open space, pleasing textures, and offer the prospect for exploration of immediate territory. Moreover, the aesthetics inherent to these environments promote a sense of calm and recovery. The presences of certain environmental features such as lush tree growth, rushing water, food, and refuge evokes

favorable perceptions for the human-environment interaction (Ulrich, 1983). Aesthetic concepts are learned in contexts where roles are learned (Nelson, Johnson, Strong, & Rudakewich, 2001). As such, environments that are perceived to both support survival and are aesthetically pleasing will covary with environments that are judged to be high in restorative potential; that is, these environments contain many of the same elements.

The environmental literature supports the notion that preferred environments include landscapes that are wide open, spatially defined, evenly textured, and provide an opportunity to explore and uncover new information (i.e., offer an element of mystery). On the other hand, the literature also points out that environments with dense trees and vegetation that obscures vision, impedes or altogether blocks passage tend not to be preferred. It is theorized that these setting characteristics imply a threat to survival. The rationale for this is that primordial survival instincts are triggered when “that which lies beyond” can be neither seen nor heard and the enclosed area offers no directed route for escape. As a result, natural areas that contain characteristics such as openness, spatial recognition, pleasing texture, and even degrees of mystery contribute to positive environmental preference and therefore higher restorative potential. In more recent times, the literature identifies that people frequently prefer spatially defined, expansive, and lush park-like spaces. Common theoretical explanations for this phenomena state that people are more readily able to make sense of the surrounding environment; that is, these environments allow a sense of depth perception, afford means of easily moving around, and appear to offer safety viz. a deep sense of coherence.

Other environmental features such as natural water sources (e.g., springs, streams, rivers, and lakes) also tend to be preferred landscape components. Conversely, other types of water sources (e.g., swamps, water rapids, or stagnant cave water) are not preferred landscape components (Herzog, 1985). Theoretical explanations for this coincide with the human survival explanations offered previously; that is, these waterscape features tend to be perceived as a threat to survival. It follows that waterscape features can be perceived with favorable environmental preference (e.g., the calming effect of a bubbling stream sliding beneath the green of a forest meadow), or perceived with unfavorable environmental preference (e.g., a murky, insect infested swamp that eerily impedes passage through its domain).

Coherence among environmental features and components fosters environmental preference in humans. Coherence is a concept identified by Kaplan and Talbot (1983) that is necessary for restorative potential in an environment. An environment is considered to have high coherence when it appears serene (as opposed to chaotic) and makes sense. A high sense of coherence cultivates an individual's ability to order the surrounding environment; that is, to quickly form a mental map of the area. Environmental features that lend themselves well to coherence are those that are perceived to be repeated (e.g., tree canopy patterns and shadows), have a spatial domain (e.g., a meadow *ecotone* or a park boundary), and have pleasing aesthetics (e.g., unifying textures, pleasant sounds, and aromatic fragrances). Environment perceptions that promote a sense of order where one feels a sense of place and has elements that seem to be in place will lend themselves to coherence in an environment, thus reducing the effects of DAF in an individual, viz. provide a restorative experience.

Environments Support a Sense of Place

Environments that are restorative will promote a sense of belonging or place. Place is described as space with meaning added (Tuan, 1977). Research supporting the idea that restorative environments promote a sense of belonging or place can be found in several studies that examine how restorative environments promote self-regulation. Being able to clear one's mind in a "favorite place" facilitates the ability to "find" one's self and supports coherence for the individual (Korpela, 1989). This may help foster development of place identity. Natural environments often afford one the space to "step back" or escape from everyday concerns, thus allowing one to disengage from directed attention and support recovery from DAF. This supports Kaplan and Kaplan's (1989) concept of being away. Physically being away is removing oneself physically from distracting and attention-demanding environments. Cognitively being away is to disengage oneself from activities such as school, work, politics, and social norms. Psychologically being away is to extricate oneself from life's demanding priorities and obligations. Placing oneself in a liminal space will provide an opportunity to experience each of these forms of being away. A sense of liminality may be seen in places that are not binding but are seen as places that help individuals to become free from place-related definitions by allowing a space for insight or introspection (i.e., to "step back" from everyday tasks). Kaplan (1985) lists several properties that allow for disengagement from everyday concerns. Important among these is that disengaging from every day activities allows for a sense of being away. Natural environments tend to do this well.

Other studies that examine how emotional and self-regulation processes underlie the development of place identity also show how an individual's favorite place can provide an environment that promotes such regulation processes (Korpela & Hartig, 1996; Korpela, Hartig, Kaiser, & Fuhrer, 2001; Korpela, Kytta, & Hartig, 2002). These studies seek to explain how favorite places are related to characteristics in restorative environments theory. One such study found evidence that supports the claim that relations exist among place attachment, restorative experiences, and self-regulation where natural settings are the preferred or favorite places (Korpela & Hartig, 1996). Evidence also suggests that overrepresentation of the number of people's favorite places in both natural and built environments and underrepresentation of places that individuals reported to be unpleasant (e.g., a bad part of town or a heavily human-impacted natural area) is worth further investigation (Korpela et al., 2001). It is this underrepresentation of unpleasant natural areas (i.e., natural areas impacted by heavy human use) that warrants further investigation of the affects of unpleasant places (e.g., natural areas that exhibit varying levels of visible visitor-caused impacts) have on the judgments about the perceived restorative potential in natural environments.

Research attempting to illustrate the positive benefits of restorative environments has shown that one such benefit in inner city environments is that settings with nearby nature facilitate self-regulatory behavior such as reducing aggression. One study examined the effects that greenery or nearby nature in urban settings has on people living in these settings and showed that the nearby natural characteristics reduced aggressive or violent behaviors (Kuo & Sullivan, 2001). This study compared responses from 145 urban-dwelling residents. The surroundings that the buildings or

residents were situated in seemed to affect the levels of self-regulation. Residents in buildings that were situated in areas with more natural features reported higher levels of restoration than residents in buildings situated in barren areas (Kuo & Sullivan, 2001). Furthermore, comparison between buildings surrounded by greenery and those without showed that residents reported reduced levels of mental fatigue in buildings surrounded by natural features and higher levels of mental fatigue from residents in buildings with barren surroundings (Kuo & Sullivan, 2001). Another study showed that plant density in office settings had a positive effect on productivity, mood, and attitude (Larsen, Adams, Deal, Kweon, & Tyler, 1998).

Previous research shows that restorative experiences help humans self-regulate their behavior, emotions, and attitudes, particularly in natural environments with high restorative potential. A strong sense of place is captured well when in the presence of nature. This notion is evident in the restorative environments literature.

Judgments About the Perceived Restorative Character in Natural Areas

Judgments about the perceived restorative character of natural areas are defined as an individual's intrinsic assessment of the significance of restorative potential in a given natural setting. Visitor perceptions of environmental impact, specifically those caused by recreation use, are a special issue within the visitor attitude and preferences body of research (Manning, 1999). A significant challenge of studying judgments about the perceived restorative character of a natural area is diversity among individual visitors.

Three main themes emerge regarding how perceptions of the restorative character of natural environments are affected. The first is that unscarred nature is

powerful in providing benefits that promote physical and psychological health. The second is that natural environments are more restorative than built environments, that is, a natural environment that is absent of visible human-caused impact. The third is the four characteristics (being away, fascination, coherence, and compatibility) that are the elements of restoration. If these attributes of a natural restorative environment are impacted, it stands to reason that unscarred nature is more restorative than scarred nature. An environment that frustrates or aggravates the goals of escape will shift an individual's voluntary attention back to involuntary attention, creating an environment that becomes a problem rather than a place to be free from problems.

Measuring Judgments of Perceived Restorative Character

Several attempts to measure the four components of a restorative environment have been attempted since the conceptual framework identified by Kaplan and Kaplan's ART theory. Development of a perceived environmental restorative scale can aid in the understanding and measurement psychological factors that are operating in response to underlying processes thought to work in a restorative experience (Hartig, Korpela, Evans, & Gärling, 1996). Hartig et al. were successful in creating a measure of these phenomena called the *Perceived Restorative Scale* (PRS); however, they were unsuccessful in establishing a consistent four-factor structure. In a similar study, an attempt to measure the psychological processes operating in a restorative experience found that there was indeed one factor, being away, that seemed to receive high scores; however, being away was split into two factors (Laumann, Gärling, & Stormark, 2001). Laumann et al. found that two distinctions of being away emerged from the rating scales they employed. Being away was found to mean both being physically away and

psychologically away (Laumann et al., 2001). Yet another study was conducted to assess psychological reactions and the restorative components of environments. This study identified that collinearity appeared among several sets of variables, most notably with the being away and setting categories (Herzog, Maguire et al., 2002). A similar scale was used to measure perceived restorative components for children (Bagot, 2004) which confirmed a five-factor model similar to that of Laumann et al. (2001). In order to empirically quantify the human-environment experience interaction, a refined version of Kaplan and Kaplan's (1995) PRS will be employed for this study using photo elicitation techniques.

Photo elicitation has its root in the late 1960s. John Collier conducted and described the first photo elicitation interviews (Collier, 1967). The use of photo elicitation evokes deeper elements of human experiences than words alone (Harper, 2002). Studies in which photo elicitation exist include Photo Elicitation Study of the Meanings of Outdoor Adventure Experiences (Loeffler, 2004). In this study, Loeffler uses the photo elicitation technique to study the effects of outdoor adventure experiences on individual outdoor recreation enthusiasts. Photo elicitation is "a collaborative process whereby the researcher becomes a listener as the participant interprets the photograph for the researcher" (p. 539). This process invites research participants to take the leading role in the interview and to make full use of their expertise (Loeffler, 2004).

A question that is important for this study is the decision to use dynamic (i.e., provides a sense of movement) or static (i.e., does not have a sense of movement) displays for eliciting responses from research participants. Dynamic displays for user-

created campsites were created for this study using a Digital Single Lens Reflex (DSLR) camera to collect a series of images to be mosaicked together in a software package. The spatial representation of any single point in three-dimensional space can be captured with the use of cubic or spherical photography. This type of photography is unique in that it allows for the capture of a volume of space from a given point in space that is naturally three-dimensional, that is, an area in a spatial environment that is directly visible from a single location within space (i.e., an *isovist*). The appeal of this type of photography is its inherent isovist. Isovists are an intuitively alluring way of representing a spatial environment because they provide an account of the space “from inside” the point of view of individuals as they perceive it, interact with it, and could potentially move through it (Turner, Doxa, O'Sullivan, & Penn, 2001). The resulting spherical imagery is a true 360-degree isovist of a user-created campsite location at the point in time the imagery was collected. The spherical imagery allows the researcher to pan and zoom the spherical image from its isovist during an elicitation session. The advantage of this method is that it implies a sense of motion and mystery as the research participants view the scene. Preference ratings for dynamic displays will also more strongly correlate with a wider range of variables, thus allowing the research to capture more criteria related to the scene and the research participants' responses (Heft & Nasar, 2000). If a scene is high in mystery, according to Kaplan and Kaplan (1989), it draws the perceiver into the scene with the prospect of more information (Heft & Nasar, 2000). Other advantages to using dynamic image displays are that these displays can be used in a mediated setting (i.e., a laboratory or classroom settings). Evidence that supports that there is restorative potential where immersive media (i.e., natural

settings projected on a screen from a computer) can be used to display a mediated natural environment (deKort, Meijnders, Sponselee, & IJsselsteijn, 2006). The disadvantage of using this type of imagery is that the viewing environment can adversely affect the quality of the imagery being viewed (e.g., the lighting conditions in the viewing room, quality of the computer display, etc.). Moreover, these dynamic spherical image displays can lead to a sense of “distortion” or “warped perspective” while viewing the scene. This could potentially skew a research participant’s responses to the study criteria in an adverse manner by introducing a sense of disorientation while viewing the scene.

Static displays, on the other hand, can also be used to elicit responses from research participants. These static displays can be created from the spherical imagery by outputting the imagery to a different format. This reformatting projects the image onto a two-dimensional area suitable for digital or traditional hardcopy display. This technique is analogous to a map projection wherein a three-dimensional surface (i.e., the surface of the Earth) is projected onto a two-dimensional surface (i.e., cylindrical, azimuthal, or orthographic area) to make a map. Viewing preference for static displays tends to be higher for research participants viewing the imagery (Heft & Nasar, 2000). Reasons for this viewing preference are identified by Heft and Nasar (2000) to be related to a long history of viewing static displays (i.e., art or pictures and an exhibition) over human history. However, Heft and Nasar go on to point out that dynamic properties that exist in the environment are important for the perceiver while interacting with the environment.

The environment as experienced has dynamic rather than static qualities. The visual world continually undergoes change both from dynamic events in the

world itself, such as the movement of trees in the wind, and from the visual changes generated from our own activities, such as locomotion. (Heft & Nasar, p. 303)

It is this reasoning that justifies the use of dynamic imagery for this study.

The type of imagery that will be used for this study will be both static and dynamic. Static imagery will be used to select five research photos using the Q-sort method. The resulting five dynamic image sets will be used to elicit responses about the judgments of perceived restorative character at a natural site where varying degrees of visible visitor-cause impacts are present.

Summary of Restorative Environments

Natural environments tend to be restorative. They are environments that assist humans in mood regulation, restoration from DAF, and escape from everyday routines. Moreover, it has been found that differing levels of restorative experiences will vary with the type of environmental settings that are present. It stands to reason that as the four factors of ART vary, so will the judgments about the perceived restorative potential of an area.

Visible Visitor-caused Impacts

Visible visitor-caused impacts occur whenever visitors use a natural recreation environment. Wildland recreation is defined as activities that offer a contrast to work-related activities and that offer the possibility of constructive, *restorative*, and pleasurable benefits while visiting natural areas (Hammitt & Cole, 1998). Impacts can be intentional and unintentional; that is, these impacts, objectively speaking, can be positive or negative. Recreational uses such as overnight car camping, hiking, and Off Highway Vehicle (OHV) use can contribute to and have long-lasting impacts on the

natural environment. Environmental impacts result in observable changes in soils, vegetation, wildlife, species diversity, watershed, air quality, and overall natural aesthetics. Each of these natural characteristics are all subject to modification and derogation as a result of recreational uses in natural areas. Acceptability of impact is a function of both the ecological significance of the alteration and human perceptions of the alteration (Hammitt & Cole, 1998). As such, the affects of visible human-caused impacts on visitors' judgments about the perceived restorative character in impacted natural areas is worth further investigation.

Visible Recreation Impacts on the Landscape

Empirically based social science research in outdoor recreation began in the early 1960s when outdoor recreation was recognized as important and potentially problematic for natural resource management (Manning, 1999). Recreation on public lands (e.g., Forest Service, Bureau of Land Management, National Park service, etc.) has become one of the most increasingly popular uses on these lands. As the demand for recreational activities in areas set aside for their natural characteristics increases, understanding of how to best manage the social and environmental settings is paramount. Reducing the adverse environmental and social impacts from increased recreation use in natural areas requires reactive management strategies aimed at minimizing and mitigating for environmental losses (Horton & Pavlowsky, 2004). Several studies that examine recreation impacts and *Recreation Ecology* in natural areas have been done (Bratton, Stromberg, & Harmon, 1982; Brooks & Champ, 2006; Farrell et al., 2001; Frissell, 1978; Horton & Pavlowsky, 2004; Lynn & Brown, 2003; Ulrich,

1983; Zabinski & Gannon, 1997). Themes about the nature of visible visitor-caused impacts in natural environments can be derived from these studies.

Themes Derived from Recreation Ecology Literature

Recreation Ecology is a theoretical framework in which wildland recreation resource impacts and their management are concerned (Hammitt & Cole, 1998). Recreation Ecology deals with recreation impacts on *all* natural resources of wildland areas—not just physical impacts (e.g., vegetation trampling, soil compaction, erosion, etc.) (Hammitt & Cole, 1998). Human-caused impacts on the landscape as a result of recreation use vary largely in their type and scope. Research on the effects of human-caused impacts to the ecological resource began in the late 1960s and early 1970s; however, research on the psychological effects of human-caused impacts on the restorative character of natural areas is relatively new. From this literature, three key themes can be derived. The first is that recreation is fundamentally comprised of a set of psychological experiences. The second is that damage to natural resources from inappropriate visitor behavior is a major problem faced by many natural resource managers and that recreation use always disturbs the natural conditions in a given area (Gramann & Vander-Stoep, 1987). The third is that in wildland recreation, the importance of the environment or setting for activities is greater than in *developed* recreation situations (Hammitt & Cole, 1998).

Recreation as a Set of Psychological Experiences

By convention, issues in outdoor recreation are dichotomized into environmental science concerns (e.g., ecological impacts) and social science concerns (e.g., user conflict, crowding, and satisfaction) (Manning, 1999). Recreation is comprised of a set

of psychological experiences. It then follows that ecological impacts left by recreation use can in fact affect the psychological experiences a visitor may encounter while occupying a given site where ecological impacts (i.e., landscape scarring) have occurred.

Social science as empirically quantifiable research began in the late 1950s and early 1960s when outdoor recreation was acknowledged as an important social phenomena (Manning, 1999). Studies that examine the possible meanings, motivations, and behaviors regarding recreation activities became more numerous in the mid 1960s and 1970s. Manning (1999) states that these studies have commonalities; however, they all tend to fall in one of three general categories: studies of general leisure behavior (Bishop & Ikeda, 1970; Driver & Knopf, 1977; Neulinger & Breit, 1971; Potter, Hendee, & Clark, 1973; Ritchie, 1975; Witt & Bishop, 1970), exploratory analysis of motivations for recreational activities (Hendee, Clark, & Daily, 1977; Moeller & Engelken, 1972; Towler, 1977), and conceptual and empirical studies of Driver and Associates (Driver & Cooksey, 1977; Driver & Knopf, 1977; Knopf, Driver, & Bassett, 1973; Manning, 1999). These three general categories are collectively referred to as the Behavioral Approach where recreation is defined as “an experience that results from recreation engagements” (Driver & Toucher, 1970).

To better understand recreation as a set of psychological experiences, an approach to define visitor use and users in the context of recreation, a definition of an individual’s subjective experience will be employed. This approach to outdoor recreation was first conceptualized by Driver and associates. It represents a shift from focusing primarily on recreation activities to a focus on providing appropriate

conditions for satisfying recreation experiences (Driver & Toucher, 1970). This approach to understanding and managing recreation recognizes that the motivation people seek to satisfy through recreation activities can be fulfilled by a wide variety of recreational activities (Mannell & Iso-Ahola, 1987). People engage in activities in specific settings to realize a set of psychological outcomes that are intrinsically known, expected, and valued by the individual (Manning, 1999). Thus, people select and participate in recreation activities in certain settings to meet certain goals or satisfy certain intrinsic needs (Manning, 1999). An activity such as dispersed camping can be undertaken in a variety of environmental, social, and managerial settings. In the domain of dispersed camping activities, the visible human-cause characteristics that comprise the setting and their effects on the intrinsic judgments of individuals is where this investigation is concerned.

Natural Resource Damage as a Management Challenge

Wildland settings are largely natural and management strives to maintain a natural appearance. Resource managers need to understand recreation impacts in sufficient detail to determine how much and what kind of change is occurring and is acceptable (Cole & Schreiner, 1981). Dispersed camping is defined as camping anywhere in the National Forest outside of a designated campground created by the managing agency (USDA Forest Service, 2007). Dispersed campsite locations are “user-created”; that is, these campsites are created in natural areas by users (i.e., visitors) for the purpose of camping. User-created campsites are not directly managed for recreation use by the managing agency. User-created campsites are typically created along access routes such as trails or roads; however, these user-created locations of

recreation often exhibit impacts as a direct result of recreation use. Hammitt & Cole (1998) state that recreation use tends to be *dispersed* (i.e., unmanaged) and that wildland recreation, in particular, depends on greater importance of the natural setting's qualities for dispersed recreation activities than it is in *developed* (i.e., managed) recreation settings. Camping use in these types of natural settings tends to be dispersed but spatially clustered among access routes, thus creating a social environment with less emphasis on certain types of social interaction where user-created campsites are concerned (Hammitt & Cole, 1998).

Depreciative Behaviors

Depreciative behavior is an action in which an individual or a group of individuals engage in activities that have consequences (e.g., negative ecological impacts as a result of vandalism) as a result of these actions (Gramann & Vander-Stoep, 1987). Depreciative behavior as a concept was first studied in the late 1960s to the 1970s. During this time, several studies examined depreciative behaviors in the form of vandalism, the social significance of vandalism, and the psychological significance of vandalism (Zimbardo, 1973, 1976). The depreciative behavior concept is derived from the Theory of Reasoned Action (TRA). This theory assumes that humans as reasoning animals systematically utilize and process information available to them (Ajzen & Fishbein, 1980; Fishbein, 1980; Fishbein & Manfredo, 1992). Ajzen and Fishbein (1980) claim that human social behavior is generally not controlled by unconscious motives or overwhelming desires, nor do they claim that it can be characterized as impulsive or thoughtless (Chandool, 1997). They in fact argue that people consider the implications of their actions before they decide to engage or not to engage in a given

behavior (Chandool, 1997). Fishbein and Manfredo (1992) also claim that for some behaviors and intentions, attitudinal considerations may be more important than normative behaviors, whereas the reverse may be true for other behaviors and intentions. For example, a camper may hold a positive attitude toward cleaning up trash from a user-created campsite but may perceive social pressure from their peers not to completely clean up and naturalize (i.e., dismantle the fire ring, clean up human waste, or replace/rehabilitate damaged vegetation) the user-created campsite. According to TRA, a person's intention to engage in a behavior is a function of two determinants, one personal in nature and the other reflecting social influence. A person may hold a large number of beliefs about an object (e.g., a user-created campsite); however, that person can attend to only a relatively small number of beliefs at any given time—these beliefs are referred to as *salient beliefs*. Salient beliefs are determinants of a person's attitude (Chandool, 1997). Ajzen and Fishbein claim that to understand why a person holds certain attitudes or perceptions toward an object (e.g., a pristine natural setting), it is necessary to access their salient beliefs about that object.

Studies closely examining people's perceptions regarding the environmental affects of vandalism have come out of the depreciative behavior literature. A study examined the effects of human-caused impacts on intertidal zone coastal ecosystems in the Pacific Rim National Park and Reserve (PRNPR)—specifically, human-caused impacts as the result of depreciative behaviors (Alessa, Bennett, & Kliskey, 2003). The study measured depreciative behavior, the attitudes, and perceptions to ecosystem resiliency among visitors to the PRNPR. The study found that visitors who perceived high ecosystem resilience in the intertidal zone engaged in significantly more behaviors

eliciting biological cost than those who perceived low ecosystem resilience (Alessa et al., 2003).

Another study examined how an appeal for help to report observations of littering events (i.e., depreciative behaviors) in a Forest Service campground would affect public involvement in addressing littering (i.e., visible visitor-caused impacts) as an undesirable activity (i.e., a depreciative behavior) (Christensen, 1981). In over 75% of the littering trials where littering was observed, some type of reaction from the visitors was observed. For example, visitors could react in more than one way; they could pick up a piece of litter and also report the violation or they could pick up the litter and deal directly with the violator. Picking up the litter was the primary reaction of most visitors (Christensen, 1981). Further, as the number of witnesses to littering increased, reactions to the rule violation decreased. Larger camping parties, however, reported littering less frequently and reactions to littering increased as the number of occupied sites nearby and visible to the subjects increased (Christensen, 1981). Moreover, the majority of camping visitors who reacted to the littering behavior also cleaned up their own sites. The results of this study suggest that when people are made aware of the negative consequences of visible visitor-caused impacts, they are more likely to react to these impacts.

