VISITOR AWARENESS OF LOW-IMPACT CAMPING TECHNIQUES IN THE WILDERNESS AREA ISLE ROYALE NATIONAL PARK, MICHIGAN: AN INVESTIGATION OF POSSIBLE AFFECTING FACTORS

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VISITOR AWARENESS OF LOW-IMPACT CAMPING TECHNIQUES IN THE WILDERNESS AREA ISLE ROYALE NATIONAL PARK, MICHIGAN: AN INVESTIGATION OF POSSIBLE AFFECTING FACTORS

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Wilderness areas possess many attributes, both ecological and recreational. However, recreational activity has been found to be the main contributor to ecosystem degradation, many times occurring through the lack of awareness of Leave-No-Trace (LNT) guidelines designed to limit ecological damage within wilderness areas. Understanding visitor behavior and encouraging behavior modification toward compliance of encouraged ethics is key to reducing such ecological impacts (Bolle 1991). The degree of visitor awareness of LNT was evaluated for Isle Royale National Park, Michigan during the 2001 visiting season. Specific variables including "previous exposure to wilderness areas," "outdoor experience and skills," "rural/urban upbringing," "educational attainment," "age," "household income," "years of exposure to camping," "exposure to natural science studies," and "gender" were tested as possible influencing factors to visitor LNT awareness. Overall, visitor awareness was found to be moderate, with no significant difference among the seasons sampled. Few of the variables tested for influence on LNT awareness were found to be significant, and those found significant were not consistent among the sampling periods.

Approved: Geoffrey L. Buckley

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Chapter One

1.1 Introduction

Wilderness areas possess many attributes that are vital to both ecosystems and humans. In addition to offering people outdoor recreational opportunities, solitude, and natural quiet, wilderness areas preserve biodiversity by protecting watersheds, maintaining habitat for wildlife, filtering and improving air quality, and maintaining gene pools. Wilderness areas also serve as laboratories for both social and physical science research (National Wilderness Preservation System 2001). Today, agencies tasked with managing these areas face a difficult challenge--the dual nature of their missions. On the one hand, they must protect and preserve the physical resource, while on the other they must provide recreational opportunities for visitors (Dilsaver 1992).

As this research intends to show, the integrity of wilderness areas is at stake. Although, the total acreage and number of wilderness areas in the United States has increased more than twelve times since the establishment of the National Wilderness Preservation System, visitation rates have also risen appreciably (NWPS). While the history of the movement has been recorded and additions to the system catalogued, relatively little information is available concerning visitor use and its associated impacts in designated wilderness areas (Cole 1996). Indeed, many wilderness areas have been managed without aid of baseline environmental data (Cole 1993, 1996). In the 1980s, only 37 percent of wilderness areas maintained or engaged in any type of research regarding fish populations, vegetation, wildlife, air and water quality, soils, and ecological processes (Reed *et al*. 1989). Similarly, a mere 14 percent engaged in social research concerning the profiles and behavioral patterns of wilderness area users.

Impacts to resources may be significantly reduced or decreased if the causes are properly identified and analyzed. To begin the process of curbing impacts to wilderness resources, managers must first understand the nature and cause of such impacts. In many cases, the greatest threat to the wilderness resource is the disturbance caused by tourists. As recreation use has

become increasingly popular over the last half century, resource managers have grappled with the issue of tourist impacts. To address these impacts we must first understand recreational behavior, particularly unskilled or unknowing behavior (Hendee *et al*. 1990). The intensity and frequency of recreational activity within a wilderness area can degrade the integrity of the area's ecosystems, as well as diminish its aesthetic value. Detrimental impacts may occur due to a lack of awareness of specific land use and recreational guidelines designed to limit ecological damage within wilderness areas.

Roggenbuck and Lucas (1985) suggest that the greatest threats to wilderness stem from visitor use, thus underscoring the importance of examining wilderness use and user characteristics in greater detail. While it is a goal of resource managers to ensure visitors have a realistic expectation of a wilderness experience, it is also critical that they promote appropriate use of the area. Reducing the impact from recreational use will depend largely on educating users and encouraging them to modify their behavior (Bolle 1991). A detailed investigation of user knowledge, user characteristics and values, and visitor behavior will provide information to public officials faced with management decisions (Lucas 1989).