In another study, researchers examined the problem of forest decline and the relationship between depreciative behavior and people's perceptions or values about the forest (i.e., natural setting) (Taylor & Winter, 1995). In this study, research participants were asked to list the three things they liked most and the three things they liked the least about the forest recreation area. Respondents listed inaccessibility, inadequate

facilities, vandalism, and discomfort while in the forest as things they disliked the most about the forest setting (Taylor & Winter, 1995). Where depreciative behaviors or socially distracting behaviors were concerned, more than half of the respondents reported seeing depreciative behavior activities (e.g., litter, carving on trees, loud noises, rule violations, graffiti on natural features, campfires in undesignated areas, etc.) (Taylor & Winter, 1995). Furthermore, respondents were asked to identify depreciative behavior activities that were so bothersome, that they could not go unnoticed (e.g., litter at picnic sites, trampled plants, people picking flowers, plants, or catching animals, evidence of campfires in undesignated areas, etc.). Fifty percent or more of the respondents said that they were extremely bothered by seeing graffiti on rocks and trees, and by seeing litter along travel routes. Forty-four percent stated that seeing people smoking bothered them a lot (Taylor & Winter, 1995). Respondents were also asked to identify suggested penalties (e.g., fines, ask to leave the forest, verbal warning, arrest, or watch a film) for a list of depreciative behaviors and activities. Where camping and picnicking were concerned, 22% suggested a fine, 17% suggested asking the visitor to leave the forest, and 49% suggested a verbal warning (Taylor & Winter, 1995). The overall results of the study suggested that there is a relationship between forest visitors values about the forest, their personal perceptions of the recreation site, and depreciative behaviors (Taylor & Winter, 1995).

Several propositions can be derived regarding depreciative behaviors in the context of dispersed camping activities that manifest themselves as visible visitor-caused impacts in the natural setting. (1) As the need for social status increases, depreciative behavior increases. (2) As responsibility denial increases, depreciative

behavior increases. (3) As awareness of consequence decreases, depreciative behavior increases. (4) As depreciator cues (e.g., visible vandalism, litter, trampled vegetation, etc.) increases, depreciative behavior increases. (5) As awareness of rules decreases, depreciative behavior increases. (6) As perception of ecosystem resilience increases, depreciative behavior increases.

Dispersed camping and Off Highway Vehicle (OHV) use are common recreation activities in backcountry settings and are often interrelated activities; that is, they are recreational opportunities that go hand in hand. Both of these activities have significant potential to impact natural areas and cause resource damage where depreciative behaviors are concerned. These recreation opportunities are activities that can be solitary (i.e., an activity in which an individual can escape common social interactions) or are group activities (i.e., a party in a user-created campsite). The manner in which situations (e.g., visible visitor-cause impacts in a user-created campsite) are perceived is worth further investigation. Further, there is still more to understand about the particular components of the environment that influence social behavior. The social significance of depreciative behavior in the context of Recreation Ecology can be better understood in the context of unmanaged outdoor recreation.

Unmanaged Recreation

A relatively new concept as coined by Forest Service Chief Dale Bosworth (2003) is that of “unmanaged recreation.” Brooks and Champ (2006) define unmanaged recreation as “a broad environmental decision and management problem, involving multiple stakeholders and numerous outdoor recreation activities and conflicts, occurring simultaneously in and around urbanizing National Forests” (p. 785).

Unmanaged recreation presents a challenge to recreation researchers and natural resource managers because it is shrouded in extreme uncertainty, which results from disagreement over the definition of the problem, the strategies for resolution, and the outcomes of management (Brooks & Champ, 2006). In his 2003 speech, Forest Service Chief Dale Bosworth addressed unmanaged recreation as a management issue:

The fourth great issue is unmanaged outdoor recreation. In my 37 years with the Forest Service, I have seen a tremendous growth in the amount of recreation on the National Forests. Last year, we had 214 million visitors. . . and it's only going to keep on growing—we expect it to more than double by the end of the century. . . . The issue is this: Back when we had light recreational use, we didn't need to manage it; but now that it's heavier, we do. . . . At one time, we didn't manage the use of off-highway vehicles [OHVs] either. OHVs are a great way to experience the outdoors, and only a tiny fraction of the users leave lasting traces by going cross-country. But the number of people who own OHVs has just exploded in recent years. In 2000, it reached almost 36 million. Even a tiny percentage of impact from all those millions of user is still a lot of impact. Each year, we get hundreds of miles of what we euphemistically refer to as 'unplanned roads and trails'. . . . We're seeing more and more erosion, water degradation, and habitat destruction. We're seeing more and more conflicts [among] users. We're seeing more damage to cultural sites and more violation of sites sacred to American Indians. And those are just some of the impacts. (Bosworth, 2003)

Unmanaged recreation is considered to be one of the five major threats, viz. build-up of fire fuels, invasive species, loss of biomass and open space, and the effects of climate change facing not just the Forest Service, but all natural resource management agencies in the US. The potential impacts of unmanaged recreation are far-reaching and lead to potential user conflicts, risk to public safety, soil erosion, destruction of habit, and wildlife disturbances. The consequences of unmanaged recreation not only entail impacts to the ecosystem but, also loss of certain recreation opportunities in natural areas.

Recent trends in growing outdoor recreation participation show the magnitude of the challenge of unmanaged recreation. A 2000 survey showed that 202 million Americans over the age of 15 participate in some form of outdoor recreation, that is, 97.5% of the population (USDA Forest Service, 2004). Between the years 1983 and 1995, the percentage of Americans over the age of 15 who participated in active outdoor recreation sometime during the year grew from 32 to 56 % and travel to recreation destinations grew from 70 to 90 % (USDA Forest Service, 2004).

From 1946 to 2000, the number of National Forest System (NFS) visitors grew 18 times. In 2002, the numbers of visitors to national forests and grasslands reached 214 million. Another 215 million people drove through and/or stopped at overlooks and scenic pullouts to enjoy the vistas but did not use Forest Service facilities. As the United States (US) population is expected to more than double from 275 to 571 million by the next century (e.g., 2100), the number of visitors to NFS lands is expected to dramatically increase. (USDA Forest Service, 2004)

Resulting pressures on undeveloped natural land for recreation purposes due to growth in the US population will be moderate to heavy through most of the Western US and heavy through most of the Southwest and Rocky Mountain region (USDA Forest Service, 2004). The potential impacts of unmanaged recreation are far-reaching for both the natural resource and Recreation Ecology. Impacts include soil erosion, user conflicts, spread of invasive plant and insect species, damage to cultural sites, disturbance to wildlife, destruction of wildlife habitat, risks to public safety, and loss of recreation opportunities. All of these impacts can result from unmanaged recreation.

Unmanaged recreation is both a management challenge and is socially complex. How a group chooses to define a problem largely determines strategies for a resolution (Allen & Gould, 1986). Full understanding of visitors' values, their relationships with one another, other stakeholders, and the landscape further complicate the problem of

unmanaged recreation (Brooks & Champ, 2006). In his 2004 speech, Forest Service Chief Dale Bosworth states:

[Since] environmental legislation of the 1970s. . . we started moving toward a new ecosystem-based model of land management. The 1990s were a transitional period where we no longer focused primarily on timber production. . . [this transition] was necessary because both our landscape and our social needs are constantly changing. . . . Today, I believe we are in a new period—a period of ecological restoration and outdoor recreation. Maybe more than ever before, we focus on delivering values and services like clean air and water, scenic beauty, habitat for wildlife, and opportunities for outdoor recreation. These are the main things people today want from their public lands. We know that from our surveys and from talking to our partners and to people in our communities. (Bosworth, 2004)

Increasing population rates, demand for recreation opportunities, and increased urbanization adjacent to public lands, when combined with decreasing capacities to manage these lands, perplexes recreation planning and management, leading to situations of unmanaged recreation (Brooks & Champ, 2006). However, dispersed recreation activities (i.e., unmanaged) traditionally carry a sense of freedom and relaxation of regulations in the National Forests. In a sense, recreation on the National Forest is unmanaged when compared to recreation in a National Park. By contrast, National Forests allow many more “unregulated” recreational opportunities (e.g., motorized recreation, dispersed camping, hunting, etc.) whereas National Parks tightly manage these types of recreation activities. National Parks very rigorously manage many types of recreation activities by restricting most motorized recreation, not allowing dogs, and allowing camping in designated areas only—it is a very structured recreation management environment. Many people may prefer to use National Forests for recreation activities due to the inherent “freedom” of unmanaged recreation; however, incomplete information about the effects of increased recreation on public

lands exacerbate an already complicated situation for resource managers by introducing uncertainty and new challenges (Brooks & Champ, 2006). In his 2005 speech, Forest Service Chief Dale Bosworth goes on to say:

Population growth has to do with our growing consumption and the boom in outdoor recreation that is outstripping our management capacity. . . . Today, the Forest Service is squarely in the business of outdoor recreation. Since 1946, the number of visitors to the National Forests and grasslands has grown about 18 times. In 2002, [the Forest Service] had more than 214 million visits, with about the same number driving through just to enjoy the scenery. As I mentioned, these number are only going to grow as our population grows. . . . You don't have to go far to see it. I could show you [picture] after [picture]—[OHV] tire tracks running through wetland; riparian areas churned into mud; [stream and river] banks collapsed and bleeding into streams; ruts in trails so deep you can literally fall in; and sensitive meadows turned into dustbowls... [The challenge of unmanaged recreation] won't be easy. There's hardly an issue I can think of in National Forest management today that is as contentious and emotionally charged as this one. But that makes it all the more important to try—all the more important to succeed—because this is only part of a much bigger picture. (Bosworth, 2005)

If increased recreation is not well managed, it can cause resource degradation. Natural resource management agencies must understand how much recreation an area can absorb before the resources are negatively affected. Management solutions based on minimizing ecological and social impact alone cannot sufficiently address the inherent subjectivities and divergent goals that are convoluting the unmanaged recreation problem (Brooks & Champ, 2006). In the case of user-created campsites, visible human-caused impacts that are the direct result of unmanaged recreation activities must be examined for their role in Recreation Ecology. Understanding the social context of the problem of unmanaged recreation are prerequisite to managing multiple stakeholders in ways that enable them to collectively address impacts to the land, natural resource protection, and sustainable outdoor recreation (Brooks & Champ, 2006). Regarding the problem of unmanaged recreation, more complete understanding

is needed about recreation visitor's values and relationships with one another and the land (Brooks & Champ, 2006).

Visible Human-caused Impact from User-created Campsites

The social logic of a given natural space (i.e., space syntax) is best described as a research framework that investigates the relationship among human societies and space from the perspective of a general theory of the structure of inhabited space in all its diverse forms, including the natural landscape (Bafna, 2003). Human societies use space as a key and necessary resource (i.e., a setting) in organizing themselves (e.g., recovery from Direct Attentional Fatigue). In doing so, the space of inhibition is “configured” or “altered”, that is, turning the continuous space into a connected set of discrete units, viz. a fire ring, nails in trees for hanging personal items, and make-shift amenities (e.g., pit toilets) in a user-created campsite. Converting a space to a discrete configuration is functional because diverse labels can be applied to its individual parts; these parts can then be assigned to different person-groups, individuals, or recreational activities (e.g., differing rules of behavior can be associated with different parts of the natural space) (Bafna, 2003). Individual parts of the natural space can then be recognized as carrying specific symbolic or cultural meaning.

People are often aware of global (i.e., first order effects) environmental impact issues; however, they are often less aware of impacts at the local (i.e., second order effects) and very-fine scales, which are those of most immediate concern and challenge to resources managers (Alessa et al., 2003). Impacts may be severe at the scale of a user-created campsite but negligible at the scale of the whole landscape. That said, site-scale impacts are not inherently less important than landscape-scale impacts. In a

Recreational Ecology context, impacts become good or bad, important or insignificant, only when humans make values judgments about those impacts (Hammitt & Cole, 1998). Generally, visitors to natural areas seem to be more concerned with impacts that decrease the functional use of a site or with “unnatural” features left by other parties (Hammitt & Cole, 1998). Several studies seek to examine how impacts, specifically human-caused impacts, affect the ecology (Bratton et al., 1982; Dasmann, 1972; Fenn, Gogue, & Burge, 1976; Hammitt & Cole, 1998; Stankey et al., 1985; Zabinski & Gannon, 1997), aesthetics (Bourassa, 1988; Cole & Schreiner, 1981; Farrell et al., 2001; Frissell, 1978; Herzog, 1984, 1985; Herzog, Chen et al., 2002; Horton & Pavlowsky, 2004; Lynn & Brown, 2003; Nelson et al., 2001; Ribe, 1994; Ulrich, 1983), and cultural meaning (Adamopoulos, 1982; Chandool, 1997; Christensen, 1981; Floyd et al., 1997; Gramann & Vander Stoep, 1986; Hartig, 1993; Kaplan & Kaplan, 1989; Korpela et al., 2001; Manning, 1999; Taylor & Winter, 1995; Zimbardo, 1976) of natural landscapes.

Measurement of most types of recreation impacts can easily be done when the goal is to determine the degree or magnitude of environmental change; however, to assess the social significance and importance of recreation impacts is a different matter (Hammitt & Cole, 1998). In assessing the importance of any recreation impact, one also needs to understand the attribute that is being impacted as well as characteristics of the disturbance itself (Hammitt & Cole, 1998). In dealing with recreation impacts, natural resource managers must understand and balance the concerns of ecology, recreation, and social significance of various user groups (Hammitt & Cole, 1998). Impacts due to recreation use are exhibited by direct impacts at a given site where recreation use occurs. One of the most distinctive characteristics of recreation use is

that it is highly concentrated in nature (Hammitt & Cole, 1998). Further, the tendency for use to be concentrated within certain parts of a natural recreation area can be either good or bad (Hammitt & Cole, 1998). Consistent use distributions result in characteristic patterns of impact on individual sites such as trails and campsites and impacts at these locations are not static; they change over time (Hammitt & Cole, 1998). The most common recreational activity causing ecological impact in wildland recreation areas is camping (Hammitt & Cole, 1998). Hammitt and Cole go on to report:

According to a 1979 survey, camping ranked third, behind swimming and bicycling, among outdoor recreation activities. Cole and LaPage (1980) report that a national survey conducted in 1960 showed 3 to 4 million active camping households in the United States. This figure had grown to 12.4 million household by 1971 and to 17.5 million household by 1978. Camping grew at an average annual rate of 20 percent in the 1960s, 8 percent in the early 1970s, and less than 5 percent in the late 1970s. Much of the early interest in recreational impacts in the United States grew out of this rapid increase in camping during the 1960s. . . . Camping, including backpacking, almost doubled in rate of participation between 1960 and 1982 (Cordell, Bergstrom, Hartman, & English, 1990). . . demand increases [for camping activities] seem evident. . . . The places most at risk today are the regularly used destination areas with numerous *potential* [i.e., dispersed user-created] campsites. (Hammitt & Cole, 1998, pp. 132-148)

Dispersed camping is considered an appropriate use of public lands except where posted otherwise. Dispersed camping occurs in natural areas that are “exterior” of the more managed developed campsites and campgrounds that are actively monitored and maintained by natural resource agencies. Advantages to dispersed camping are a sense of solitude, peace, and even adventure. In most natural areas managed by natural resource agencies there are, however, limitations or “drawbacks” to dispersed camping. For example, during certain times throughout a season, fire permits may be required. Visitors are encouraged, or even expected, to utilize water purification techniques or pack in their own water. When selecting a location for camping, visitors are required to

camp at least 100 feet (i.e., ~30.5 meters) from *any* water source. Dispersed camping also lacks common facilities present at many developed campground such as toilet facilities, garbage services, and carefully designed buffer zones that mitigate impact to an aggregate of campsites (USDA Forest Service, 2007). Dispersed camping is distinct from developed or “managed” camping in that, dispersed campsites are “user-created”; that is, campsite location, spatial distribution, and area of impact are created by the users, not the managing agency. As such, areas where dispersed campsites are created also exhibit moderate to severe levels of visible visitor-caused impacts. It is in the context of dispersed camping that the remaining discussion will be focused.

Site-level Impacts

Impacts of recreation use in natural areas where soils are concerned are more complex than one may initially believe. Hammitt and Cole (1998) identify several key claims related to the impacts of recreation use on soil regimes. First they propose that soils are actually alive with macrobiotic (i.e., biotic) organisms and activities. Biotic activity is most concentrated in the A1 soil horizon (i.e., slightly below the surface). Interactions between living organisms, rock, air, water, and sunlight are forms of “soil maintenance” (Dasmann, 1972). Second, different types of soils (e.g., sandy, clays, and silts) have different properties and are therefore affected in different ways by the amount and intensity of recreation use. Soils that are loose and porous have low bulk densities. Fine textured soils are of particular importance where aeration can be affected by trampling. For example, clays and silts hold more water but less air than sands and can remain waterlogged for a long time, which in turn reduces air available for plant growth. Recreation use (e.g., trampling) decreases the total porosity (i.e., void

spaces in a material) and macroporosity, though macroporosity tends to be less affected. Third, organic matter can improve the structure of soils of various textures. The most erosive soils are homogeneous-textured soils, particularly those that are high in silt or fine sand but also low in organic matter. The reduction of water infiltration rates is the most important environmental consequence of soil compaction. As compaction increases, soil moisture usually decreases, which is a consequence of the loss of organic matter in soils. The composition of soil microbial communities can affect the competitive outcome among plants, thus altering species composition and affecting a species' ability to colonize an area; that is, recreation use changes the structure and function of soil microbial communities (Zabinski & Gannon, 1997). Overall, soil compaction occurs rapidly with even light use. The magnitude of organic matter loss varies with amount of recreational use, recreational activity involved, and environmental conditions. As recreation use increases, soil bulk density (i.e., compaction) increases; as recreation use increases, organic matter decreases; as recreation use increases, soil moisture decreases—simply put, recreational use impacts soil (Dotzenko, Papamichos, & Romine, 1967). However, Hammitt and Cole also state that the relationship between recreation use and soil erosion is indirect; that is, other causes such as wind and water, which are the two most significant erosional forces, are also factors.

Impacts of recreation use in natural areas where vegetation is concerned is perhaps more visually apparent than impacts on soils (though the two are related). Hammitt and Cole (1998) identify several propositions related to recreation use impacts where vegetation is concerned. Both vegetation and organic matter serve to moderate

temperatures, keeping them from getting too high during the day or too low at night thus, providing “comfortable” recreation opportunities such as camping. They explain that plants with different growth forms respond differently to recreation use. They extend this to state that most vegetation types have a vertical structure that consists of a number of horizontal strata. They claim that there are three important and distinct strata: the ground cover layer, shrubs and saplings, and mature trees. Ground cover, in particular, is profoundly impacted by visitor use, particularly trampling affects. Trampling has direct and indirect affects on the ground cover. Even though there is evidence that the growth of a few vegetation species is actually stimulated by low levels of trampling, most species exhibit reduced abundance, height, vigor, and reproductive capacity on recreation sites. Soil compaction resulting from trampling inhibits germination, emergence, and establishment of new *native* planets. Recreation-caused loss of vigor and death occur most commonly where soils are thin and/or droughty or where trees are thin-barked and particularly susceptible to decay. Tree seedlings are particularly sensitive and readily killed when trampled. Removal of saplings from the immediate vicinity of campsites is cutting off the source of new trees to replace the current overstory when it eventually succumbs to old age. Changes in species composition is usually evaluated by reporting difference in the cover of all individual species, either over time or between recreation sites and undisturbed controls. These changes lead to a reduction in species richness and almost always occur where recreation use levels are high; that is, as recreation use increases, species richness decrease, though Hammitt and Cole (1998) also point out that vegetation with reduced stature is commonly found at the periphery of campsites and along the edge of trails.

They also note that most impacts occur to the shrub and sapling layer as the result of either damage caused by Off Highway Vehicles (OHVs) or by conscious removal.

Other impacts that are a result of recreation use are consumptive in nature.

Firewood gathering, for example, has several implications regarding Recreation Ecology. A study conducted in the Great Smokey Mountains National Park (GSMNP) examined the effects of human trampling and firewood gathering on eight backcountry campsites (i.e., dispersed or user-created campsites) a posteriori (Bratton et al., 1982). Results of this study showed that the actual activity of gathering the firewood itself was not a significant source of impact; however, trampling as a result of searching for firewood did have significant impact affects. Intensive human trampling in the center of the sites inhibited reproduction of ground cover and tree saplings, whereas firewood gathering alone did not (Bratton et al., 1982). Stem counts were significantly reduced and injuries to trees increase tenfold from control areas to the center of campsites. Furthermore, there were more cut stumps in the impacted plots than in the control sites, the number of stumps was the same for central, transitional, and firewood gathering areas. The ground fuels (e.g., naturally “downed” tree branches) showed a significant decrease relative to impact. They also identified that the depletion of litter (e.g., organic matter such as small twigs and leaves) and woody fuels within and around campsites suggest that the nutrient cycles may be impacted. They also found that injuries to trees increased tenfold in areas where user-created campsites had been established. Finally, they identified that reduction in basal area at the center of the sites was statistically significant; however, standing dead stem basal area was not significantly reduced by trampling and firewood gathering. Overall, they propose that trampling effects due to

firewood gathering activities is a significant source of artificial vegetation openings (i.e., visible human-caused impacts); however, the firewood gathering activity itself had a less significant effect on the landscape in backcountry recreation settings.

Impacts associated with campfires, generally speaking, are small and locally concentrated; however, firewood gathering and removal can greatly increase the area of disturbance around user-created campsites. Burning firewood in a user-created campsite disturbs a relatively small and concentrated area, but the effects are more serious. Fires alter the organic matter to a depth of approximately 4 inches (i.e., 10.16 centimeters) and destroy 90 % of the organic matter in the surface inch of soil (Fenn et al., 1976). Overall, fire use impacts result in sterilization of the soil, which in turn inhibits the growth of vegetation, and requires 10 to 15 years for complete recovery (Cole & Dalle-Molle, 1982). Though the impacts of fire use in a user-created campsite can contribute to site degradation, it is a common use and therefore an associated impact as a result of recreational activities in natural settings.

Site-level impacts can have long-lasting effects on the physical and aesthetic characteristics of a natural setting, especially where user-created campsites are concerned. However, some ecologists question the importance of recreation impacts because they tend to be confined to concentrated linkages (e.g., legally designated travel routes) and nodes (i.e., a user-created campsites). The views of resource managers and visitors differ in their perceptions of what acceptable recreation impact is (Martin & McCool, 1989). As such, resource managers need to understand visible visitor-caused impacts in sufficient detail to determine how much and what kind of visible visitor-caused is occurring and is acceptable (Hammitt & Cole, 1998).

Desirable Impacts

Impacts due to recreation use can alter the physical characteristics of natural areas; however, some impacts are desirable or even go unnoticed by users. A 5-year study that examines visitor impact on newly created campsites found that visitors did not perceive physical campsite impacts (Merriam & Smith, 1974). Hammitt and Cole (1998) and Manning (1999) suggest that some visible human-caused impacts are actually desirable in backcountry settings. They support this claim in light of evidence found in several studies that examine the importance or significance of impacts perceived by visitors (Franklin, 1987; Knudson & Curry, 1981; Martin & McCool, 1989). Hammit and Cole argue that most visitors do not even notice ecological change and may not conceive of changes as environmental damage or undesirable change. Manning claims that preferences for existing campsite conditions were nearly unanimous among campers surveyed in a 1973 study. Moreover, Manning suggests that visitors tend to define natural areas in terms of what the visitors use them for rather than the purposes for which the natural areas may have originally been designated.

Manning (1999) points out that, in general, backcountry visitor attitudes and preferences seems to indicate that (1) most visitors favor resource use limitations, (2) most visitors do not favor prohibition of campfires, (3) most visitors do not favor a policy requiring use of designated campsites, (4) fireplaces and picnic tables are generally not preferred at campsites whereas fire rings are, and (5) the majority of visitors favor the presence of rangers. This indicates that there are in fact visible visitor-caused impacts that tend to be preferred or even desirable by visitors to natural areas.

A study that examines the perceptions and evaluation of campsite impacts observed by wilderness campers in the Mt. Jefferson Wilderness located in Oregon was conducted (Farrell et al., 2001). This study sought to identify how the perception of wilderness campers was being affected by impacts (e.g., vegetation loss, soil impacts, damage to trees, etc.) at wilderness campsite locations. Fifty-one groups of wilderness campers participated in the study. This study found that 75% of the groups did in fact notice vegetation impacts, 52% noticed soil impacts, and 51% noticed damage to trees (Farrell et al., 2001). However, this study also found that more than 70% of the comments about the campsite conditions were positive related to functional benefits of certain impacts (Farrell et al., 2001). However, this study is limited to campsite impact conditions in a wilderness setting. User-created wilderness campsites typically do not exhibit the more severe impacts that backcountry campsites do. Further, visitors that tend to use wilderness for camping typically are less prone to engage in depreciative behaviors (e.g., vandalism, littering, motorized used off designated routes, etc.) that leave lasting scars on the natural landscape.

Understanding when visible visitor-caused impacts become such deterrents to a natural settings' perceived restorative character is important for backcountry environments where use is generally moderate to heavy, where more frequent and more diverse visitor groups tend to recreate, and where recreation is widely dispersed. Moreover, understanding why visitors would be concerned or give notice to more extreme impacts (e.g., visible visitor-caused impacts) at user-created campsites (i.e., resource degradation as a result of depreciative behaviors) is important for sustained

environmental aesthetics and perceived restorative quality in natural settings where camping activities occur.

Visitor Perception of Resource Degradation

Human activities can affect several key attributes of ecosystems (Hammit & Cole, 1998). Differences between visitor's and managerial evaluations of human-caused impacts present considerable challenges for selecting and successfully implementing management policies (Farrell et al., 2001). Further, how a group chooses to define a problem largely determines strategies for resolving the problem (Allen & Gould, 1986). Visible visitor-caused impacts are a problem faced by natural resource managers; however, the literature suggests that visitors may not notice or perceive visible visitor-caused impacts as a problem. Studies that examine visitor's perceptions of resource impacts have found that visitors do indeed perceive impacts when the impacts are moderately to extremely visible (Bourassa, 1988; Christensen, 1981; Farrell et al., 2001; Frissell, 1978; Gramann & Ruddell, 1989).

In a report sponsored by the National Park Service (NPS), investigators examined visitors' perceptions of resource degradation in Padre Island National Seashore, Texas during the winter and summer use seasons. The purpose of the report was to provide evidence that winter and summer visitors perceived resource damage as a result of recreational activities. The report found that a significant amount of visitors perceived resource damage as the result of over-use (Gramann & Ruddell, 1989). The perceived "seriousness" of natural resource damage was delimited in to 12 categories including vegetation trampling, litter, and areas created by heavy concentrated use, viz. examples of visible visitor-caused impacts.

The results of the report found where vegetation trampling was perceived as serious resource damage, 22.4% of the winter research participants ($n=487$) perceived vegetation trampling as a moderate to extremely serious problem and 23.8% of the summer research participants ($n=471$) perceived vegetation trampling as a moderate to extremely serious problem. Where litter left by other visitors was perceived as serious resource damage, 45.5% of the winter research participants ($n=500$) perceived littering as a moderate to serious problem and 54.5% of the summer research participants ($n=477$) perceived litter as a moderate to serious problem. Where areas created by heavy concentrations of users were perceived as serious resource damage, 40.2% of winter research participants ($n=497$) perceived these areas as a moderate to extremely serious problem and 41.5% of summer research participants ($n=475$) perceived these areas as a moderate to extremely serious problem. The investigators found these results to be statistically significant especially where litter, vandalism, and worn areas were concerned (Gramann & Ruddell, 1989). The investigators summarized these findings and go on to say:

If visitors are damaging [the natural] resources because they feel they have no reasonable choice, providing reasonable options to the damaging behavior is an important key to reducing [these types] of [problems]. . . any factor that negatively affects just one of the major [resource] uses will have impacts on a large proportion of the visitor population. (Gramann & Ruddell, 1989, pp. 154-155)

Understanding how visible visitor-caused impacts are perceived by visitors to natural areas is important for the continued quality of the recreational activity. Several reasons that support this claim are identified in the literature. First is that some kinds of impacts create cycles of impact (e.g., user-created OHV trails damage the vegetation, compact the soil, and promote severe erosion). Second is that impacts do not occur in

isolation; that is, single activities cause multiple impacts, and each impact tends to worsen or compensate for other changes (Hammit & Cole, 1998). Third is that impacts tend to feedback on themselves and increase the impact (e.g., a fire pit becoming a trash dump site).

Human activities can affect several key attributes of an ecosystem; they can affect the structure and spatial arrangement of the parts of ecosystems and, in turn, affect the overall function of the ecosystem. The literature suggests that impacts are seen in ways that are good and ways that are bad. If visitors see and judge impacts as a problem, then it stands to reason that visitor's perceptions of the perceived restorative character of impacted natural areas can be affected thus, reducing the restorative potential of a given natural setting. Studies have shown that reduced satisfaction can be linked with reduction in scenic beauty (Atkinson & Birch, 1972; Fishbein & Ajzen, 1974; Gramann & Ruddell, 1989; Manning, 1999). Finally, the acceptability of visible visitor-caused impacts is a function of both the ecological significance of the visible alteration and the human perception (Hammit & Cole, 1998). Hammit and Cole state "in addition to concern with the physical ability of the resource to sustain use, there is an equally important concern with the effect of use on the recreational experience of the user" (p. 14).

Summary of Recreation Ecology in the Wildland Recreation Literature

Visible human-caused impacts affect the ecological, aesthetic, and psychological quality of natural settings. Minimizing human-caused impacts in natural settings is a management concern. It has been found that some human-caused impact tends to be preferred by visitors to natural areas; however, when visible human-caused impacts

become so great that they become a distraction in a natural setting, they can reduce the restorative potential of the natural setting. It stands to reason that as the amount of visible human-caused impacts vary in a natural setting, so will the judgments about the perceived restorative character of these natural settings.

Conclusion

The purpose of this study is to examine the relation between the effects of visible visitor-caused impact (i.e., user-created campsites) on the judgments about the perceived restorative character of natural settings. The literature has suggested that some impacts are desirable; however, the literature also suggests that noticeable and excessive visible visitor-caused impacts can affect judgments about the perceived restorative character of a natural setting. Increased future use is a valid reason for identifying a limit of acceptable change (LAC) for severely impacted user-created campsites, avoiding future management problems, and an increased understanding about people's perceptions of the restorative character in impacted natural settings. Results of these analyses can be used to examine and set LAC in these natural areas.

Hypothesis

The literature review discussed above warrants an exploratory investigation to study the effects of visible visitor-caused impacts on judgments about the perceived restorative character of natural areas. The hypothesis tested will be that judgments about the perceived restorative character in natural areas declines with increased visible visitor-caused impacts.

H1: As visible human-caused impact (represented by *CUA Condition Class*) increases, judgments of perceived restorative character decreases.

CHAPTER III

METHOD

The purpose of this study is to examine the effects of visible visitor-caused impacts on the judgments of the perceived restorative potential of user-created campsites in natural areas. This chapter will describe the methods used to address the research hypotheses. Sections in this chapter provide methodological details including a panel of judges who rated photographs for amounts of visible visitor-caused impacts and measurement of judgments about the perceived restorative character, being away, fascination, coherence, and compatibility at natural sites exhibiting varying levels of human-cause impact. Procedures for data collection, data analysis, and a description of a pilot study are also discussed.

Research Participants

University students were used as the research participants in this study. Students are often used as research participants in visual management research. Although such samples are nonrandom, in this kind of research, inferences are often not made from samples to populations but, rather, study results are generalized to relations among constructs as they might appear in formal propositions (Martin & Sell, 1979). In the context of restorative environments research, university students are both convenient and relevant. Student research participants draw much of their relevance because university student populations are especially prone to high levels of attentional

fatigue. For this study, research participants were students taking classes in the Department of Geography and Department of Parks, Recreation, and Tourism at the University of Utah.

Photo Set

Scene imagery for this study was created by the researcher by using a Digital Single Lens Reflex (DSLR) camera with a specialized spherical panoramic mount to collect imagery necessary to create Quick Time Virtual Reality (QTVR) cubic panoramas (i.e., spherical panoramas) using a specialized photo stitching software package. Spherical panoramas are three-dimensional digital representations of a scene wherein an interpreter can view the entire scene by panning, zooming, and rotating the scene from its isovist. The isovist of each spherical panoramic image for this study was selected at the center fire ring of the user-created campsite. Use of spherical panoramas was advantageous for this study because the researcher could create a sense of motion for the interpreter by “driving” the spherical panorama during the elicitation session.

To create the spherical panoramic imagery, the researcher revisited several mapped user-created campsites ($n=30$) on the Uinta-Wasatch-Cache National Forest, Salt Lake Ranger District located in the Stansbury Management Area (SMA). These user-created campsites were previously mapped ($n=104$) by the researcher for *Concentrated Use Analysis* (CUA) using Global Positioning Systems (GPS) and Geographic Information Systems (GIS) technologies. During CUA, each user-created campsite was evaluated for various levels of impacts. While in the physical location, a posteriori of the user-created campsite, photos of the user-created campsite were collected. Moreover, attribute values describing the user-created campsites’ ecological

conditions were populated using a data dictionary. These attribute data are of fundamental importance for capturing descriptions of the user-created campsite in their spatial and temporal context; divorced from their spatial context the attribute values lose their value and meaning (Bailey & Gatrell, 1995). Finally, during a user-created campsite evaluation, a CUA Condition Class was calculated for the level of human-caused impact at a user-created campsite.

The 30 revisited user-created campsites were selected for spherical panoramic photography based on a number of variables: spatial distribution, assigned *Concentrated Use Analysis Condition Class* (CUACC) values, and spatial dependencies (i.e., spatial autocorrelation) (Christensen, 2007).

Spatial data analysis involves the accurate description of data relating to a process operating in space, the exploration of patterns and relationships in such data, and the search for explanations of such patterns and relationships (Bailey & Gatrell, 1995). Spatial dependency is a concept in geographic study that is interested in physical or conceptual entities that are spatially near each other and often share similarities with nearby entities than others that are further apart. This is similar to Tobler's first law of geography defined by Bailey and Gatrell (1995) which states that "everything is related to everything else, but nearby objects are more related than distant objects" (p. 45). To examine spatial dependency where user-created campsites are concerned, spatial dependency could be due to at least three possibilities. One is that there is a simple spatial correlation relationship; that is, whatever is causing a user-created campsite with a high or low degree of visible visitor-caused impacts in one location also causes similar types of user-created campsites in nearby locations. A second possibility is spatial causality; that is, something at a given user-created campsite location directly influences nearby user-created campsite locations. For example, lack of resource management and education of the impacts of human-caused impacts tends to contribute to increased visible visitor-caused impacts (i.e., more impact on existing user-created campsite, or creation of new user-created campsite) due to the lack of management, education, and when necessary, enforcement of resource regulations. A third possibility is spatial interaction; that is, the movement of something (e.g., people, recreation opportunities, releaser cues, etc.) creates apparent relationships among user-created campsite locations. (Christensen, 2007, p. 3)

Of the 30 spherical panoramas that were collected at the revisited user-created campsites, 5 were selected for the pilot study based on spatial statistical analysis (i.e., identified spatial dependencies) using the Moran's-*I* statistic to measure for spatial autocorrelation. The measurement was based on both the user-created campsite spatial location, the assigned attribute values among all the mapped user-created campsites ($n=104$), and the 30 revisited user-created campsites' CUACC value in a GIS. The panoramas of the five user-created campsites identified in locations by the Moran's-*I* test of spatial dependency (i.e., which user-created campsites were both spatially distributed throughout the SMA and exhibited a normal distribution based on their CUACC) were used to elicit judgments about the perceived restorative character of the user-created campsites from research participants in a pilot study.

Pilot Study

Prior to data collection, a pilot test was conducted as an initial test of the study's procedures. Forty resource managers participated in the pilot test. All were resource managers with the USDA Forest Service Uinta-Wasatch-Cache National Forest. Frequencies and other descriptive statistics were examined for information that might suggest modifications to the study's design and measurement.

The pilot study participants viewed five digital spherical panoramas and responded to 26 items on a questionnaire for each panoramic (for a total of 1040 responses). The spherical panoramas were displayed digitally on a projection screen from a computer. The five spherical panoramic images were selected based on the level of impacts recorded at the time the site was mapped and photographed based on the user-created campsite's CUACC. The CUACC is determined at the site by ocular

examination of impacts such as soil exposure from trampling, vegetation coverage, proximity to water sources and routes (e.g., roads, trails, etc.) (Frissell, 1978). When the site is evaluated, it then receives a CUACC value ranging between 1 and 5, 1 being low impact, 5 being high impact. One spherical image representing each CUACC along the 5-point scale was selected from 30 spherical panoramic images collected for the study to elicit responses from the pilot study participants. Each image for each respective CUACC was rearranged prior to administering the pilot study; that is, the order in which each image was presented to the research participants was changed irrespective of its 5-point CUACC value.

The researcher panned (i.e., rotated) one spherical panoramic image at a time as the research participants collectively viewed each image and filled out a separate questionnaire for each spherical panoramic image. It took approximately 12 to 15 minutes for each participant to complete the questionnaire. Each spherical image was rotated approximately two and a half times during each elicitation session. After administering the pilot study, it became apparent that the participants would begin to experience fatigue after approximately 30 minutes or by the time they evaluated the third spherical panoramic image. Consequently, a refined 12-item version of the Perceived Restorative Scale (PRS) developed by Ruddell and Bennett (2004) was used in the actual study.

Also, the spherical imagery selected for each CUACC value presented some challenges for capturing the levels of visible visitor-caused impacts at each site. In addition, the less than desirable lighting conditions and the shape and size of the room presented viewing difficulties for those seated in the back of the room. Some research

participants commented that the ambient light was too bright to allow them to see the spherical image on the projection display. They also commented that the relative size to the image display made it difficult to see the spherical image. Furthermore, many of the research participants commented on “similarities” among the user-created campsite panoramas. The research participants commented that differences among vegetation types, vegetation content, and other image characteristics made determination of certain questions on the PRS difficult to answer. As such, an alternative method for sorting the 30 panoramas was used. To select spherical panoramic imagery from the 30 collected image sets that best captures the varying levels of visible visitor-caused impact along the 5-point CUACC scale, a Q-sort method was administered. Moreover, the viewing environment was more tightly controlled for optimal lighting conditions and viewing distance in the actual study.

Measurement

Research participants responded to five ($n=5$) spherical panoramic image sets that showed varying degrees of human-caused impacts at user-created campsites. The spherical panoramas showed varying levels of visible visitor-caused impacts. Participants assessed each spherical panoramic image for restorative character by using items from a modified version of the Perceived Restorativeness Scale (PRS) (Ruddell & Bennett, 2004). This instrument is a 14-item version of the longer 26-item PRS developed by Hartig et al. (1996). It also improves on the original PRS by altering the wording of some items to create parallel structure and increased clarity. Items on the 14-item PRS can be found in Appendix A. Items were rated by using a 7-point Likert-type scale with the following response categories: 0 = not at all, 1 = somewhat disagree

2 = slightly disagree, 3 = neutral, 4 = slightly agree, 5 = somewhat agree, and 6 = very much so. Cronbach's Alpha coefficients across the panoramas ranged from 0.92 to 0.94 (Table 1). Consequently, a composite restorative character score was created by averaging across the 14 items. The 14-item PRS can be found in Appendix A.

Operationalization of Visible Visitor-caused Impact Index

Visible visitor-caused impacts was operationalized in this study by a combination of a Q-sort procedure and previously assigned CUACC values along a 5-point Likert scale to each spherical panorama. CUACC values range across a 5-point scale, 1 being little or no impact, 5 being very high impact. The CUACC values are as follows:

Class 1: Campsite barely distinguishable. Soil surface only slightly disturbed. Vegetation cover and organic litter barely altered. Often a campsite that has not seen recent use.

Class 2: Campsite apparent, effects confined. Soil surface has been cleared of large stones and branches where primary activities occur. Vegetation and organic litter has been lost or trampled. Obvious effects concentrated and tapered towards boundary.

Table 1. Cronbach's Alpha Table

<i>Cronbach's Alpha Table</i>	
Condition Class	Cronbach's Alpha
CUA Condition Class 1 Site 036	0.94
CUA Condition Class 2 Site 037	0.94
CUA Condition Class 3 Site 026	0.92
CUA Condition Class 4 Site 043	0.94
CUA Condition Class 5 Site 008	0.93

Class 3: Campsite obvious, effects throughout the dispersed site. There is a distinct boundary between the campsite and the undisturbed adjacent areas. Vegetation cover and organic litter are lost on much of the site. Primary area of activity is clear of any stones or gravel. Most gravel or stones are outside of primary activity area.

Class 4: Campsite obvious effects widespread. Distinct boundary exists between dispersed campsite and undisturbed area. Nearly complete or total loss of vegetation cover and organic litter. Bare soil widespread with little gravel or few stones present anywhere within boundaries.

Class 5: Campsite obvious effects widespread and condition greatly different from adjacent areas. Roots exposed, vegetation absent, and soil compressed. (Frissell, 1978)

Q-sort

In order to reduce an original set of 30 spherical panoramas to a smaller set to be used in the study, a panel of 13 interpreters participated in a Q-sort. The intent of the Q-sort was to verify that panoramas selected for rating based on condition class accurately reflected varying levels of visible human-caused impact. Most of the interpreters were not familiar with the restorative environments literature; however, all had engaged in camping and other outdoor recreation activities.

To do this, 30-8" x 11 ½" two-dimensional representations of the three-dimensional spherical panoramas were created by the researcher using a specialized map projection algorithm. The map projection algorithm is capable of converting a three-dimensional image space (e.g., a globe) to a "flat" (i.e., projected) image space (M. Waltermann, personal communication, July 13, 2006). The two-dimensional representations are necessary to view all the panoramas simultaneously. The resulting two-dimensional panoramas were then spread out on a table for sorting. This simultaneous viewing is more difficult to accomplish with the digital spherical

panoramas. A single interpreter would then take a turn sorting the panoramas in a five-round selection process—each interpreter completed this process one at a time. First, the researcher asked each interpreter to select from among the panoramas the scene that exhibited the most visible human-caused impacts in a panoramic. That selection was then coded on the back of the panoramic. The second selection involved identifying the scene that exhibited the least amount of visible human-caused impacts—again, the selection was coded on the back of the panoramic. The third selection involved identifying the next three panoramas that exhibited the most visible human-caused impacts. The fourth involved identifying the next three panoramas with the least amount of visible human-caused impacts. The fifth selection involved identifying the next five panoramas with the most visible human-caused impacts. The final sorting involved identifying the five panoramas with the least amount of visible human-caused impacts. Composite scores across the interpreters enabled the panoramas to be ordered in a normal distribution of scenes ranging from most to least amount of visible human-caused impacts in the scenes and ensured representations of a range of visible human-caused impact.

Following the Q-sort, in consultation with an expert in Recreation Ecology and restorative environments research, five panoramas were selected as representations of environments with varying levels of human-caused visible impact for ratings of restorative character. Selection criteria were results from the Q-sort that preserved the CUA condition class ratings for the sites. As an example, sites 008 and 043 were consistently selected by the Q-sort panel as the most impacted sites. Site 008 already

had a condition class rating of 5. Consequently, site 008 was retained for use in the study. Examples of the five panoramas are shown in Appendix B.

An interesting result of the panoramas identified for use in the current study by the Q-sort method is that the five user-created campsites are relatively close to one another in spatial context as compared with the other user-created campsites that were mapped for this study (Figure 4). The five sites identified by the Q-sort are all within an area of approximately 4 square miles (i.e., 6.6 kilometers²) in the study area. That the sites selected by the Q-sort interpreters should occur in such close proximity is an interesting side note.

Procedures

On the day of the study, the researcher arrived at the end of class and was introduced by the class instructor. The researcher distributed to each student (i.e., research participant) (1) a questionnaire cover letter, (2) five copies of the 14-item questionnaire, and (3) an electronic presentation of the five digital spherical panoramas. Research participants were then asked to read the questionnaire cover letter that explained the following: (1) the purpose of the study, (2) why this study was investigating restorative environments, (3) how confidentiality was protected, (4) what research participants should do if they would not like to answer a certain question, (5) how long it would take to complete the questionnaire, and (6) information on how to contact the principal investigator with any questions they may have had regarding the study. The researcher also read the items above aloud to the research participants and concluded by asking if the research participants had any questions regarding the study. One warm-up spherical panoramic was used to allow for respondents to become

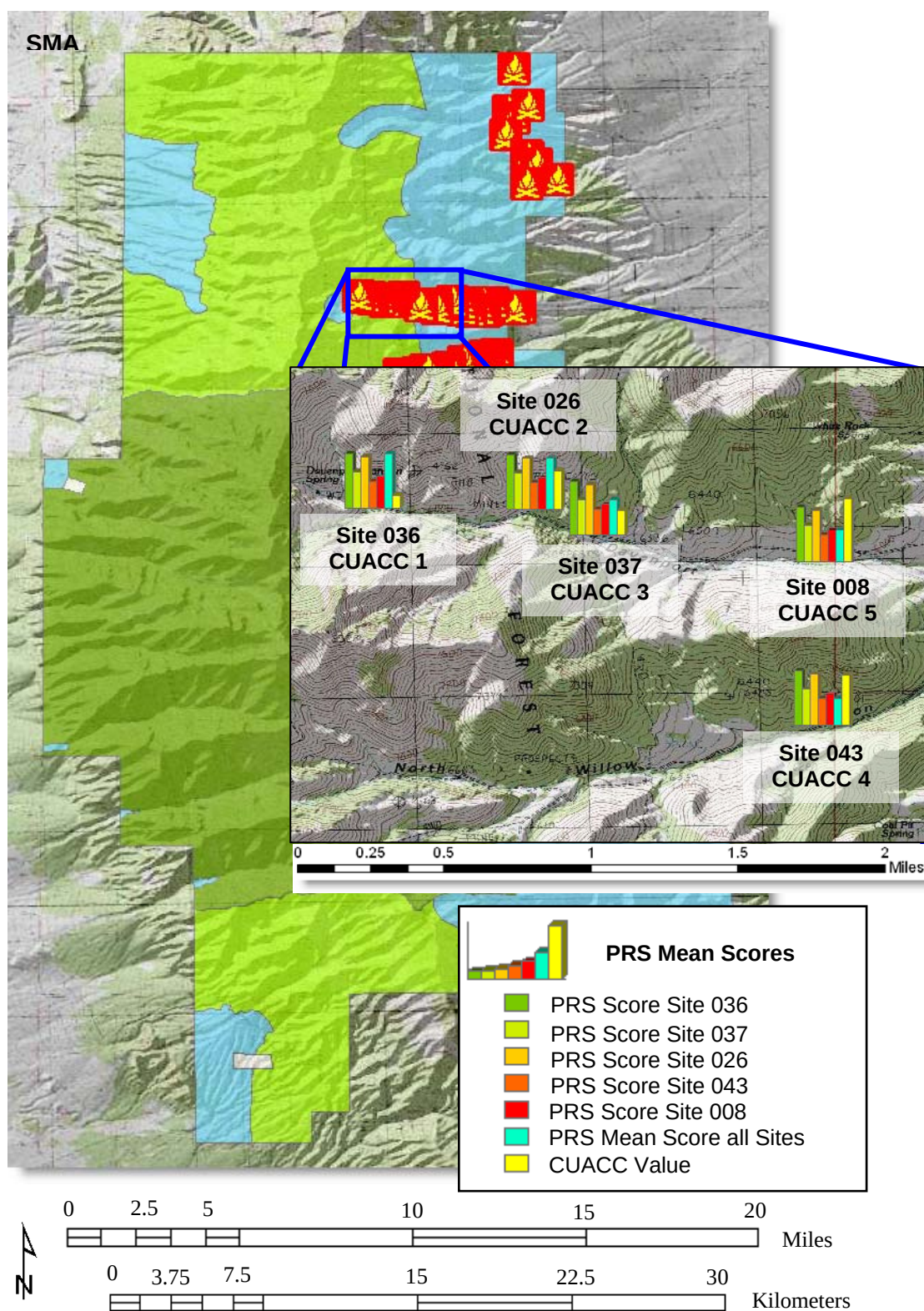


Figure 4. Study site locations identified by Q-sort method

familiar with both the environments they would be rating and the rating instrument. The five spherical panoramas the participants responded to varied in levels of visible visitor-caused impact. The questionnaire contained Perceived Restorative Scale (PRS) items (e.g., being away, fascination, coherence, and compatibility) and restoration items. Prior to administering the experiment, PRS items were randomly placed on the questionnaire. The spherical panoramas were displayed from a projector onto a large projection screen. Because the panoramas required a digital display and specialized display software, a computer was used to control (i.e., zoom, pan, and rotate) the spherical panoramas during each elicitation session. Initial ordering of the panoramas was based on random selection. Subsequent panorama presentations were counterbalanced by changing the rotation direction and display sorting for each panorama relative to the initial sorting to control for order effects. In addition, direction of panning was varied with the first panoramic presented from right to left, panning the second panoramic left to right, panning the third right to left, panning the fourth left to right, panning the fifth right to left.