1.2 Research Questions

This study seeks to answer the following questions: First, to what degree is the park's visiting population aware of federally encouraged minimal impact guidelines (Leave-No-Trace or LNT principles) applied to the wilderness area Isle Royale National Park, Michigan? (figure 1). Second, is there a difference in LNT awareness among visitors sampled during the spring, summer, and fall seasons?

The hypothesis for this research is that the variables "previous exposure to federally designated wilderness areas," "outdoor experience and skills," "rural/urban upbringing," "educational attainment," "age," "household income," "years of exposure to camping," "exposure to natural science studies," and "gender" may influence or predict visitor LNT awareness within

the designated wilderness area of study. The data for these variables were gathered using a visitor questionnaire specific to Isle Royale National Park and tested through statistical analysis.

1.3 Background of Isle Royale National Park, Michigan

Located in the northwest corner of Lake Superior, Isle Royale has a history of human occupation dating back to nearly 3500 B.P. (Shelton 1997). The island was regularly used by pre-historic Native Americans from the surrounding region as hunting and fishing grounds, a source of copper and other metals for crafting tools and jewelry, and even as a refuge during times of war among Great Lakes Indian tribes (Shelton 1997).

From the 17th to 19th centuries, the island's timber, fishing, and copper resources were exploited on a large scale by Euro-Americans. At this time, successful logging, commercial fishing, and mining ventures were established throughout the island (Shelton 1997). Much of the island was completely cut over between 1890 and the mid-1930s, a time of high timber production in the Great Lakes region (Williams 1989). Logging declined rapidly after a large forest fire burned one fifth of the island's forest in 1936, destroying nearly all of the timber company holdings (Shelton 1997). Commercial fishing began on the island before 1800, flourished for several decades, and slowly declined throughout the 20th century (Shelton 1997). By the 1890s, mining operations had all but ceased (Shelton 1997).

As resource extraction declined, the island became a popular destination for vacationers. During the late 1800s and throughout the early 1900s, many Midwesterners bought property and built summer homes and hotels on the island (Shelton 1997). Large passenger ships shuttled people back and forth from mainland Michigan, Minnesota, and Wisconsin. By the 1920s the