Data Analysis

Data were entered into the Statistical Package for the Social Sciences (SPSS) and postprocessed (i.e., cleaned). Because the research design was a repeated measures design with a high likelihood of substantial intraclass correlation (i.e., Person Level Effects), Hierarchical Linear Modeling (HLM) using HLM 6.0 software (Raudenbusch, Byrk, Cheong, Congdon, & deToit, 2004) was used to test the study's hypothesis. Observations represented level 1 variables along repeated measures of the PRS. CUA Condition Classes (CUACC), Person Level Effects (PLE), and laboratory environment

(e.g., a room in which the elicitation session is held) represented level 2 variables. Such group characteristics could account for differences in scores on the PRS. Person-like variables can cause intraclass correlations among research participant groups; that is, a person's own unique life experiences may affect how one rates any given item on the questionnaire. HLM 6.0 does not allow for missing values in the data matrix. Consequently, mean substitutions were made for missing values in this study.

CHAPTER IV

RESULTS

This study examined the effects of visible visitor-caused impacts on the perceived restorative character of user-created campsites in an arid wildland recreation setting. This chapter provides results of the data analysis that includes a summary of the descriptive statistics, a description of the panel of judges, and results of the hypothesis test.

Characteristics of the Sample

Photo elicitation sessions ($n=6$) were carried out in a lab setting during Spring Semester, 2009. Total cases that comprised the sample ($n=60$) viewed the image sets ($n=5$) and responded to a single 14-item PRS per image. Most of the research participants were male (65%), with a third of the participants being female (35%); the average age was 31 years, with a range from 18 to 62 years of age; and the typical student was a senior in class-standing. All of the participants were either students in the Department of Geography at the University of Utah or employees of the Remote Sensing Applications Center.

Descriptive Statistics

Central tendency statistics suggest that the restorative character score varied across condition classes. The range of means scores for restorative character was from

2.08 to 4.25 with higher scores generally belonging to less impacted scenes (Table 2). Distributions of restorative character across the CUA Condition Classes were typically normal as indicated by Skewness and Kurtosis statistics (Table 2). Skewness and Kurtosis statistics indicated fairly normal distribution across the five CUA Condition Classes with the range of scores being from 2.08 to 4.25. Distributions of the scores are shown in Figure 5, Figure 6, Figure 7, Figure 8, and Figure 9, respectively.

Hypothesis Tests

Hypothesis tests were conducted using HLM 6.0, a multilevel modeling program. HLM uses maximum likelihood regression procedures and models variables at multiple levels. In this study, level 1 variables were taken at the observation (i.e., judgments of restorative character on each item on each panorama). Level 2 variables represented person effects such as the respondent's age or year in school. When conducting hypothesis tests using multilevel modeling techniques, a null model containing only the intercept term and no variable is run. This model provides initial variance components for calculating the intraclass correlation coefficient and subsequent R^2_{PRE} statistics. The intraclass correlation coefficient is a measure of nonindependence of observations. Large intraclass correlations substantially bias parameter estimates upward and can result in type one errors. HLM makes adjustments for such bias and gives more accurate regression results. The R^2_{PRE} is an indicator of effect size. The variance components, intraclass correlation, and Model Chi-Square statistic for the null model are presented in Table 3. The large and significant chi-square statistic indicates that the null model is not an adequate fit to the data and further variables need to be added. The large intraclass correlation ($\text{ICC} = 0.16$) indicates

Table 2. Restorative Character Descriptive Statistics

Restorative Character Descriptive Statistics

Condition Class	Mean	SD	Skewness	Kurtosis
CUA Condition Class 1 Site 036	4.25	0.89	-0.67	1.72
CUA Condition Class 2 Site 037	2.84	1.03	0.09	-0.24
CUA Condition Class 3 Site 026	4.01	0.88	-0.55	1.09
CUA Condition Class 4 Site 043	2.08	1.08	0.74	0.88
CUA Condition Class 5 Site 008	2.44	1.07	0.49	-0.02

substantial nonindependence of observation and, in the case of this study, a large person effect.

The level-1 model in this study was a direct test of the study's hypothesis. This model examined the effect of visible visitor-caused impact (CUA Condition Class) on perceived restorative character. Results are summarized in Table 4. Table 5 is read by comparing each CUA Condition Class to CUA Condition Class five, the most visually impacted scene. CUA Condition Classes 1, 2, and 3 exhibited significantly more restorative character than did CUA Condition Class 5. CUA Condition Class 4 exhibited significantly less restorative character than did CUA Condition Class 5.

A summary of effect size is presented in Table 6. Condition class accounted for about 43% of variability in restorative character scores. Level-2 variables represented person-level effects. All were nonsignificant and were dropped from the final model.

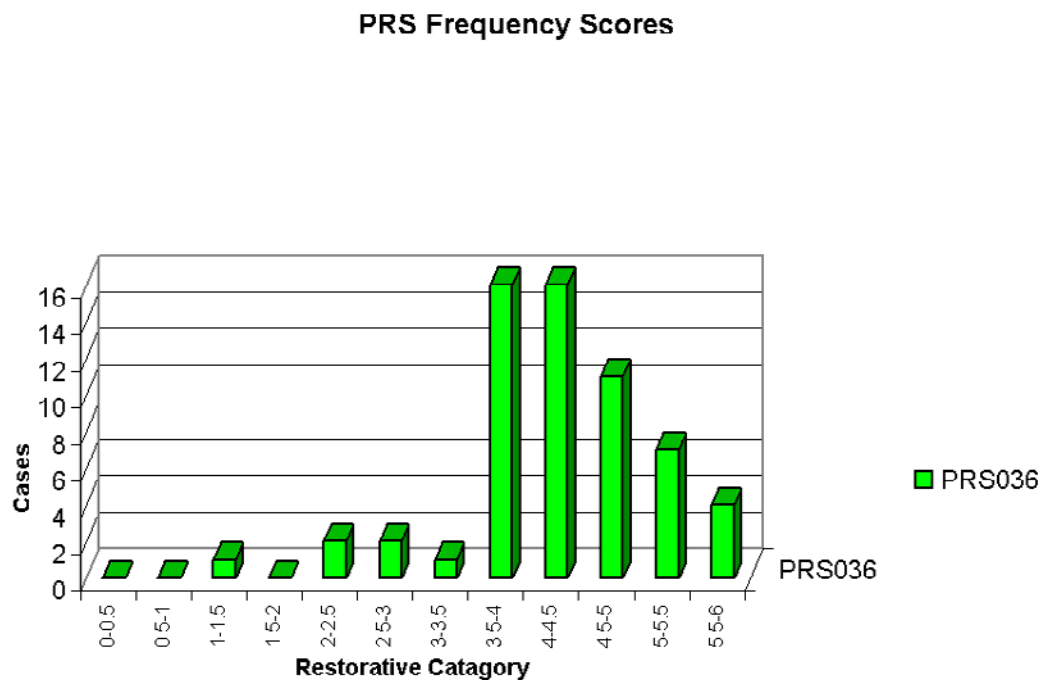


Figure 5. CUACC 1, Site 036

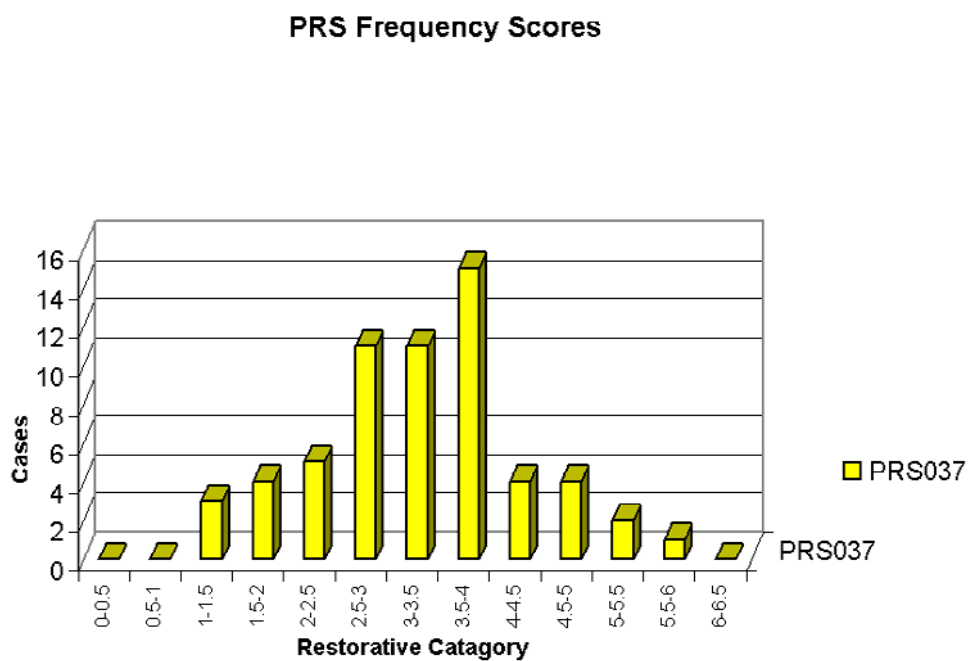


Figure 6. CUACC 2, Site 037

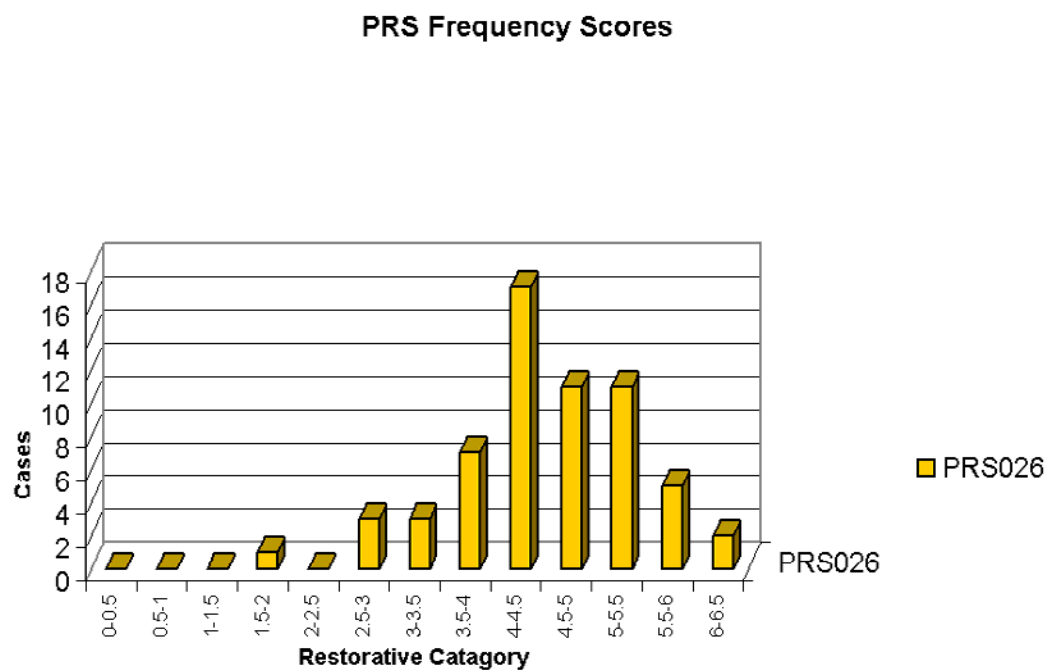


Figure 7. CUACC 3, Site 026

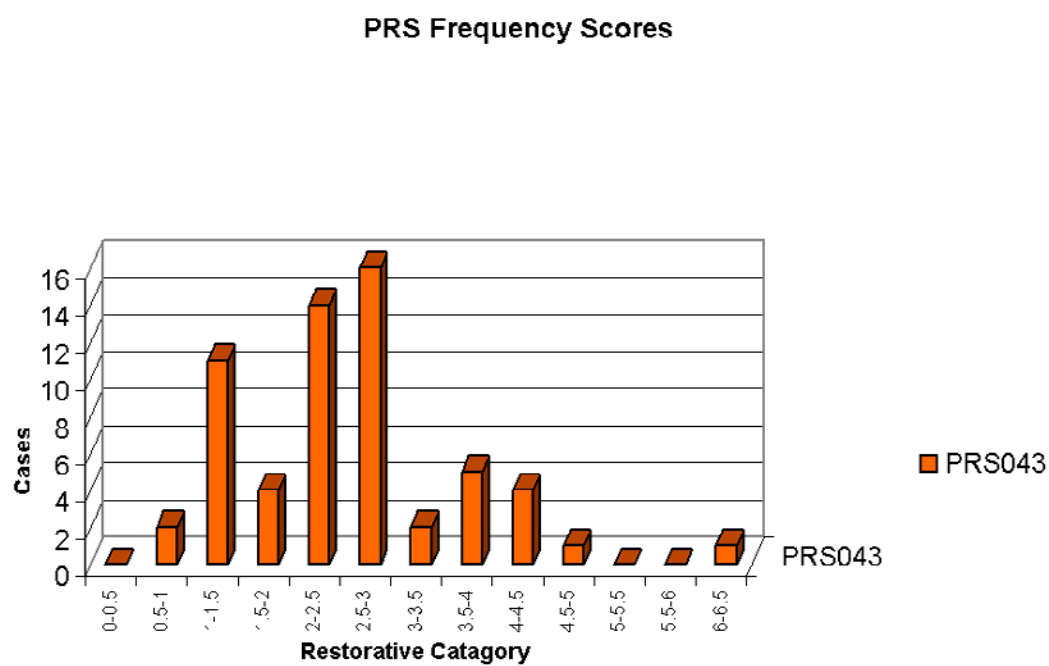


Figure 8. CUACC 4, Site 043

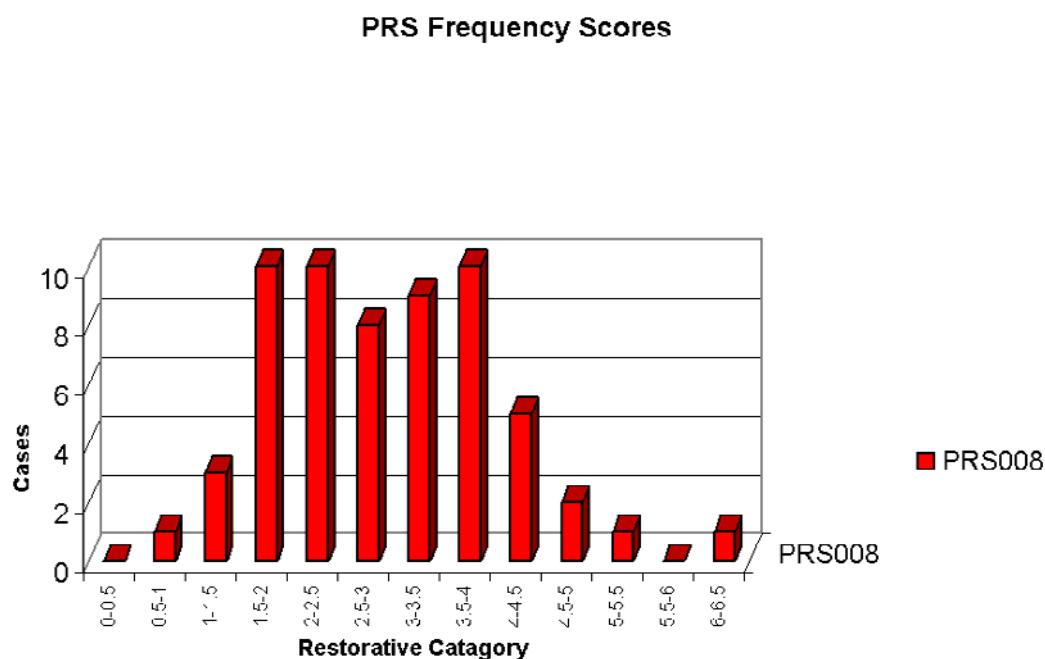


Figure 9. CUACC 5, Site 008

Table 3. Variance Components for the Null Model

Variance Components for the Null Model

Random Effect Level		SD	Variance Component	DF	Chi-square	P-value
Intercept 1	u_0	0.52	.27	59	114.33	<0.01
Level-1	R	1.20	1.44			

Interclass Correlation = 0.16

Table 4. Variance Components for Level-1 Model

Variance Components for Level-1 Model (regression of restorative character scores on condition class)

Condition Class		SD	Variance Component	DF	Chi-square	P-value
Intercept 1	u_0	0.67	0.46	59	311.30	<0.01
Level-1	R	0.72	0.53			

Table 5. Parameter Estimates for Level-1 Model

Parameter Estimates for Level-1 Model (regression of restorative character scores on condition class)

	Coefficient	Standard Error	T-ratio	P-value
Intercept	3.12	0.96	32.57	<0.001
CUA Condition Class 1	1.80	0.16	11.50	<0.001
CUA Condition Class 2	0.40	0.14	2.89	0.005
CUA Condition Class 3	1.57	0.13	12.07	<0.001
CUA Condition Class 4	-0.36	0.13	-2.69	0.008

Table 6. Summary Table

Summary Table

	R^2_{PRE}
Null	0
Level-1	.43*

*significant at $p < 0.001$

CHAPTER V

DISCUSSION

This chapter provides a discussion of the results of this study. The first section provides a summary of the purpose and results of the study. The second section integrates the results of this study with previous research. The third section addresses the challenges and limitations of the study. The fourth section discusses contributions of the study. The fifth and sixth sections discuss implications for practice and provide recommendations for future research. Finally, the seventh section provides conclusions of the study.

Summary of Purpose and Results

The purpose of this study was to examine effects of visible visitor-caused impacts on judgments of the perceived restorative character of user-created campsites in an arid wildland recreation setting. This study was situated with the theoretical framework of Attention Restoration Theory (ART) (Kaplan & Kaplan, 1989).

Based on the theoretical underpinnings and review of the literature, the hypothesis that restorative character of user-created campsites would be associated with human-caused visible impact was tested. This hypothesis was supported. Three of the four condition classes that represented lesser levels of impact than CUA Condition Class five exhibited significantly higher restorative character scores than did CUA

Condition Class five. No person-level variables were associated with restorative character.

Integration with Previous Research

The finding that judgments of perceived restorative character decrease in the presence of increased amounts of visible visitor-caused impacts is consistent with current propositions in the restorative environments and recreation ecology literature. Kaplan and Talbot (1983) and Kaplan (1984) speculated that the combination of the four components (being away, fascination, coherence, and compatibility) enable a restorative experience. For these authors, restorative experiences are most likely to occur when the quantity of each is high. Interestingly, it is unknown whether these four components of a restorative experience act in combination or independently to produce a restorative experience. Further, it is not known how the four elements of restorative character are differentially affected by the presence of varying degrees of visible visitor-caused impacts.

Being away includes experiencing a freedom from normal roles, expectations, goals, and urban cues. Natural settings, particularly wildland recreation settings, facilitate removing oneself from one's usual cares, routines, and social pressures. Being away from society and urban life affords mental space introspection and the re-evaluation of one's priorities and values. The common belief that the more removed from Western society, the more simplified, and more natural the environments the greater is the potential for a restorative experience. Interestingly, the results of the current study showed a discrepancy in the predicted order of restorative character scores based on CUA Condition Class. For instance, sites 037 and 043, CUA Condition Class

values 2 and 5, respectively, exhibited restoration scores that are not in the predicted order of the expected CUA Condition Class values.

These anomalies suggested that there are other visual cues influencing the research participants' judgments of the perceived restorative character in sites 037 and 043. Human behavior cues such as litter can increase perceptions of crowding and conflict (Titre & Mills, 1982). Urban cues similar to these examples are things that people "read" when the natural setting is adversely affected. Intuitively, such cues may compromise a visitors' sense of being away. They may serve as reminders of the greater human densities they left behind. For instance, site 048 (CUA Condition Class 4) exhibited various urban cues (e.g., toilet paper strung through trees) that seemed to decrease site 048's total restorative score in relation to site 008 (CUA Condition Class 5). Furthermore, site 037 (CUA Condition Class 2) had a lower restorative score than site 026 (CUA Condition class 3). Site 037 contained visual cues such as a wooden fence that surrounded the user-created campsite. These visual cues may have influenced participants' judgments of perceived restorative character in a way that is not in line with the expected CUA Condition Class scale. With respect to the element of being away as defined by ART, visual cues such as those mentioned remove one from the essential characteristic of being away. One of the goals of restorative experiences in natural environments is to get away from an impacted environment. By removing one's self from an impacted environment only to find one's self in another impacted environment, especially where a natural setting is concerned, defeats the purpose. This raises the question of what does the relation of impact do in terms of the elements of restoration?

Combining ART with recreation ecology within a wildland recreation opportunity context may support the claim that people have decreased restorative experiences in heavily impacted natural areas. It is possible to build on this theoretical framework by including additional variables with the rubric of ART and campsite condition class evaluation criteria. Such variables might include additional perceptual elements such as sounds, smells, and other sensory influences (e.g., ambient temperature, seasonality, social interactions, etc.) Exploration of these variables may add greater understanding to the association between judgments of perceived restorative character and visible visitor-caused impacts in natural settings.

Limitations

A few limitations of the study that may limit inferences drawn from the study are worth noting. Among these limitations may be the representativeness of the sample of stimuli used to represent level of human-caused visible impact. Of the entire CUA user-created campsite mapping inventory ($n=107$), and the subsequent revisited and re-photographed with spherical panoramic imagery ($n=30$), only five CUA sites were selected to be used in this study.

These five sites may represent an inadequate sampling of CUA Condition Class, thus raising questions regarding the *ecological validity* of the sample. That is, a single panoramic with each CUACC may not adequately represent the variability of restorative characteristics within each CUA Condition Class. Therefore, additional work should be done to validate reliability of the CUA Condition Class scale for representation of visible visitor-caused impacts. Furthermore, rather than on-site experiences, settings were presented as digital representations (i.e., digital spherical

panoramas). Such representations do not capture many characteristics inherent to the actual natural environments such as sounds, smells, temperature, person-environment interactions, etc. Although the digital representations are seemingly a useful technique for representing an isovist of a given natural setting (e.g., the center of a user-created campsite), it is important to note that the spherical panoramas used in the study's experiment only capture a single moment in time. The implications of this fact are that the spherical panoramas do not place the participant into a natural environment where other important cues (e.g., sounds, smells, sensations of temperature, and temporal passage) may act on the participants' perceptions. All panoramas can be classified as depicting settings of varying degrees of visible visitor-caused impacts in natural areas along the 5-item CUA Condition Class scale. To the degree that judgments about the perceived restorative character might be best associated with five classifications of visible visitor-caused impacts, the finding that judgments about the perceived restorative character decreases as visible visitor-caused impacts increases is limited to impacted scenes with these five classifications.

Moreover, limitations of the image set may be indicated by the idiosyncratic effect of the panoramas themselves on judgments about the perceived restorative character of the imaged site. The imagery captured a range of human-caused impact as measured by their assigned CUA Condition Class value. Yet, the panoramas used to elicit responses do not contain additional characteristics of the natural setting such as weather (e.g., a thunderstorm), variations in seasonality (e.g., fall or winter conditions), wildlife, other human social interactions (e.g., a group of nearby friends), or a sense of temporal enactment. The intent was to provide enough homogeneity within the image

set to eliminate nuisance variance. Despite measures taken to create spherical panoramas without these and other nuisance factors, results showed differences in predicted restoration scores among the CUA Condition Class values assigned to each user-created campsite. Among factors that may have accounted for differences in the predicted CUA Condition Class among the five user-created campsites may be the color tone of the setting, ground texture, and visual penetration. Brown hues, for example, can be associated with dryness and a threat to survival in the context of psychoevolutionary theories of landscape preference (Ulrich, 1983). Settings with brown versus green hues could have accounted for some variance in the restoration scores. Ulrich (1983) has also shown that uneven ground textures are associated with preference scores. Following from the same psychoevolutionary theories, the ground surface texture is a determinant in preference as ground that is uneven and rough does not lend to ease of mobility, whereas smooth, even textured surfaces allow for easy movement. The five panoramas identified by the Q-sort and subsequently used in the study do capture visible qualities of hue and texture in ideal outdoor lighting and weather conditions, thus allowing for visual representation of these qualities. All five panoramas exhibit strong blue skies, light to dark brown top soils and ground cover, as well as lush green surrounding foliage typical of a bright summer day (as apposed to a somber rainy day).

The sample of panoramas used in this study limited the kinds of hypotheses that could be tested and inferences that can be made to varying kinds of campsites in wildland recreation settings. For example, developed campsites may present cues that either mask impact or cause visible impacts to be interpreted as something other than

impact. Similarly, social definitions of developed campsites may act on impact perception in the same way. Thus, generalizing from scenes of user-created campsites to developed campsites should be made with caution.

Another limitation of the study is that the setting was limited to a naturally arid region rather than other environments such as densely vegetated or coastal settings. These settings may have characteristics that mask or hide several human-caused impacts (e.g., fallen leaf ‘litter’ that covers impacted soil or footprints washed away by an incoming tide). Densely vegetated natural settings in particular possess other characteristics that can obscure or “screen” visual penetration beyond the ecotone of a given natural setting. As visual penetration into near-view forest scenes (i.e., densely vegetated) increases, preference scores for the setting increases (Ruddell, Grammann, Rudis, & Westphal, 1989). Ruddell et al. explain that visual screening decreases preference for a setting. Much of this may be due to the reduced information gathering capacity that screening causes. Reduced information gathering capacities can be associated with negative affective states, thus reducing feelings of restoration. Although this does not pose a threat to inferences that restoration scores do not directly correspond with CUA Condition Class values, such differences may limit effect sizes associated with these variables that may have been found in a more heterogeneous image set.

An additional limitation of the study is that the interpreters who rated the panoramas were comprised of students and faculty members at the University of Utah or employees of the USDA Forest Service. The main limitation of this sample is that the respondents (primarily geography students) may have certain ways of reading a

landscape; that is, this sample may be more likely to see and interpret things (e.g., range use, soil erosion, built fencing, etc.) as impact than actual users of these sites. There are three reasons for this. Their training will make their eye more discriminating. They know what is and is not an impact. Second, they are self-selected into environmental disciplines and careers and thus may be more likely to react negatively to any impact they see. Third, the actual users of these sites may either (1) not be interested in restorative experiences at all or (2) their restoration may come from things other than the visual environment.

Moreover, the interpreters represent a convenience sample, thus, generalizing from the sample to a larger population must be made with caution. Further, this sample is probably in many ways unlike actual users of the depicted sites. Thus, generalizing from this sample to the population of users of the depicted sites should be done with caution. Future research might make use of user-created campsite users. However, such interpretation panels are common in environmental psychology and restorative environments research where the aim is to generalize from study results to relations among constructs (i.e., nomological validity) and less so in generalizing from samples to populations. For a review of the distinction between such descriptive versus formal approaches see Martin and Sell (1979). In spite of these limitations, there are a number of implications for advancing the study of human-caused impacts on the restorative character of natural environments.

Contributions of the Study

The present study tested the hypothesis that judgments of perceived restorative character will decrease when visible human-caused impacts increase. The results of this

study provide advances in the progress of Attention Restorative Theory (ART) and understanding in recreation ecology. This section will explore the present study's contributions to both the cross-disciplinary study of restorative environments and to the field of wildland outdoor recreation ecology.

Recreation ecology, with its focus on describing and documenting physical impact, tends to be atheoretical and tends to ignore the study of psychological responses to impact or benefits lost that might be associated with impact. Hammitt and Cole (1998) emphasize the idea that impacts, per se, are neutral. Our judgments about impact and how they relate to human values represent a different set of constructs. The present study sought to examine the effect of impact on a psychological variable (judgments of restorative character) and in doing so, embedded the study of impact within an environmental psychology framework. Such recontextualization of impact research opens the door for thinking about impact from theoretical perspectives often lacking in the recreation ecology literature. Such recontextualization also has the potential to link issues in recreation ecology to benefits gained or lost among recreation users.

Since the seminal work of Kaplan and Talbot (1983), authors have built on the concept of restorative environments. Key advances were made in the works of Korpela and Hartig (1996), and Herzog (1984) who identified perception of preference in natural settings and added clarification to the concept of restorative environments by separating antecedents and outcomes of preference in natural settings from perception itself. Following the foundation established by those authors, the present study offered a number of unique contributions to the understanding of perceptions in natural settings.

Furthermore, the works of Frissell (1978), Hammitt and Cole (1998), and Manning (1999) have also made key advances in the understanding of recreation ecology. These authors identified key concepts related to visitor behavior and recreation impacts in wildland recreation areas. Following the foundation established by these authors, the present study offered a number of additional contributions to the understanding of recreation ecology.

Although researchers have made noteworthy progress in the study of restorative environments and recreation ecology, one weakness of the cross-disciplinary restorative environments and recreation ecology literature is the failure to utilize a larger theoretical framework to explain judgments of perceived restorative character in wildland settings. The use of ART in the present study provided consistency between theoretical constructs and operational definitions in the measurement of judgments of the perceived restorative character in natural settings. Further, linking human-caused visible impact to the construct of restorative character allows for the development of propositions that fit nicely within ART. Operationalizing human-caused impact via CUA Condition Class affords the development of and testing of hypotheses that correspond to such propositions. The present study did this by showing the importance of varying degrees of visible visitor-caused impacts and focusing on the nature of the perceptions of restorative character in the impacted natural settings as they relate to natural resource management. Hence, the use of ART grounded perceptual judgments with the definition of restorative character in a theory that explained the formation of perceptions of restorative character in impacted natural settings.

By viewing judgments of perceived restorative character through the lens of ART, new avenues for impacts research might be opened. For example, some studies have focused on a setting's restorative character without taking visible human-caused impacts into account (Bodin & Hartig, 2001; Bratton et al., 1982; Cole & Dalle-Molle, 1982). ART directed the restorative character measure to account for the formation of judgments of perceived restorative character toward an object (i.e., an impacted natural setting of a user-created campsite) rather than merely evaluating the recreation impacts themselves that are cues of urban life.

The Perceived Restorative Scale (PRS) (Hartig et al., 1996) remains a widely-used tool for measuring judgments of perceived restorative character in various settings. However, many of the studies that report to have used this measure remain somewhat limited by their correlational nature. The present study is among only a few other studies (Farrell et al., 2001; Knudson & Curry, 1981; Lynn & Brown, 2003) that report to have measured visitor's perceptions of visible human-caused impacts in natural settings. The CUA Condition Class scale (Frissell, 1978) was a unique way to represent visible visitor-caused impacts while utilizing the PRS. It allowed for interpretation of the relative influence of visible impacts on each characteristic of a restorative environment (e.g., being away, fascination, coherence, and compatibility) in a single experiment which was a unique contribution of this study. However, one question that can be raised about the CUA Condition Classes is their generality. Although the CUA Condition Classes are a measure of global visible impacts, they do not capture whether an impact is intended (e.g., a fence built to discourage motorized vehicle use on vegetation) or a result of negligence. This raises an interesting subject, as the present

study measured judgments of perceived restorative character in user-created campsites, not developed campsites. It can be argued that developed campsites actually have more impact on natural settings as they are built for the purpose of providing visitors with convenient amenities (e.g., concrete slabs, installed iron fire rings, picnic tables, etc.).

Manning and colleagues (1999) showed that issues in outdoor recreation are conventionally dichotomized into environmental science concerns (e.g., ecological impacts) and social science concerns (e.g., crowding and conflicting uses); however, it was yet to be determined whether visible human-caused impacts had an effect on the judgments of perceived restorative character in natural settings. Although their analysis clarified aspects of the relationships between environmental science concerns and social science concerns, it did not specifically analyze the implications among the being away, fascination, coherence, and compatibility and visible visitor-caused impacts in natural settings. The results of the present study confirmed that increased visible visitor-caused impacts can affect a person's judgments of perceived restorative character in user-created campsites through a single experimental design. Further, this design allowed for testing other aspects of Frissell's campsite condition classes (1978) by virtual representation of user-created campsites using digital spherical panoramic photography. However, the population used in the present study was delimited to a small convenience sample (i.e., college students and USDA Forest Service employees). These research participants may have certain interpretations of landscape characteristics, that is, a certain way of reading the landscape. This raises the issue of conducting future research with a broader sample of the population.

Finally, the present study contributed further empirical support to an already well-established body of research in restorative environments (Kaplan & Kaplan, 1989; Kaplan & Talbot, 1983; Korpela et al., 2001) and recreation ecology (Hammit & Cole, 1998; Manning, 1999; Merriam & Smith, 1974) by distinguishing between visible visitor-caused impacts and judgments of the perceived restorative potential in natural areas using user-created campsites. This distinction becomes increasingly important within the context of wildland outdoor recreation. Along with the contributions listed above, the present study offers several contributions to outdoor education and natural resource management.

Implications for Practice

The present study utilized a formalized approach to the study of restorative environments and recreation ecology. Natural resource managers have acknowledged the importance of managing recreation impacts on public lands but are faced with the challenge to manage public lands for multiple uses. The present study offers a theoretically-based example of how visible visitor-caused impacts affect judgments of perceived restorative character in natural settings and offered empirical evidence that supports the study's hypothesis.

With a notable cache of work documenting the benefits of restorative environments, some wildland recreation researchers are turning their attention toward understanding the process or mechanisms whereby those benefits can be better achieved. Authors have found Awareness of Consequence (Gramann & Vander Stoep, 1986) messaging to be highly influential in reducing depreciative behaviors (e.g., leaving trash at a campsite, vandalism, user-created trail proliferation, etc.). There

appears to be growing interest in understanding the role that natural resource managers play in the process of wildland recreation opportunity and resource management—mainly resource protection from unmanaged recreation.

This study suggests ways in which visible human-caused impacts can influence judgments of the perceived restorative character in natural areas. Natural resource managers can positively influence visitor's perceptions by offering insight into how visible human-caused impacts can be reduced in frequently used areas. This can encourage appropriate behavior with prompt maintenance of the user-created campsites thus, improving restorative potential between visitors and the natural landscape. This may be a vital step toward a better understanding of the process through which judgments of the perceived restorative potential of natural areas are affected by visible human-caused impacts.

Managers may be reluctant to use visitor management tools at their disposal until it can be shown that human-caused visible impact is related to an important user benefit such as restorative character. This study showed such a link and may warrant managers using the tools at their disposal. The practical applications of this study can be framed around how to maintain and encourage proper visitor behavior in frequently used areas such as user-created campsites. Examples might include removing or restoring longstanding visible human-caused impacts (e.g., user-created OHV trails) to a preexisting natural state, thus improving the natural appearance of frequently used areas. This study suggests that such natural setting conditions should have high levels of restorative potential and yet should also have low levels of visible human-caused impact so that one's restorative experiences are not decreased by these impacts and

other urban cues. This can be a difficult management goal as visitors' wildland recreation ambitions tend to be very diverse; that is, some visitors may see a user-created campsite as a place to let loose and party.

There are implications concerning the most direct outcome of mitigating visible human-caused impacts in frequently used natural areas such as user-created campsites. Natural resource managers often communicate to visitors the importance of visitors practicing Leave No Trace (LNT) techniques (e.g., carry out what you bring in). Likewise, visitors will more often find themselves in a natural setting that can promote and enhance a restorative experience. Therefore, the natural resource manager's ability to inspire LNT practices among visitors or by using Awareness of Consequence messaging more frequently and effectively might influence an improved condition of frequently used natural areas (e.g., user-created campsites) by maintaining and encouraging low impact ethics in frequently used natural areas to better promote a restorative experience. Considering the psychological benefits of restorative environments (Kaplan & Talbot, 1983) and the literature discussed throughout this study, the results support the notion that restorative experiences in wildland recreation settings can influence decisions in regard to managing for unmanaged recreation and is worthy of attention.

Natural resource managers should be intentional about how the landscape is cared for by actively maintaining frequently used areas where unmanaged recreation is rampant. They should find appropriate ways to communicate how the effects of visible human-caused impacts can undermine a setting's restorative potential. Knowing what landscape elements increase a restorative experience is beneficial when selecting a place

to retreat to and recover from everyday demands. For example, when taking a trip to experience what the great outdoors have to offer, instead of encountering natural settings with large amounts of visible human-caused impact, management can take proactive measures that will provide a more restorative environment in frequently used areas.

Finally, knowing what settings promote a restorative experience is especially beneficial when determining how to maintain frequently used areas such as user-created campsites. Retreating to a setting that is high in restorative potential should help one escape from the everyday normalcy of life's demands and help to recover from effects of attentional fatigue. It should also provide attentional focus rather than an unpleasant state of dissonance due to high levels of visible human-caused impact—that which is high in natural restorative potential will provide the needed restorative experience.

Recommendations for Future Research

Researchers have made progress regarding the study of restorative environments and recreation ecology—this study supports those efforts. However, considerable work remains. Regarding this progress, it seems reasonable to conclude that the current conception of judgments of perceived restorative character acting within a visitor performs well as both a conceptual explanation of restorative experience potential and as a variable of interest within scientific studies. Foremost among the work that remains might be further investigation of the relationships among recreation participants and their desired recreation opportunities in respect to a natural restorative potential in the presence of visible human-cause impacts.

Kaplan and Kaplan (1989) and Hammitt and Cole (1998) offered an effective body of research for why these variables are distinctly different and suggest that each one contributes individually to explanations of restorative experiences natural settings—the present study supports this claim. However, there is also adequate reason to suggest that this relationship is worthy of further exploration. For example, previous definitions of campsite condition classes may not completely capture other important cues (e.g., other sensorial perceptions). The challenge might be resolved by the way one operationally defines these variables (i.e., include measures of other perceptual cues).

The present study advanced operational definitions of judgments of perceived restorative character and visible visitor-caused impacts in natural areas by specifying their orientation toward the potential of restorative character and the amount of visible human-caused impacts in natural settings, respectively. However, the relationships among the visible visitor-caused impact variables have not been empirically tested given these modified definitions. A future correlational study could clarify how these variables are related to one another by testing the research design in an actual natural setting.

This correlational study could be similar to other correlational restorative environment and recreation ecology studies (Bodin & Hartig, 2001; Farrell et al., 2001; Floyd et al., 1997). The researcher could design and administer a survey to wildland outdoor recreation participants in a natural setting. The survey could consist of multiple item measures of sounds, smells, and other sensations present in the natural setting (e.g., weather conditions, temperature, seasonality, etc.), and could ask research participants

to rate their actual judgments of perceived restorative character based on those attributes. A measure of influential environmental factors could also be collected and this would allow a researcher to explore the relationships between judgments of perceived restorative character variables and natural settings.

Future research might move beyond a photo elicitation session in the lab to a field-based survey of actual visitors using user-created campsites. Such research would allow for more direct inferences and more perceptual cues regarding the association between visible visitor-caused impacts and judgments of perceived restorative character in the presence of the actual campsite. For instance, a sample of visitors actually using user-created campsites *a posteriori* could be explored as opposed to a sample of potential visitors in a lab setting.

Before moving to a field experiment, it is appropriate to gain clarification regarding the relationship between the variables and to determine if the CUA Condition Class scale design is, indeed, an effective way to capture and represent aspects of visible visitor-caused impacts in natural areas. With the relationship between the variables further specified, it would be beneficial to determine the validity of the five condition class operational definitions used to classify the impact at user-created campsites. As mentioned in the limitations section, these five condition class definitions may fail to capture all that is involved with the visible visitor-caused impact variables. Perhaps a five category classification scheme of these variables is insufficient. Both of these issues could be explored by first establishing a multi-item (i.e., more classes) measure for the factors of campsite condition class, much like that of Frissell (1978).

Once the relationship between these variables is clarified, one way to ensure that each of the condition classes can be accurately represented in hypothetical scenarios is to conduct a validity check, that is, to evaluate the level of agreement among evaluators of campsite impacts where multiparameter (i.e., multiple attributes) campsite monitoring programs are employed (Glidden & Lee, 2007). In their study, Glidden and Lee showed that there were moderate to low levels of proportional agreement among campsite monitoring evaluators for certain campsite characteristics (e.g., tree damage, differences in vegetation cover, and vegetation on-site, etc.). The results of this study suggest that data collection protocol (i.e., proper and consistent campsite monitoring training) should be improved to increase the level of interobserver agreement among the campsite evaluators (Glidden & Lee, 2007). An additional method that could be employed is by using the Q-sort method. This could be accomplished by asking participants to interpret imagery of user-created campsites and then to complete the multiple item measure of CUA Condition Class at the user-created campsite. If participants recognize the varied levels of sounds, smells, and other perceptual cues, as they are operationally defined in the scenarios, then it would be reasonable to conclude that the scenarios are representing the CUA Condition Classes are, therefore, a useful measure of visible visitor-caused impacts in a natural setting context.

With this work complete, and depending on the outcomes, there would be justification to initiate a field experiment. The primary question involved in a field experiment becomes whether or not visitors can be trained to interpret visible human-caused impacts, including sights, sounds, and smells, and thereby influence participants' judgments of perceived restorative character in natural settings. A researcher could

facilitate this experiment by establishing a treatment condition in which one group of participants receives special training on how to interpret human-caused impact as positive or negative impact on the natural setting and a control group that receives no special training. At the completion of the field experiment, participants could complete measures of visible visitor-caused impacts and judgments of perceived restorative character and differences between the two groups of participants could be analyzed.

An important consideration for future research would be to measure judgments of perceived restorative character in developed campsites and compare the results with the current study. Visitors who use developed campsites may have very different perceptions of impact than do visitors that use user-created campsites or even wilderness campsites. Other important considerations in regard to the present study are the type of environment the study represented in the experiment (i.e., an arid environment). The present study found that as visible visitor-caused impacts get worse, judgments of perceived restorative potential also gets worse—would this hold true in other environmental settings such as a densely vegetated or forested region?

Furthermore, the data in the present study suggest that there are visual human-caused cues (e.g., fencing, toilet paper in trees, developed roads, etc.) that seem to influence judgments of perceived restorative character more than CUA Condition Class. Take, for example, the difference in the total restorative scores for each CUA Condition Class shown in Table 2. The overall mean scores for each condition class are not in the predicted order. CUA Condition Class 2 (site 037) and CUA Condition Class 4 (site 043) have overall scores that when compared with CUA Condition Classes 1 (site 036) and CUA Condition Class 5 (site 008), respectively, there is a pattern inconsistent with

the CUA scale. This seems to indicate that there is some visual component that is affecting judgments of restorative character beyond that of CUA Condition Class alone. The effect of such cues might be built more explicitly into future studies.

Future research might focus on building on the results of this study as well as reducing the limitations discussed previously. For instance, interclass correlation among research participants may be associated with certain judgments about landscape conditions (e.g., is a fence actually an impact); thus, it is suggested that future research should replicate this study using a larger and broader sample of the population. For instance, a sample including visitors actually using a user-created campsite could be more explored as opposed to research participants in a lab setting.

Finally, future research should be directed toward how visitors actually interpret human-caused impacts as impacts. It is suggested that visitors have the ability to interpret impacts as impact and frame their interpretation in the context of expected outdoor recreation goals (Bourassa, 1988; Christensen, 1981; Christensen et al., 1992). Thus, it is important to understand how the visible visitor-caused impacts describe the association between judgments of perceived restorative character in natural settings. Do visitors expect low visible human-caused impacts in natural settings? Do they want to have a true restorative experience in a natural setting in the presence of human-caused impacts? There are still many questions and concerns regarding the influence of visible human-caused impacts on the judgments of perceived restorative character in natural areas.

Conclusion

Beginning largely with the work of Kaplan and Kaplan (1989), researchers have focused considerable attention on understanding the restorative effects of built and natural environments. Following Kaplan and Kaplan's work, it took nearly 20 years for researchers to begin examining the effects of human-caused impacts on the perceived restorative character of natural settings. Through those years, authors working with this line of research have documented many positive and important outcomes of the restorative effects of natural environments. The large majority of this work examined the restorative effects of a natural environment and focused on natural resource visitors and natural resource managers because researchers believed restorative environments to be an important remedy for Direct Attentional Fatigue (DAF). This body of literature provided the foundation for the present study largely because there is no recognizable understanding of how human-caused impacts affect judgments of perceived restorative character in natural settings in the recreation ecology literature. Therefore, among the primary contributions of the present study are the recognition of outcomes associated with varying degrees of human-caused impacts on the judgments of perceived restorative character specifically where user-created campsites in natural settings are concerned.

This study attempted to explain how judgments of perceived restorative character in natural settings can be affected by increasing severity of visible human-caused impacts through the use of photo elicitation techniques. Situational context, participant gender, and participants' age (i.e., level-2 variables) did not influence judgments about the perceived restorative character of five user-created campsites

located in an arid wildland recreation setting. However, increasing degrees of visible visitor-caused impacts were found to influence decreased judgments of the perceived restorative character in these settings. Therefore, natural resource managers are encouraged to make conscious efforts to recover and maintain natural aesthetics in concentrated use areas in an effort to support and sustain recreation opportunities for future generations and perhaps influence low impact recreation use in these concentrated use areas. Whether or not visitors to public lands can be influenced to act responsibly and reduce as much as possible their impact on public lands is an increasing challenge. However, this study offers a strong theoretical foundation for showing how human-caused impact can influence judgments of perceived restorative character in natural environments.

APPENDIX A

QUESTIONNAIRE

The modified 14-item Perceived Restorative Scale (PRS) appears below. The items used to represent judgments of perceived restorative character were derived from the PRS designed by Hartig (1996, 1997) and modified by Bennett and Ruddell (2004).

Person ID code:_____

Day code:_____

Date:_____

What is your age?:_____

What year of school (circle one)?:

____Freshman

____Sophomore

____Junior

____Senior

____Graduate student (master's)

____Ph D. student (dissertation)

____Noncredit student

____Other

What is your gender (circle one)?:

Female

Male

How many years have you been engaged in wildland recreation?

How often do you engage in wildland recreation (check one)?

_____1 to 5 times per year

_____6 to 10 times per year

_____11 to 20 times per year

_____21 to 40 times per year

_____over 41 times per year

What is/was your college major?

Please read each question below. Circle the number (0-6) that most closely corresponds to the experience you had when you saw the landscape on the screen.

Site ID_____

Being away

BA_01: This place would help me to get away from it all.

Not at all 0 1 2 3 4 5 6 Very much so

BA_02: Being in this place would be an escape experience for me.

Not at all 0 1 2 3 4 5 6 Very much so

BA_03: Being in this place would help me to get relief from unwanted demands on my attention.

Not at all 0 1 2 3 4 5 6 Very much so

Fascination

FA_01: I would like to spend more time looking at the surroundings here.

Not at all 0 1 2 3 4 5 6 Very much so

FA_02: My attention is drawn to many interesting things here.

Not at all 0 1 2 3 4 5 6 Very much so

FA_03: For me, this place is fascinating.

Not at all 0 1 2 3 4 5 6 Very much so

Coherence

COH_01: This place has landmarks that would help me get around.

Not at all 0 1 2 3 4 5 6 Very much so

COH_02: Being in this place would be an escape experience for me.

Not at all 0 1 2 3 4 5 6 Very much so

COH_03: Being in this place would help me to get relief from unwanted demands on my attention.

Not at all 0 1 2 3 4 5 6 Very much so

Compatibility

COMP_01: Being here suits my personality.

Not at all 0 1 2 3 4 5 6 Very much so

COMP_02: I have a sense of oneness with this place.

Not at all 0 1 2 3 4 5 6 Very much so

COMP_03: I have a sense that I belong here.

Not at all 0 1 2 3 4 5 6 Very much so

Restoration

RES_01: Being in this place would make me feel restored.

Not at all 0 1 2 3 4 5 6 Very much so

RES_02: This place would help me feel restored.

Not at all 0 1 2 3 4 5 6 Very much so

APPENDIX B

PHOTO SET

Spherical Panoramic, Davenport Canyon: 036 = CUACC 1. Collected 08.24.2007



Figure 10. Site 036, CUACC 1, Miller Cylindrical Projection



Figure 11. Site 036, CUACC 1, Spherical Panoramic North-facing



Figure 12. Site 036, CUACC 1, Spherical Panoramic South-facing

Spherical Panoramic, Davenport Canyon: 037 = CUACC 2. Collected: 08.24.2007



Figure 13. Site 037, CUACC 2, Miller Cylindrical Projection



Figure 14. Site 037, CUACC 2, Spherical Panoramic North-facing



Figure 15. Site 037, CUACC 2, Spherical Panoramic South-facing

Spherical Panoramic, Davenport Canyon: 026 = CUACC 3. Collected: 08.24.2007



Figure 16. Site 026, CUACC 3, Miller Cylindrical Projection



Figure 17. Site 026, CUACC 3, Spherical Panoramic North-facing



Figure 18. Site 026, CUACC 3, Spherical Panoramic South-facing

Spherical Panoramic, North Willow Canyon: 043 = CUACC 4. Collected: 8.26.2007



Figure 19. Site 043, CUACC 4, Miller Cylindrical Projection



Figure 20. Site 043, CUACC 4, Spherical Panoramic North-facing



Figure 21. Site 043, CUACC 4, Spherical Panoramic South-facing

Spherical Panoramic, Davenport Canyon: 008 = CUACC 5. Collected 8.24.2007



Figure 22. Site 008, CUACC 5, Miller Cylindrical Projection



Figure 23. Site 008, CUACC 5, Spherical Panoramic North-facing



Figure 24. Site 008, CUACC 5, Spherical Panoramic South-facing

APPENDIX C

THE STUDY'S GIS

Perceived Restorative Scale and Concentrated Use Analysis

GIS Project in the Stansbury Management Area

Detailed Mapping and GIS Project Report, 2006

GPS Data Collection and Processing

To collect Concentrated Use Analysis (CUA) data and take inventory of dispersed campsites (i.e., user-created campsites) a Trimble data dictionary for CUA was created in spring 2006. The CUA data dictionary was then tested during a pilot study to identify necessary refinements. With these refinements identified, the CUA data dictionary was uploaded and tested using Trimble mapping-grade Global Positioning Systems (GPS) technology. An initial field test of the updated data dictionary was conducted on the Logan Ranger District on June, 24, 2006. The purpose for the initial field test was to ensure the inclusiveness of the CUA attributes and the overall measures necessary to properly map dispersed campsites. Each field mapper used a GPS data collector on site and conducted the inventory. To ensure that each field mapper was properly calibrated to attribute a dispersed campsite, populated attributes were compared and discussed. Several modifications of the data dictionary were identified and incorporated into the final data dictionary to be used for the CUA inventory.

Once the field mappers were calibrated and techniques for mapping the dispersed campsites were practiced (e.g., collecting ground photos for each campsite while operating the GPS receiver), the CUA inventory was ready for field GPS data collection. Procedures for mapping the dispersed campsites include traveling to,

identifying (i.e., previously unmapped campsites, primarily in the Stansbury Management Area), and locating (i.e., navigating to previously mapped campsites on the Logan Ranger District) each dispersed campsite. Upon completion of this testing and calibration phase, the field mappers were assigned to project areas. For the remainder of this discussion, the author will discuss mapping techniques and results for the Stansbury Management Area (SMA) on the Salt Lake Ranger District as this is the study area.

Traveling to each dispersed campsite required the use of motorized trail bikes. Use of the trail bikes allowed the author to travel to each dispersed campsite in a time efficient manner. Dispersed campsites that are in close proximity (i.e., could be seen when driving by) to roads and trails were selected for CUA inventory. At each dispersed campsite, the author would open a point feature defined in the CUA data dictionary and collect GPS position estimates (which automatically “average” as a result of using a data dictionary). While GPS data were collected, the author would attribute the point feature based on ocular observations at the dispersed campsite. When attributes were compiled for the point feature, the author would take one to three digital photos of the campsite for inclusion in the final Geographic Information Systems (GIS). When necessary, the author would also collect a short video clip on the campsite showing a 360-degree view of the dispersed campsite that were also for use in the final GIS.

GPS “not-in-feature” (i.e., a GPS tracklog) data were collected during the 2006 CUA inventory. These data were used for “monitoring” purposes during the CUA project. The GPS not-in-feature data provide several advantages on top of traditional

GPS mapping techniques. First, the GPS not-in-feature data serve to provide a “bread crumb” trail of the routes explored during the CUA project. Several attributes that are included in the GPS not-in-feature data that are of great value for subsequent GIS analyses are velocity records, GPS time and date values, and feature geometry. These data, in particular, are among several of the valuable data collected and stored in the GPS not-in-feature data.

Second are the time and date data that are associated with the GPS not-in-feature data. These data can be used with the Tracking Analyst extension in ArcGIS to analyze time and movement patterns during the CUA project. Travel pattern analysis can be used in a variety of ways regarding the CUA mapping project. Resulting not-in-feature data can be converted to linear GIS features that can be used to determine the total distance covered during the CUA project. It can be used to analyze velocities at any give location in the GIS feature as well as a map layer to show subsequent CUA surveyors territory that was covered during the initial CUA inventory and identify the best routes to travel in future CUA mapping.

Third, and quite possibly of the greatest value, is the ability to use the GPS not-in-feature data to create hyperlinked “multimedia” data that can integrate with the CUA GIS other computer applications like an Internet browser or a third party application (e.g., Google Earth). Using a software application called GPS Photolink, an analyst can quickly and easily create very “easy to use” data that can be viewed in Google Earth and/or create GIS layers (i.e., shapefiles) for use in ArcGIS. The GPS Photolink-derived GIS layers contain several attribute data related to the GPS not-in-feature data. When these GPS not-in-feature data are combined with digital photos collected in

tandem and then processed with GPS Photolink, useful and “media-rich” GIS data are created. These output data can be added to ArcMap with automatically hyperlinked, geolocated, and watermark ground photos that provide a geographic record of the mapping effort. These data are very useful for subsequent change detection analysis, ground condition studies, and resource monitoring. The Google Earth output data can be rapidly deployed on a website for quick and easy access to a larger audience if necessary that can be very valuable for public and resource manager meetings.

A description of the GPS/GIS hardware and software appears below.

Equipment and software used to conduct the CUA inventory in the SMA include the following:

Trimble GPS receivers/dataloggers/field software:

- GeoXT 2003 series (back-up GPS receiver and data logger)
- GeoXH 2005 series (primary GPS receiver and data logger)
- Trimble TerraSync field mapping software v2.53
- Trimble’s GPS Pathfinder Office v3.1
- Trimble’s Planning Software (GPS project mission planning)
- ESRI ArcGIS v9.2, ArcINFO license
- ESRI ArcINFO Workstation (DEM Lattice Command in GRID)
- Leica Geosystems Imagine v9.0 and Image Analysis for ArcGIS v9.1
- Geospatial Experts GPS PhotoLink v4.0.49

Quality Control of GPS Data

Postprocessing GPS data was completed in the office using Trimble's GPS Pathfinder Office v3.10. In lieu of traditional differential correction techniques, H-Star data (i.e., carrier positioning) were also collected to allow for higher-accuracy differential corrections. H-star corrections allow the user to differentially correct GPS data using a network of base stations rather than a single base station. Differentially corrected and averaged GPS data can have expected accuracies on the order of centimeter accuracy depending on several GPS and terrain-related factors (e.g., the number of satellites and their relative signal strength at given time at a certain location). An example of the H-star base station network that was configured to differentially correct the GPS data for the 2006 CUA inventory is shown in Figure 25.

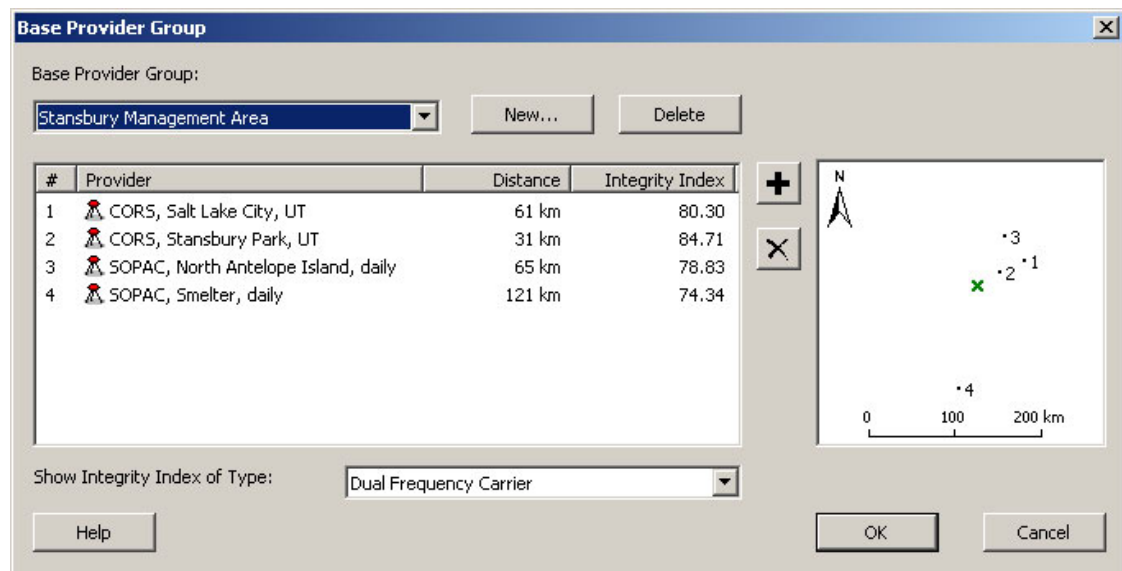


Figure 25. Dual Frequency Base Providers

The small overview map shows the four base stations that were added to the base provider group. The small “x” represents that location of GPS data collection (i.e., the SMA). All GPS data that were collected for the 2006 CUA inventory have accuracies that meet and often exceed National Map Accuracy Standards (NMAS). That is all dispersed campsites in the SMA CUA inventory have ± 3 meters Circular Error Probable (i.e., 50% CEP) or ± 5 meters Confidence Interval (i.e., 95% CI) (see Figure 26. GPS accuracy circles at site 026). Reports of the GPS accuracies appear in the metadata enclosure project folder in the CUA GIS project.

CUA GPS Data Collection Timeline

The author mapped the 108 identified dispersed campsites in the SMA over the course of 9 field days. Typically, a field mapping day consisted of a 10-hour working

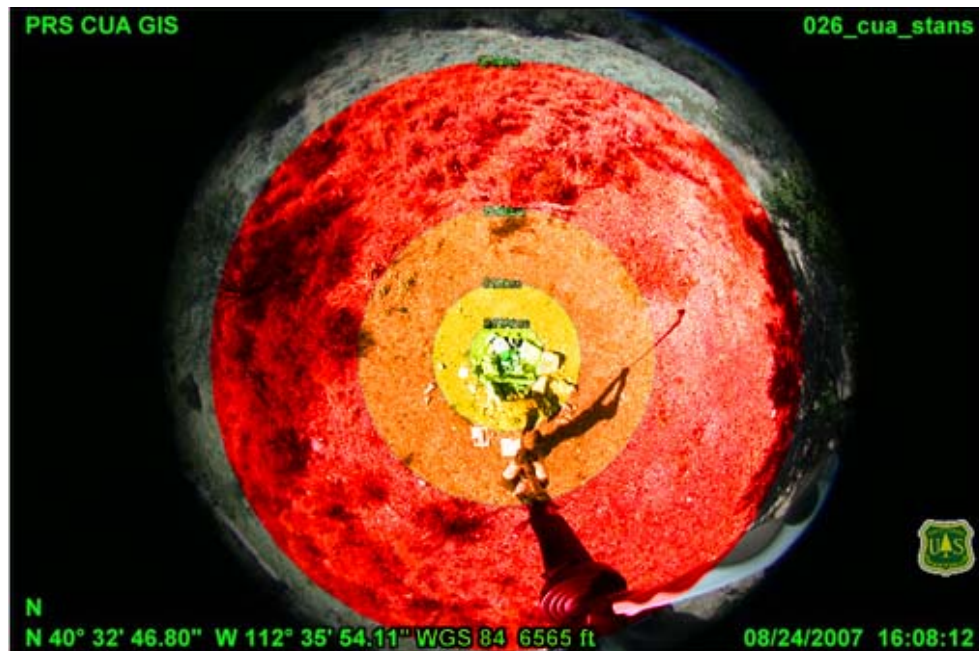


Figure 26. GPS accuracy circles at site 026

shift on a weekend day. Postprocessing of the GPS data and archiving of the rich media (i.e., ground photos, movies, etc.) was completed generally in 2-hour blocks during the following week of data collection (see Figure 27). Please refer to the timeline graphic at right for a time-plot of field data collection. Note: the date format on the X axis shows day-month-year. Each “cluster” of red points represents a field data collection day.

GIS Data Collection/Processing

Other GIS layers necessary for the CUA inventory were acquired from various sources. Several data that were obtained for this project required various post-processing to make them suitable for use in the final GIS. For example, Digital Elevation Models (DEMs) that were obtained for this project were acquired from 6 7.5' map extents as ESRI Grids. The grids were mosaicked to match the project area extent. The resulting Grid was then processed using ArcINFO Workstation using the DEMLatitude command in GRID to “clean and fill” any “null” cells in the areas of overlap from the mosaic process. The final grid was converted to the .IMG format for

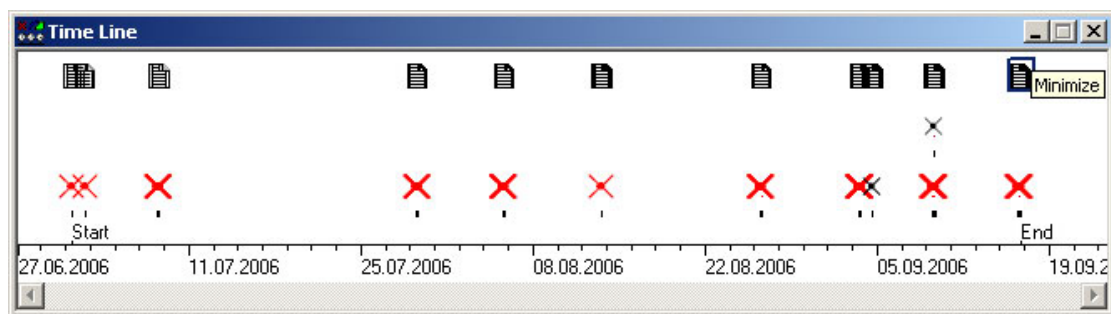


Figure 27. CUA site mapping timeline

easy-of-use and subsequent analysis using Leica Geosystems' Imagine and Image Analysis (an extension for ArcGIS).

Other layers that are necessary for the Perceived Restorative Scale and Concentrated Use Analysis (PRS CUA) GIS required similar processing. For example, Digital Raster Graphics (DRGs) were mosaicked from 6 7.5' map extents to create a final "seamless" GIS layer necessary for the project. The final format for the DRG layer is Tagged Image Format (.TIF). The gray-scale Digital Orthophoto Quadrangles were also processed in this manner. The final file format for the gray-scale DOQ is MrSID (.SID). The color National Agriculture Imagery Program (NAIP) imagery, on the other hand, was obtained as a county mosaic and needed to be "subset" to the project area. Leica Geosystems's Imagine was used for this process for its robust capabilities as a raster-based GIS/image processing system. The final file format for the NAIP image layer is also MrSID.

Creating the PRS CUA GIS

After GPS data were collected and postprocessed, they were exported to a GIS format for GIS integration. The Export Utility in Trimble's GPS Pathfinder Office was used to export the GPS data (both CUA dispersed campsite inventory geometry and attributes as well as velocity records and the not-in-feature GPS data) to a GIS format. Due to limitations with the ESRI Shapefile format, the exported CUA inventory data required further processing prior to adding the layers to the PRS CUA GIS. The Pathfinder Office Export Utility at the time of this project does not create the projection file (.PRJ) necessary for ArcGIS to spatially align the datasets. ArcCatalog was used to "redundantly" define the spatial reference for the CUA inventory data. The spatial

reference selected for the CUA dispersed campsite features is Universal Transverse Mercator (UTM), North American Datum 1983 (NAD83), Zone 12 North (Z12n). The spatial reference for the not-in-feature GPS data is World Geodetic System 1984, International Terrestrial Reference Frame 2000 (WGS84, ITRF00 (Epoch 1997.0)), Earth Centered Earth Fixed (ECEF) with Latitude Longitude coordinates. The reason these two elevational and horizontal datums and coordinate systems were selected is due to additional processing of the not-in-feature data. An additional export was configured for the not-in-feature GPS data to postprocess using GPS Photolink. This export template was configured to export an American Standard Code for Information Interchange (ASCII)-compliant dataset. The resulting data were processed in GPS Photolink.

After the spatial reference information was assigned the exported GPS data, the Union tool in ArcToolBox was used to combine the multiple shapefiles (the Pathfinder Office export prefers to “split-up” a combined rover file) to a single data set. The results were added to ArcMap for further analysis and were symbolized for cartographic purposes. The CUA inventory data were added to the PRS CUA GIS as shapefiles. The attribute tables for the CUA dispersed campsite inventory were edited to hyperlink ground photos and ground movies to each dispersed campsite. The hyperlinked media for each dispersed campsite can be called by a GIS analyst at the click of a button. The GPS photolink “monitoring” layers were imported from shapefile format to a personal geodatabase (PGDB) feature class and edited to maintain hyperlink functionality. A custom built toolset for ArcMap is required to activate and view these “monitoring” features and associated media.

The mosaicked/subset image layers were all processed and projected to match the UTM NAD83 Z12n projection. With the exception of the DRG layer, all image layers required little processing once they were added to the GIS. The DRG layer was added to the final GIS project twice to allow for unique symbology and transparency settings for the layer. For example, the initial DRG layer was added and a transparency setting of ~45% transparency was applied to the layer for visual and cartographic aesthetics when viewed at a scale of 1:24001 or greater with an accompanying hillshade layer (hillshade creation is discussed below). The second DRG layer was configured to display certain values in the color table as “no color” to provide cartographic information when juxtaposed to the NAIP color image.

The 10-meter DEM layer is necessary to the PRS CUA GIS for a number of reasons and possible analyses. The first use of the DEM layer is to provide elevation values in the GIS. Very few surface analyses have been performed in the CUA GIS thus far; however, using Spatial Analyst, a hillshade layer was generated for cartographic purposes as mentioned above. Subsequent three-dimensional analysis and visualization requires the use of the DEM layer. Several animations of the project area and the CUA inventory were created in ArcScene to visually show the results of the 2006 CUA inventory.

Selected vector layers were added to the PRS CUA GIS for cartographic purposes, proximity statistics, and overlay analysis. These vector layers required further processing to make them suitable for the PRS CUA GIS. A routes layer containing GPS-derive road and trail information was obtained from the Salt Lake Ranger District; unfortunately, no accompanying metadata were provided. Several

attribute values in this layer are “unknown”; however, an attribute value that indicates the type of line (e.g., road or trail) is present and interoperable in this layer. Two other vector layers were obtained from the Automated Geographic Reference Center (AGRC) in Salt Lake City, Utah for hydrology/proximity to water analysis. All vector layers were “clipped” using the clip tool in ArcToolbox to the project area. All vector layers were symbolized based on “categories” within their respective attribute tables.

With the necessary spatial layers added to the PRS CUA GIS, scale dependencies were set for layers in the GIS to optimize viewing the GIS at differing scales.

Alias the CUA Attributes

To make the CUA attributes “more readable” to a GIS analyst, “aliases” were assigned to all attribute values for the CUA GPS-derived data. The PRS CUA GIS project must be used for to view aliases for the CUA dispersed campsite layer.

Metadata

Metadata for spatial layers obtained from data clearing houses contain metadata from those sources. The author does not guarantee the accuracy or authenticity of the metadata associated for the data in the PRS CUA GIS other than the GPS-derived collected by the author.

Metadata for the CUA dispersed campsite inventory are complete for the CUA dispersed campsite inventory according to CUA project guidelines (note: the actual project guidelines do not require the analyst to generate metadata). Metadata are viewable using the ArcCatalog component of ArcGIS in the PRS CUA GIS project.

PRS CUA GIS 2007 Project Addendum

Following-up the 2006 CUA mapping effort in the SMA, 30 CUA were selected for return visits. The return visits were deemed necessary to collect 360-degree spherical panoramic imagery. The return visits were conducted between August and September, 2007 by the author. Using geospatial data collected during the 2006 CUA mapping effort, the author selected 30 CUA sites to revisit and collect imagery necessary to create 360-degree spherical panoramic imagery. The 30 CUA site locations were uploaded to a mapping-grade GPS data logger. The CUA site location data (i.e., a Shapefile) and the GPS data logger were used to navigate back to previously mapped CUA sites. Upon returning to a given CUA site, the author set-up the equipment necessary to collect the 360-degree spherical panoramic imagery and began the process of capturing imagery of the CUA site.

At each CUA site where imagery were to be gathered, the author would first set-up the DSLR with a specialized spherical panoramic mount fixed to a tripod and calibrate the spherical mount to cancel the effect of parallax (Figure 28).

The DSLR lens was oriented to the north using a compass bearing. The spherical mount was then leveled and adjusted to begin collecting the necessary imagery. A GPS receiver was attached to the DSLR to capture coordinate and time information in the Exchangeable Image File Format (EXIF) header for each image. A mapping-grade GPS data logger was also used to capture geospatial data necessary to hyperlink the resulting 360-degree spherical panoramic image to the corresponding CUA site feature in the PRS CUA GIS. A dry-erase board was used to indicate the cardinal directions and the CUA feature identification (CUA-FID) number.



Figure 28. Spherical camera mount and the author at CUA site 043

Once the set-up of the 360-degree spherical panoramic equipment was complete, the author captured approximately 24 digital image frames using an 18mm digital focal length (the 27mm equivalent for the 35mm film format) for the CUA site. The author repeated this procedure for each revisited CUA site.

Once the imagery was collected, the author used a computer program to stitch the individual images together to create a Quick Time Virtual Reality (QTVR) image. The resulting QTVR imagery was then added to the PRS CUA GIS. The QTVR imagery was also used to conduct the Q-sort and photo elicitation sessions (i.e., research experiments) for the author's thesis research.

Concentrated Use Attribute Definitions

Listed below are the attribute definitions for the dispersed campsites mapped during the 2006 CUA mapping project.

Site Identification: Each site is to be identified with a combination of letters and numbers. Ranger Districts may divide their district into working circles that make sense for the management of dispersed camping. The letters correspond to District working circle abbreviations (see below). For example, W1 for the first site inventoried in the Wasatch Range working circle on the district. The numbers will begin at 1 within each working circle.

Inventoried by: Identify the person or persons responsible for the site assessment.

USGS Quadrangle: Choose the USGS Quad the site is located on.

Total Campsite Area: The area that has noticeably been used including tent site and vehicle parking. Usually distinguished by visible human trampling of vegetation. Pace the area off and calculate a square footage.

Total Barron Core Area: The barren core is within the total area and is distinguishable by bare soil caused by heavy use in an area. Pace this area off and give a square footage.

Litter/Trash: Within view from the campsite, how much litter or trash is observable. The categories of light, moderate, heavy, and none correspond with the amount of trash at the site. Large pieces of trash such as mattresses, 5 gallon drums and minute-sized trash exceeding the capacity of two 5 gallon bucket but not exceeding two 5 gallon buckets would be moderate, whereas just some fire ring litter or trash less than 2 ½ gallons would be light. The GPS specialists collecting the spatial and attribute data will coordinate to agree upon the differences between the categories.

Trees Damaged: Count the trees that have human-caused damage within the campsite boundary or within clear visibility of the site. Include trees with scars, nails, ax marks, painted graffiti, broken limbs, and tree stumps.

Tree Damage Extent: The categories are slight, moderate, severe, and none. Slight damage would be nails in trees and one ax hack/inscription or a few small branches broken. Moderate would be slight damage combined with four or more branches broken, numerous scars, and/or up to four stumps. Severe would be moderate damage plus painted graffiti, and any more than four trees cut and/or mangled.

Vegetation Cover Onsite: Use the categories listed to estimate the percentage of vegetation (nonwoody) ground cover within the dispersed campsite boundaries. This includes herbs, grasses, and mosses. A) 0-10% B) 11-50% C) 51-90% D) 91-100% E) 76-95%.

Vegetation Cover Offsite: Use the same categories as above (A) 0-10% B) 11-50% C) 51-90% D) 91-100% E) 76-95%) to estimate the percentage of vegetative ground cover in an adjacent but largely undisturbed “control” area. The control site should be similar to the dispersed campsite slope, tree canopy cover, and other environmental conditions.

Canopy Cover: Observe tree canopy cover directly over the dispersed campsite and derive whether there is None, Light, Moderate, or Dense cover corresponding to sunny, mostly sunny, partly cloudy, and mostly cloudy.

Fire Rings: Count the number of fire rings for each dispersed site. If there are more than one, determine that it is within the one site and is not another site. Count only the rings that look like they have been used recently (no grass or trees growing out of the ring).

Human Waste: Do a quick search of likely latrine areas in the vicinity of the dispersed campsite. The categories are light, moderate, and heavy. Light is defined as two sightings of toilet paper. Moderate is three to four spots, and heavy is more than four latrine spots.

CUA Condition Class: Select the condition class that most closely represents the campsite. Condition class is determined by soil exposure and vegetation coverage. Condition class IS NOT determined by size, trash, or tree damage other than root exposure. Classes are based on Frissell’s Campsite Condition research (Frissell, 1978). CUA condition classes are as follows:

Class 1: Campsite barely distinguishable. Soil surface only slightly disturbed. Vegetation cover and organic litter barely altered. Often a campsite that has not seen recent use.

Class 2: Campsite apparent, effects confined. Soil surface has been cleared of large stones and branches where primary activities occur. Vegetation and organic litter has been lost or trampled. Obvious effects concentrated and tapered towards boundary.

Class 3: Campsite obvious effects throughout the dispersed site. There is a distinct boundary between the campsite and the undisturbed adjacent areas. Vegetation cover and organic litter is lost on much of the site. Primary area of activity is clear of any stones or gravel. Most gravel or stones are outside of primary activity area.

Class 4: Campsite obvious effects widespread. Distinct boundary exists between dispersed campsite and undisturbed area. Nearly complete or total loss of vegetation cover and organic litter. Bare soil widespread with little gravel or few stones present anywhere within boundaries.

Class 5: Campsite obvious effects widespread and condition greatly different from adjacent areas. Roots exposed, vegetation absent, and soil compressed.

Distance to Nearest System Road: Pace the distance from dispersed campsite boundary to the nearest system or other constructed road. This road should be either on the quad map or identified on a Forest Service Travel Map or Visitor Map.

Distance to Nearest System Trail: Pace the distance from dispersed campsite boundary to the nearest trail, either motorized or nonmotorized.

Screening: Calculate the screening between the dispersed campsite and the travel path to the site. The travel path does not include the path that leads solely to the individual site. Complete screening is when the dispersed campsite is well-hidden from others traveling by; they may not even notice a site there. Partial screening is when you can see the site from the travel route if you look hard enough. No screening is when the campsite is out in the open with nowhere to hide.

Distance to Nearest Water Source: Pace the distance to the nearest water source from the campsite boundary.

Water Source Type: Indicate the type of the water source identified. Classes are as follows: Perennial Stream, Intermittent Stream, River, Lake/Pond, Spring, Developed Spring, Man-made, None.

Community Type: Using the following class list, indicate the predominate community type for the surrounding forest. Classes are Mixed Conifer and Deciduous, Conifer-Spruce Fir Pine, Conifer-Pinion/Juniper, Deciduous, Meadow, Riparian, Shrub and Forbs, Shrub and Grass, Grass, Bare, Other.

Surface Substrate: Select from the following class list the type of surface substrate at the campsite: Duff, Sand, Gravel, Topsoil, Rocky Soil, Bed Rock, Other.

Overland Flow: Select, if any, the type of overland flow occurring at the dispersed campsite. Slight overland flow indicators are sheet flows occurring at the site, a moderate indicator would be rivulets, and a severe indicator is "gullying".

Corral: Has a corral been constructed at the site (present/absent)?

GFA: General Forest Area (to be generated postdata collection in the GIS)

Complex: No description available.

Harden Spur: The presence of a connecting route to a system road or trail to the dispersed campsite.

Barrier Rock: Indicate whether or not FS installed barrier rocks installed near dispersed campsite location.

Fence: Indicate whether or not a human-made fence is installed near dispersed campsite location.

Horse Use: Indicated whether or not horse/equestrian use is prevalent at or near the dispersed campsite.

Motorize Access Route: Number of motorized routes to site.

Nonmotorized Access Route: Number of foot trails from road.

Motorized Connector: Does not provide access to site.

Non Motorized Connector: Does not provide access to site.

Motorized Water Connector: No description available.

Nonmotorized Water Connector: No description available.

Presence of ATV Use: Indicated whether or not OHV/ATV use is prevalent at or near the dispersed campsite.

Corral: “redundant” attribute.

Harden Picnic Area: Indicate whether or not a human-made picnic area is present at the dispersed campsite location.

Presence of Forest Service Installed Fire Ring: Indicate whether or not a Forest Service installed fire ring is present in dispersed campsite location.

Presence of Forest Service Installed Retaining Wall: Indicate whether or not a Forest Service installed retaining wall is near dispersed campsite location.

Presence of Forest Service Installed Signage: Indicate whether or not Forest Service installed signage is near dispersed campsite location.

Presence of Forest Service Installed Table: Indicate whether or not a Forest Service installed table is near/in dispersed campsite location.

Additional Comments: Empty text field to be used to provide extra comments about the dispersed campsite being mapped.

Digital Photo One: Placeholder for the first digital image file name collected for the dispersed campsite being surveyed.

Digital Image Path One: Placeholder for the pathname to digital image one to hyperlink to in the final GIS.

Digital Photo Two: Placeholder for the second digital image file name collected for the dispersed campsite being surveyed.

Digital Image Path Two: Placeholder for the pathname to digital image two to hyperlink to in the final GIS.

Digital Photo Three: Placeholder for the third digital image file name collected for the dispersed campsite being surveyed.

Digital Image Path Three: Placeholder for the pathname to digital image three to hyperlink to in the final GIS.

Digital Movie: Placeholder for the digital movie file name collected for the dispersed campsite being surveyed.

Digital Movie Path: Placeholder for the pathname to digital movie to hyperlink to in the final GIS.

Pathfinder Office Generated Attributes (Trimble, 2007):

Maximum PDOP: The maximum Positional Dilution of Precision value for the GPS-derived feature.

Correction Type: Differential correction method used to increase the accuracy of the GPS position estimates that make up the GPS-derived feature. To export the type of correction that has been applied to the positions within a feature. For line and area features, the correction type of the feature is the correction type of the worst vertex in the feature. For example, if a line feature has 10 postprocessed carrier fixed positions but one uncorrected position, the CORR_TYPE for that feature is Uncorrected. The worst position is not based on the actual quality of the position in question, but is based on a fixed hierarchy of position types, from L1/L2 carrier (best) through Uncorrected (worst).

The possible values for the CORR_TYPE attribute are:

Uncorrected

Uncorrected positions.

P(Y) Code

Positions collected using P-code or Y-code. Only military receivers can compute or log positions using these codes.

Real-time SBAS Corrected

Positions that have been corrected using real-time SBAS.

Real-time Code

Positions collected using real-time differential GPS and computed using a code phase solution.

Postprocessed Code

Positions that have been differentially corrected using code processing.

Real-time Carrier Float

Positions collected using real-time differential GPS and computed using a carrier float solution.

Postprocessed Carrier Float

Positions that have a carrier float position. These positions were corrected using either the H-Star processing option in the Differential Correction wizard, or using the Smart Code and Carrier Phase Processing option or the Carrier Phase Processing option in the Differential Correction utility.

RTK Fixed

Positions collected using real-time kinematic techniques and computed using a carrier fixed solution.

Postprocessed Carrier Fixed

Positions corrected in the Differential Correction utility using the Centimeter Processing option, and having a carrier fixed solution.

Unknown Correction

Positions in the feature have been differentially corrected, but it is uncertain how.

Receiver Type: Use to export the receiver type of the GPS receiver that was connected to the datalogger when the feature was collected.

GPS Date: The GPS date (based on GMT) that the GPS data were collected for the GPS-derived feature. Used to export the date when the feature was collected. The Date Format field in the Units tab determines the format of the exported dates.

GPS Time: The GPS time (based on GMT) that the GPS data were collected for the GPS-derived feature. Use to export the time of day when the feature was collected. The Time Format field in the Units tab (in PFO) determines the format of the exported times.

Update Status: To export the update status for each feature. The possible values are described in the following table.

New: A new feature is one that has been added to a data file in the most recent session. A new data file will only contain new features.

Updated: An updated feature is one that previously existed in a data file, but has been edited or updated in the most recent session.

Imported: An imported feature is one that previously existed in a data file and has not been edited or updated in the most recent session. When data is imported from a GIS or CAD system, all features are considered to be imported.

Feature Name: Use to export the name of the feature. For example, pole features will export the text 'Pole.' For data types that are not features, such as GPS positions and notes, feature names are assigned as shown in the following table.

POSNPNT: Points created from GPS positions

AVEPOSN: Points averaged from a file of GPS positions

POSNLINE: Lines created from GPS positions

POSNAREA: Areas created from GPS positions

NOTE: Notes

VELOCITY: Velocity records

SENSOR: External sensor records

Datafile: Use to export the name of the data file that the feature was exported from.

Unfiltered Positions: to export the number of positions that make up the feature in the SSF file, regardless of how many are used when the feature is exported. The number exported may be less due to position filtering. For note, velocity and sensor records, and points created from GPS positions, the value for this generated attribute will always be 1. Note: Generally, this generated attribute is exported in conjunction with the Filtered Positions generated attribute to determine the proportion of positions that were filtered out of a feature during export.

Filtered Positions: to export the number of positions that are exported with the feature. This number may be less than the number of positions that make up the feature in the SSF file due to position filtering. For point features, this attribute is the number of positions that were averaged to make up the exported point. For note, velocity and sensor records, and points created from GPS positions, this attribute will always be 1. Note : Usually this generated attribute is exported in conjunction with the Total Positions generated attribute, to determine the proportion of positions that were filtered out of a feature during export.

Data Dictionary: Use to export the name of the data dictionary used to collect the data.

GPS Week: Use to export the date when the feature was collected, expressed as the number of weeks elapsed since GPS zero-time (midnight on January 5, 1980). Note: Usually this generated attribute is exported in conjunction with the GPS Second generated attribute, for chronological sorting of features. Note: If the feature was collected before GPS zero-time (midnight on January 5 1980), a negative value is exported.

GPS Height: Use to export the height (elevation) of the feature. Heights are exported using the height reference and units specified in the Coordinate System tab (in PFO). Use this attribute if your GIS or CAD system does not accept three-dimensional coordinates but you require this information. The height is available as an attribute of each point. CAUTION: If your GIS or CAD system accepts three-dimensional coordinates, the exported height attribute will not be updated when you edit the heights of points in the GIS or CAD system. Trimble recommends that you avoid this option if your GIS or CAD system stores three-dimensional positions.

Vertical Precision: Use to export the vertical precision of the averaged position for the feature. The exported attribute will be in the distance units specified in the

Units tab (in PFO), and to the confidence level specified in the GPS Pathfinder Office software's Units dialog.

Horizontal Precision: Use to export the horizontal precision of the averaged position for the point feature. The exported attribute will be in the distance units specified in the Units tab (in PFO), and to the confidence level specified in the GPS Pathfinder Office software's Units dialog.

Standard Deviation: Use to export the standard deviation of the positions that were averaged to make the exported point. Only filtered positions are used to calculate the standard deviation. Standard deviations are exported in the units specified in the Distance field on the Units tab (in PFO). For any feature with just a single position, including note, velocity and sensor records, and points created from GPS positions, this attribute will always be 0.0. **CAUTION:** Standard Deviation is not a measure of the accuracy of a point feature's position. It indicates the spread of the positions within the point feature that were averaged to create the exported position.

Northing: UTM Northing Coordinates for the GPS-derived feature.

Easting: UTM Northing Coordinates for the GPS-derived feature.

Point ID: Use to export a unique identification number for the feature. The Export Utility generates the Point ID automatically. When you export to Microsoft Access (MDB) format, the Point ID attribute indicates which feature each position belongs to.

Data Sources

Listed below are the data sources used in to create the PRS CUA GIS project.

Please note: all necessary data layers are collected and incorporated into an existing GIS that the author plans to use for the author's thesis research.

Raster:

- NAIP natural color imagery obtain from the USDA NRCS Data Gateway:
 - o <http://datagateway.nrcs.usda.gov/GatewayHome.html>¹
 - o Uses:
 - Backdrop image
- Grayscale Digital Orthophotoquads (DOQs) obtained from the USDA Forest Service Geospatial Data Gateway:
 - o <http://fsgeodata.fs.fed.us/>
 - o Uses:
 - Backdrop image (less process-intensive than color imagery for 3D visualization)
- Digital Raster Graphics (DRGs)² obtained from the USDA Forest Service Geospatial Data Gateway:
 - o <http://fsgeodata.fs.fed.us/>
 - o Uses:
 - Visual map reference
 - Backdrop Image
- Landsat 7 TM multispectral imagery³ obtained from USDA Forest Service Imagery Archive.
- 10 meter Digital Elevation Models (DEMs)⁴ obtained from the USDA Forest Service Geospatial Data Gateway:
 - o <http://fsgeodata.fs.fed.us/>
 - o Uses:
 - Surface analysis, elevation reference, 3D image visualization
 - Hillshade

Vector:

- GPS derived **point**, line, and polygon data for locations of depreciative behavior occurrences (e.g., dispersed campsite locations). All data collected shall be attributed with descriptions necessary for this project using a data dictionary.

¹ Note: access to the NRCS data gateway requires a security clearance.

² Will require mosaic process.

³ Imagery shall be processed for atmospheric correction, terrain correction, and subset.

⁴ Will require mosaic process.

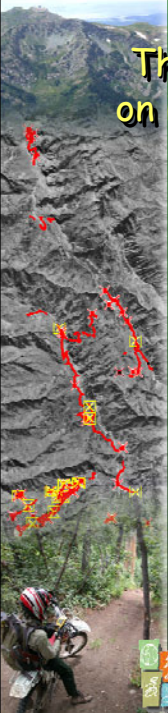
- o **Point** data will contain numeric and categorical data that can be used for statistical analysis
 - For example, campsite location data
 - o All GPS data collected with mapping-grade GPS to meet NMAS standards for electronic geographic data
- Roads (including trails and other routes) layer for project area obtained from the Salt Lake Ranger District via FTP
 - o Uses:
 - Proximity statistics
- Hydrology layer (streams) obtained from the AGRC's spatial database (ArcSDE):
 - o ArcCatalog spatial database connection: oldagrc.state.ut.us
 - o Uses:
 - Proximity statistics

Ancillary Data:

- Geolocated ground photos and movies
 - o Obtained and processed during GPS data collection
- HTML webpage output
 - o Hyperlinked in ArcMap to provide more visual information for each mapped feature
- KML/KMZ output for Google Earth Visualization and analysis
 - o For feature visualization of mapped features for distribution to a wide audience via internet

APPENDIX D

THESIS DEFENSE PRESENTATION



The Effect of Human-Caused Visual Impacts on Restorative Character of an Arid Wildland Recreation Setting

Master's Thesis Defense
Forest Service Geospatial '09 Conference
April 2009
Thöre (TC) B. Christensen
Department of Parks, Recreation, and Tourism
University of Utah
USDA Forest Service, Uinta-Wasatch-Cache National Forest &
Remote Sensing Applications Center

THE UNIVERSITY OF UTAH

U.S. FOREST SERVICE RSAC

Geospatial Information Office

Master's Thesis Defense

Topics

- Introduction
 - ♦ Rationale
 - ♦ Problem (variables)
 - ♦ Why?
 - ♦ Purpose
- Literature Review
 - ♦ Setting
 - ♦ Variable Definitions
 - ♦ Hypothesis
- Method
 - ♦ Measurement
 - Pilot Study
 - ♦ Participants
 - ♦ Procedures
 - ♦ Data Analysis
- Results
- Discussion
- Summary/Questions/Comments



Master's Thesis Defense

Introduction

Rationale

"When pressures have built to a critical point people say they have 'to get away from it all' or 'to escape.' These expressions suggest the need for a change of venue, but they ignore the fact that where one is headed may be as important as where one is coming from. One can, after all, escape to many places that would fail to achieve the desired *recovery*." (Kaplan & Kaplan, 1989)

- Restorative environments are of great importance
 - ♦ They contain qualities that support physical, mental, and spiritual restoration and recovery
 - ♦ Attention Restoration Theory (ART) seeks to explain why environments support recovery from Direct Attention Fatigue (DAF) (Kaplan & Kaplan, 1983)
 - ♦ There are four components that make-up a restorative environment (being away, coherence, compatibility, and fascination)

Master's Thesis Defense

Introduction

Rationale

"Acceptability of impact is a function of both the ecological significance of the alteration and human *perception* of the *alteration*." (Hammit & Cole, 1998)

- Recreation Ecology
 - ♦ Behavioral Approach (Driver and associates, 1970)
 - That is: Recreation is a set of "psychological experiences"
 - ♦ Natural resource damage is a management challenge
 - ♦ Visible human-caused impact is a result of recreation use in natural areas
- Problem
 - ♦ The effects of depreciative behaviors (e.g., landscape scarring) can undermine the restorative potential of an area
 - ♦ Natural resource management issue (e.g., unmanaged recreation) displacement of user groups to other areas
 - ♦ Increased instances of landscape scarring (e.g., user-created campsites)
 - ♦ Are impacts actually perceived as impacts?

Master's Thesis Defense

Introduction

Rationale

"A resource manager's opinion of what visitors *should* prefer may well influence their view of what visitors *do* prefer." (Manning, 1999)

- Why might the DV and IV not be related?
 - ♦ Some environments satisfy users' goals better than others do
 - ♦ Some users become highly dependent on specific places for goal attainment
 - ♦ Visitors might not perceive impact as impact
 - ♦ Visitors might perceive impact but, may not interpret the impacts as undesirable
 - ♦ Visitors and resource managers interpret impact differently

Master's Thesis Defense

Introduction

Purpose

The purpose of this study is to examine visible visitor-caused landscape impacts on the judgments of perceived restorative character of backcountry user-created campsites as well as show spatial patterns of these locations of impact in a natural setting

Master's Thesis Defense

Topics Revisited

Topics

- Introduction
 - ♦ Rationale
 - ♦ Problem (variables)
 - ♦ Why?
 - ♦ Purpose
- Literature Review
 - ♦ Setting
 - ♦ Variable Definitions
 - ♦ Hypothesis
- Method
 - ♦ Measurement
 - Pilot Study
 - ♦ Participants
 - ♦ Procedures
 - ♦ Data Analysis
- Results
- Discussion
- Summary/Questions/Comments



Master's Thesis Defense

The Setting

"Emerging Christian ideology came to see wilderness as an environment presenting earthly temptations, physical dangers, and spiritual confusion...wilderness represented unfinished business; it was the proper function of Christians to cultivate such areas and to build the city of god." (Kaplan & Kaplan, 1983)

- Natural environments have long been used for retreat, leisure, and restoration
 - ♦ Wilderness (i.e., natural areas) is a common cultural concern
 - ♦ Natural areas have been set aside for their aesthetic qualities
 - ♦ Recreation is a primary leisure use
- Characteristics of the Study Area
 - ♦ Managerial Setting
 - ♦ Physical Setting
 - ♦ Social Setting

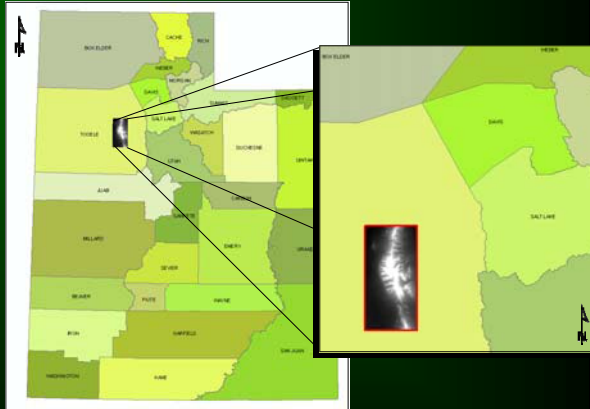
Master's Thesis Defense

The Setting: Managerial

Project Area—Stansbury Management Area (SMA)

Characteristics:

- ♦ Located west of Tooele Valley
- ♦ Managed by USDA FS, Uinta-Wasatch-Cache NF, SL Ranger District
- ♦ Selected for inventory due to lacking dispersed campsite inventory
- ♦ Area is approx. 69179.60 acres/280 Kilometers²
- ♦ Diverse recreation opportunities



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The Setting: Physical

Field-base feature capture (i.e., Mapping Techniques)

- Mapping-grade GPS used to map dispersed (i.e., user-created campsites) in 2006
 - ♦ Collect geographic information (i.e., discrete point features)
 - ♦ Collect Attribute Information
 - Required data dictionary
 - ♦ Collect "rich media" to link to GIS features
 - ♦ All dispersed campsites were mapped using ~100 averaged GPS position estimates
- Mapping sites
 - ♦ Traveled among sites via trail bike
 - ♦ Setup require GPS data be collected at all times
 - ♦ Digital camera required to collect "rich media"
 - ♦ All dispersed campsites mapped with averaging (~100 position estimates), H-star data, and velocity records
 - ♦ GPS accuracies were controlled during data collection using quality masks
 - ♦ GPS accuracies are reported in CUA GIS metadata

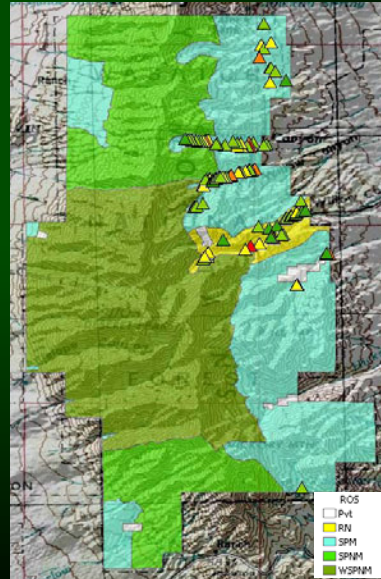


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The Setting: Physical

Project Area

- SMA
 - ♦ Management areas along the ROS
 - ♦ Most sites located in Semi Primitive Motorized zones
 - ♦ Fly by after data collection ($n=107$)
 - ♦ Red columns represent "high-impact" dispersed site
 - ♦ Green columns are "lower impact"
 - ♦ Impact level determined by CUA condition class value



Master's Thesis Defense

Literature Review

Restorative Environments

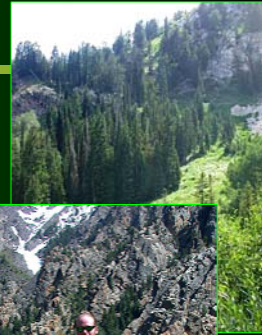
- Restorative Environments literature
 - ♦ Attention Restoration Theory (ART)
 - ♦ Direct Attention Fatigue (DAF)
 - Voluntary/involuntary attention
 - Four components of a restorative environment
- Restorative Environments themes
 - ♦ Natural environments have varying levels of restorative potential
 - ♦ Environmental perceptions depend on visual and spatial characteristics
 - ♦ Environments support a sense of place

Master's Thesis Defense

Introduction

Restorative Environments

- Effects on user perception and experience
 - ♦ Attention Restoration Theory (ART)
 - ♦ Four components of RE (Kaplan & Kaplan, 1989)
 - Being Away
 - Fascination
 - Coherence
 - Compatibility



Master's Thesis Defense

Literature Review

Restorative Environments

- Recreation is a set of psychological experiences
- (DV) Judgments about the perceived restorative character in natural areas
 - ♦ Definition: an individual's intrinsic assessment of the significance of restorative potential in a given natural setting
 - ♦ Visitor perceptions affected by the level of "visible visitor-caused impacts"

Master's Thesis Defense

Literature Review

Visible Visitor-caused Impacts

- Natural resource damage is a management challenge
 - ♦ Depreciative Behaviors
 - ♦ Unmanaged Recreation
- They can result in:
 - ♦ Scarring of the landscape (ecological impacts)
 - ♦ Vandalism (ecological impacts)
 - ♦ Perception of restoration (psychological impacts)
 - ♦ Experience threats:
 - Loss of privilege uses
 - Tax dollars
 - Legacy
- Of interest in this study are user-created (i.e., dispersed) campsites. Conduct Concentrated Use Analysis (CUA) to inventory user-created campsites.

View heading north



View heading south



Master's Thesis Defense

Literature Review

Visible Visitor-caused Impacts

- Recreation Ecology Themes
 - ♦ (IV) Visible human-caused impact as a result of user-created campsites
 - Site-level impacts
 - Desirable impacts
 - Visitor perception of resource degradation
- Capturing Visible Visitor-cause Impact domains and characteristics (i.e., operationalization)

Master's Thesis Defense

Measurement

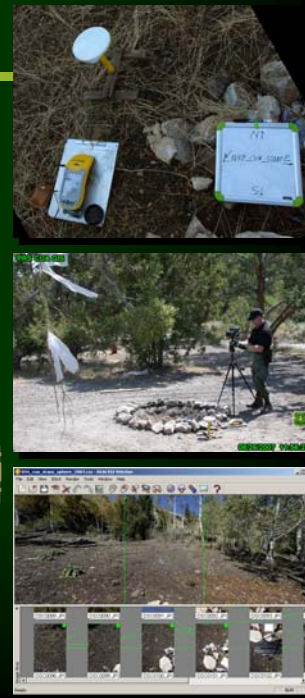
- Concentrated Use Analysis Condition Class (CUACC)
 - ♦ Based on Frissell's campsite condition class scale (1978)
 - One = little to no impact
 - Five = very high to extreme impact
 - ♦ Used for evaluation of user-created campsite condition during 2006 mapping effort
 - Frequency analyses in GIS using other collected site attributes (proximity to water, roads, trails; soil, vegetation, types; size of impact zone—barren core, entire campsite, etc.)
 - ♦ For this study impact is defined as visible human-caused impact
- Revisited user-created campsites ($n=30$) in 2007
 - ♦ Selected using spatial statistics (Moran's I) to test for spatial dependencies (i.e., spatial autocorrelation) among the original 107 mapped sites in the SMA
 - ♦ Collection of 360° panoramic image sets ($n=30$)
 - GIS integration
 - ♦ Photo elicitation techniques

Master's Thesis Defense

Measurement: Photo Generation

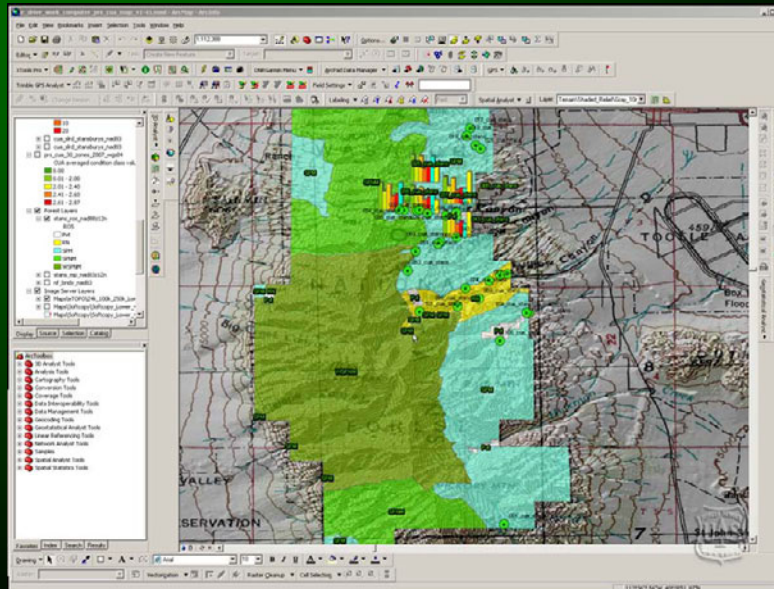
Spherical and Panoramic Imagery

- Revisit select CUA sites in late summer 2007
 - ♦ Used Mobile GIS to navigate and return to appropriate CUA sites
 - ♦ Used 2006 CUA inventory as navigation layer
- Upon site revisit:
 - ♦ Set-up necessary equipment
 - ♦ Align image sensor to face north using a compass
 - ♦ Record site number and cardinal arrows on dry-erase board
 - ♦ Collected imagery to capture and show CUA site characteristics
 - ♦ Take single images for spherical image stitch



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Measurement: GIS integration



Master's Thesis Defense

Measuring Judgments of Perceived Restorative Character

"If a scene is high in mystery, it draws the **perceiver** into the scene with the prospect of **more information**." (Kaplan & Kaplan, 1989)

- Photo elicitation
 - ◆ Static or Dynamic imagery?
 - Static imagery used for Q-sort
 - Dynamic imagery (i.e., cubic or spherical) used for actual study
- Used the Perceived Restorative Scale (PRS) to elicit responses (Hartig et al., 1996) as modified by Ruddell & Bennett (2004)
 - ◆ Operationalize judgments of perceived restorative character

Master's Thesis Defense

Hypothesis

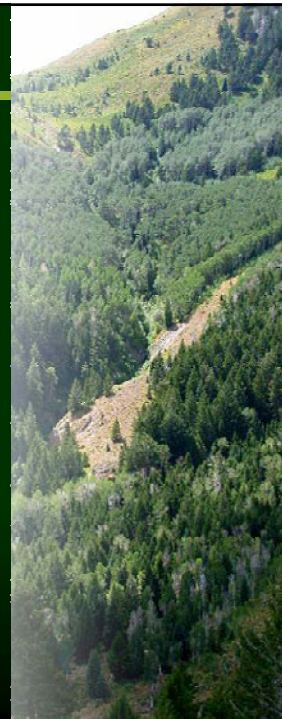
H1: As visible human-caused impact (represented by CUA Condition Class) increases, judgments of perceived restorative character decreases.

Master's Thesis Defense

Topics Revisited

Topics

- Introduction
 - ♦ Rationale
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Master's Thesis Defense

Method

Measurement

- Pilot Study
 - ♦ Panorama selection ($n=5$) based on spatial statistics using:
 - CUACC values
 - Spatial distribution
 - Measure for spatial dependencies (i.e., spatial autocorrelation) using Moran's I statistic
 - ♦ All were located in Davenport Canyon (high spatial dependencies)
 - 036 (CUACC=1), 034 (CUACC=2), 026 (CUACC=3), Sites 007 (CUACC=4), and 008 (CUACC=5)
 - ♦ Natural resource managers from the Forest Service ($n=40$)
 - ♦ 26-item PRS (Hartig et al., 1996)
- Results
 - ♦ Too many questions caused fatigue
 - ♦ Harsh lighting and difficult viewing conditions
 - ♦ Question of validity among the panorama's respective CUACC values (i.e., are visible human-caused impacts adequately represented?)

Master's Thesis Defense

Method

Q-sort

- Interpreters ($n=13$)
 - ♦ Asked to identify panoramas with the "most levels of visible human-caused impact"
 - ♦ Asked to identify panoramas with the "least visible human-caused impact"
- Panoramas were selected based on a normal distribution of the scores ($n=5$)
- Validation of CUACC field measures



Master's Thesis Defense

Method

- Cronbach's Alpha scores indicated good internal consistency among the CUACC values for their respective sites
 - ♦ Indicative that the 14 PRS items "hang well" with each CUACC value among the panoramas identified by the Q-sort
- Cronbach's Alpha coefficients across the five panoramas ranged from 0.92 to 0.94

Cronbach's Alpha Table

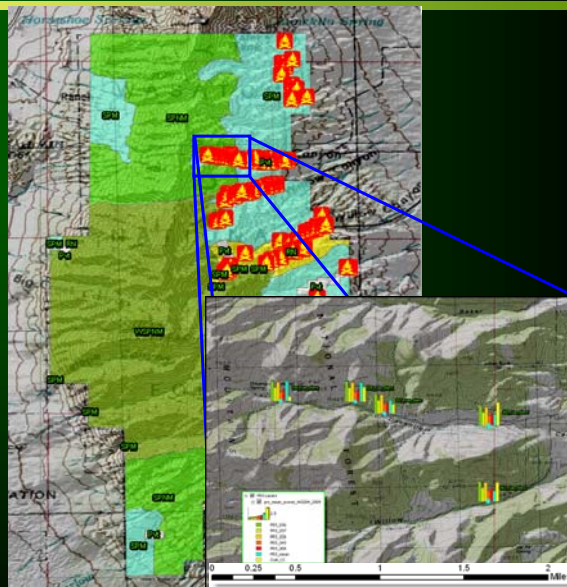
Condition Class	Cronbach's Alpha
CUA Condition Class 1 Site 036	0.94
CUA Condition Class 2 Site 037	0.94
CUA Condition Class 3 Site 026	0.92
CUA Condition Class 4 Site 043	0.94
CUA Condition Class 5 Site 008	0.93

Master's Thesis Defense

Method

Measurement

- Setting is the *isovist* among five user-created campsites in the SMA
 - ♦ Judgments about the perceived restorative character using the 14-item PRS (Ruddell & Bennett, 2004)
 - ♦ CUACC (1=low impact, 5=very high impact)



Master's Thesis Defense

Method

Measurement

- Repeated measures design nesting observations within person effects
 - ♦ Observations (level-1) repeated measures along the PRS for each CUA CC ($n=300$)
 - ♦ Person Level Effects (level-2) ($n=60$)

Master's Thesis Defense

Method

Participants/Procedures

- In-class sessions ($n=6$), Spring 2009
 - ♦ Actual study convenience sample
 - University of Utah students and Forest Service personnel
- Administration
 - ♦ Digital cubic (i.e., spherical) panoramas
 - One "warm-up" image
 - One representing each CUACC value; rating scale of 1-5, 1 being low impact, 5 being high impact
 - Order was varied according to CUACC
 - Rotation of panoramas varied (i.e., counterbalanced) to control for order effects
 - ♦ PRS scores, 14-item PRS
 - Empirically quantify judgments about the perceived restorative character



Master's Thesis Defense

Method

Data Analyses

- Data Analyses
 - ♦ Statistical Package for the Social Scientist (SPSS)
 - Descriptive statistics
 - ♦ Hierarchical Linear Modeling (HLM) for repeated measures

Master's Thesis Defense

Topics Revisited

Topics

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 - ♦ Procedures
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- Results
- Discussion
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Master's Thesis Defense



Results

- Characteristics of the Sample
 - ♦ Female 35%, Male 65%
 - ♦ Average age 31 years ranging from 18-62
 - ♦ Typical participant was a senior
 - ♦ Other (e.g., college major—categorical)
- Descriptive Statistics
 - ♦ Composite Restorative Character score created by averaging across 14-item PRS
 - ♦ Range of Restorative Character mean scores 2.08 to 4.25

Restorative Character Descriptive Statistics

Condition Class	Mean	SD	Skewness	Kurtosis
CUA Condition Class 1 Site 036	4.25	0.89	-0.67	1.72
CUA Condition Class 2 Site 037	2.84	1.03	0.09	-0.24
CUA Condition Class 3 Site 026	4.01	0.88	-0.55	1.09
CUA Condition Class 4 Site 043	2.08	1.08	0.74	0.88
CUA Condition Class 5 Site 008	2.44	1.07	0.49	-0.02

Master's Thesis Defense

Results

Site 036 CUACC = 1: Mean = 4.25 Skewness = -0.67 Kurtosis = 1.72

Uinta-Wasatch-Cache National Forest: Stansbury Mountains



Master's Thesis Defense

Results

Site 037 CUACC = 2: Mean = 2.84 Skewness = 0.09 Kurtosis = -0.24

Uinta-Wasatch-Cache National Forest: Stansbury Mountains



Master's Thesis Defense

Results

Site 026 CUACC = 3: Mean = 4.01 Skewness = -0.55 Kurtosis = 1.09

Uinta-Wasatch-Cache National Forest: Stansbury Mountains



Master's Thesis Defense

Results

Site 043 CUACC = 4: Mean = 2.08 Skewness = 0.74 Kurtosis = 0.88

Uinta-Wasatch-Cache National Forest: Stansbury Mountains



Master's Thesis Defense

Results

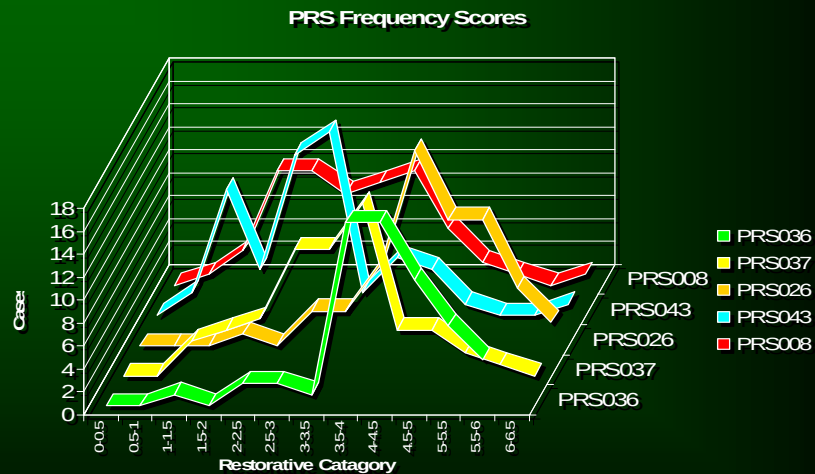
Site 036 CUACC = 5: Mean = 2.44 Skewness = 0.49 Kurtosis = -0.02

Uinta-Wasatch-Cache National Forest: Stansbury Mountains



Master's Thesis Defense

Results



Master's Thesis Defense

Results

- Hypothesis tests using HLM 6.0
 - ♦ Level-1 variables taken at the observation
 - ♦ Level-2 variables represented person effects
 - ♦ Large ICC (ICC=0.16) indicates a large person effect

Variance Components for the Null Model

Random Effect Level		SD	Variance Component	DF	Chi-square	P-value
Intercept 1	u_0	0.52	.27	59	114.33	<0.01
Level-1	R	1.20	1.44			

Intraclass Correlation = 0.16

Variance Components for Level-1 Model (regression of restorative character scores on condition class)

Condition Class		SD	Variance Component	DF	Chi-square	P-value
Intercept 1	u_0	0.67	0.46	59	311.30	<0.01
Level-1	R	0.72	0.53			

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Results

- Parameter Estimates for Level-1 Model
 - ♦ Each CUA site is compared to CUACC 5 (site 008)
 - ♦ CUACC 1, 2, & 3 exhibited significantly more restorative character than CUACC 5
 - ♦ CUACC 4 exhibited significantly less restorative character than did CUACC 5
 - Indicative that participants may be picking up on certain visual cues in site 043 (e.g., toilet paper in trees)

Parameter Estimates for Level-1 Model (regression of restorative character scores on condition class)

	Coefficient	Standard Error	T-ratio	P-value
Intercept	3.12	0.96	32.57	<0.001
CUA Condition Class 1	1.80	0.16	11.50	<0.001
CUA Condition Class 2	0.40	0.14	2.89	0.005
CUA Condition Class 3	1.57	0.13	12.07	<0.001
CUA Condition Class 4	-0.36	0.13	-2.69	0.008

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Results

- Summary of effect size
 - ♦ CUACC accounted for ~43% of variability in restorative character scores
 - ♦ Level-2 variables were non-significant and dropped

Summary Table

	R^2_{PRE}
Null	0
Level-1	.43*

*significant at $p < 0.001$

Master's Thesis Defense

Topics Revisited

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Discussion

- Integration with Previous Research
 - ♦ Hypothesis was supported
 - Results are consistent with large body of research in the Restorative Environments literature that shows judgments of restorative character are higher for natural environments than environments with cues of human intrusion (e.g., Kuo & Sullivan 2001; Hartig 1993, 2003)
 - ♦ Combination of ART and Recreation Ecology
 - ♦ Results did not directly correspond to predicted CUA Condition Class order
 - Visual urban cues seem to influence restorative scores
 - ♦ Combination of ART with recreation ecology
 - Include additional variables with the rubric of ART and CUA Condition Class (e.g., seasonality, social interactions, etc.)

Master's Thesis Defense

Discussion

- Limitations

- ♦ Small setting sample ($n=5$)—threat to external validity
 - Lab setting vs. actual setting
 - User-created campsites vs. developed campsites
 - Generalizing from user-created campsites only
 - Arid region vs. densely vegetated region
 - Impact “masks” (e.g., leaf litter, ocean tides, etc.)
 - CUACC scale may be too general
- ♦ Convenience sample—threat to external validity
 - Generalizing from study sample to a population of actual users should be done with caution
 - Sample may better interpret impact as impact
 - (1) More discriminating landscape “eye”
 - (2) Self-selected into environmental disciplines and careers
 - (3) Actual users may not be interested in a restorative experience or their restoration comes from other things in the setting
 - Affects ability to make inferences to population of users of the actual sites

Master's Thesis Defense

Discussion

- Contributions of the Study

- ♦ Recreation ecology tends to ignore psychological responses to resource impacts
 - The current study embedded study of impact in an environmental psychology framework
 - Recontextualization has potential to link recreation ecology issues to recreation use benefits or gains
- ♦ Use of ART
 - Provides consistency between theoretical constructs and operational definitions
 - Allows for development of propositions that fit well in ART
 - Operationalizing human-caused impact (via CUACC) testing of additional hypotheses
 - Contributed empirical support to restorative environment and recreation ecology research

Master's Thesis Defense

Discussion

• Implications for Practice

- ♦ Offers theoretically-based example
- ♦ Increased interest in resource protection from unmanaged recreation
- ♦ Displacement of particular user groups
- ♦ Better utilize Awareness of Consequence (Gramann & Vander Stoep, 1986) messaging
 - Importance of restorative character as an important user benefit?
- ♦ Removing or restoring longstanding impacted sites?
 - Knowing what landscape elements increase restorative experiences can help

Master's Thesis Defense

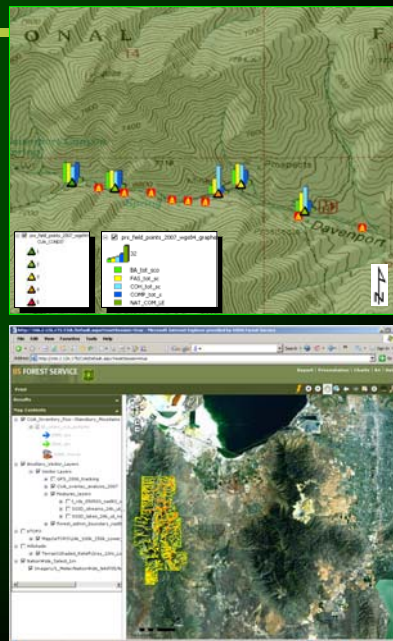
Discussion

• Recommendations for Future Research

- ♦ Field experiment
 - A sample of actual users at user-created campsites
 - Operationally define perceptual cue variables (e.g., weather conditions)
- ♦ Define additional human impact variables (e.g., visible impact and auditable impacts)
- ♦ Compare user-created campsites with developed campsites
- ♦ Additional group comparisons
 - (1) trained to interpret impacts, (2) not trained to interpret impact
 - Wilderness campers vs. backcountry campers
- ♦ Different environmental settings

• Conclusion

- ♦ This study offers theoretical foundation showing how human-caused impacts can influence judgments of perceived restorative character—useful to help determine & set Limits of Acceptable Change (LAC)



Master's Thesis Defense

The Effect of Human-caused Visual Impacts on Restorative Character of an Arid Wildland Recreation Setting
University of Utah: Department of Parks, Recreation, and Tourism and Ulna-Wasatch-Cache National Forest

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Questions/Comments?

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Utah Department of Parks, Recreation, and Tourism

Master's Thesis Defense

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