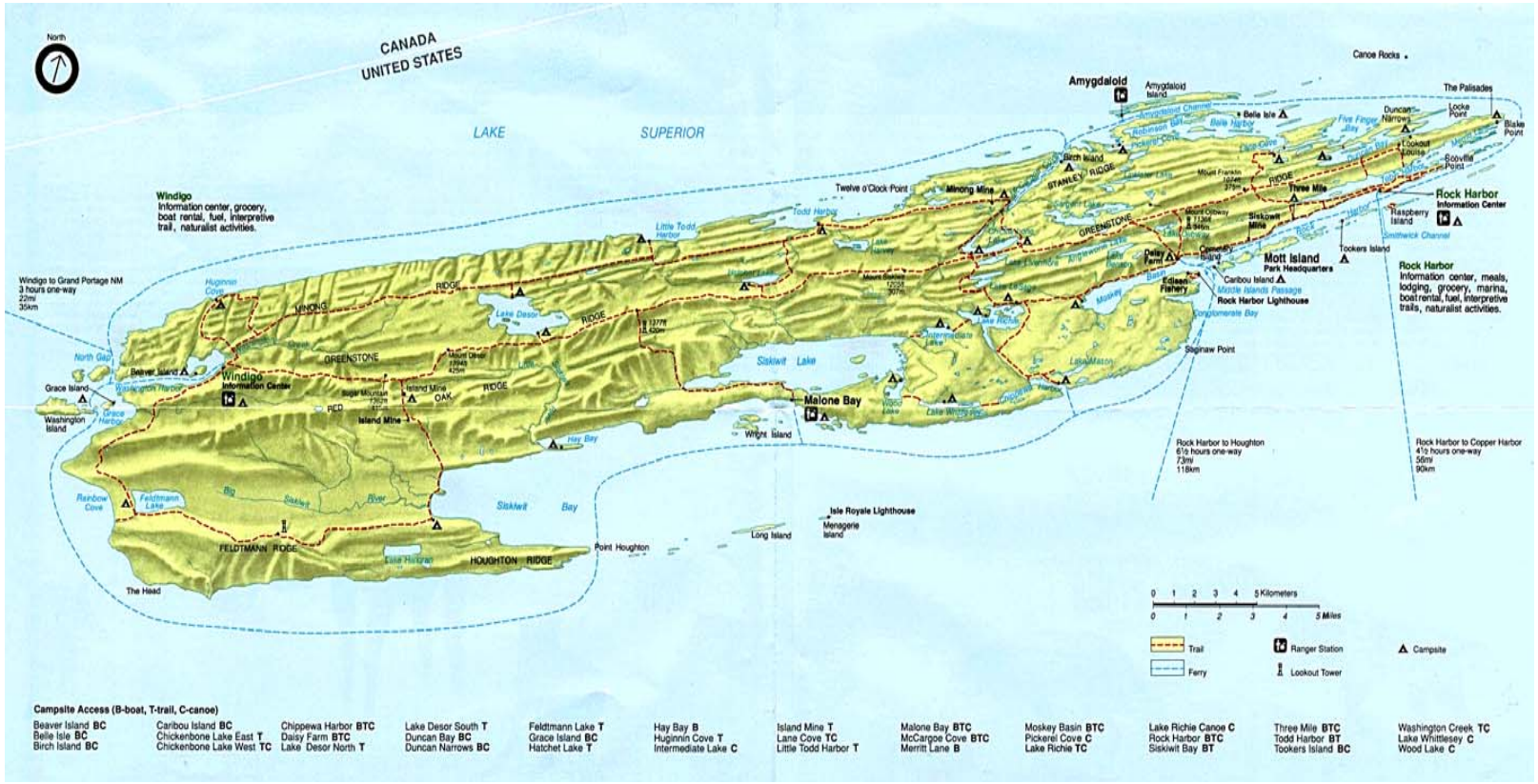

Figure 1. Map of Isle Royale National Park, Michigan and regional location. Source: Department of the Interior, National Park Service.

island had reached its peak as a destination, with extravagant hotels, a three-hole golf course, and a swimming pool available for visitors.

Isle Royale received authorization for national park status in 1931, and on April 3, 1940, it was officially established as a national park. It was not until October 20, 1976, however, that legislation designated 99% of the island's land area as wilderness, an area equivalent to approximately 134,000 land acres of contiguous wilderness (Parratt 2000). With wilderness designation came a shift to a more restrictive management of the park's lands as required by the Wilderness Act of 1964. For example, the Act prohibits the use of motorized vehicles and wheeled devices, as well as commercial development within wilderness boundaries. Fossil fuel and mineral exploitation were prohibited after 1984. The wilderness designation of Isle Royale meant that all areas used for administrative purposes and inhabited by humans were to be considered non-wilderness and included in the park's 1% non-wilderness land area. In 1980, the park was accorded International Biosphere Reserve status without further restriction due to its unique, isolated ecosystem (Parratt 2000). This isolation provides researchers with an opportunity to study rare species, as well as intricate ecosystem and landscape relationships and processes.

1.4 Statement of the Problem

Considered a jewel of the National Park Service, Isle Royale attracts approximately 16,000 to 18,000 visitors per open season (April through October). Overall, the park is one of the least visited but sustains some of the highest backcountry usage of national parks. Many visitors engage in primitive camping, kayaking, canoeing, diving, day hiking, and recreational boating (Parratt 2000). All of these activities require access into the wilderness resource, some more intensively than others. For example, fishermen and recreational boaters regularly use island waters and designated mooring sites. While these boater campgrounds are considered non-

wilderness areas, or wilderness portals, there is a need to follow land use guidelines due to the close proximity to the actual wilderness resource. On the other hand, an individual camping in the interior of the park must travel by canoe or by foot on designated trails. This type of travel on the island involves direct use of the wilderness area, and requires disciplined adherence to encouraged land use guidelines to minimize human impacts. For this reason, park service personnel strongly encourage the use of Leave-No-Trace (LNT) practices (Goodrich 2000).

Individual perceptions play a key role in the application of LNT practices within wilderness and park areas. An individual who is unaware of wilderness land ethics, or who has not had or taken the time to understand them, is likely to have a more negative effect on the wilderness resource than one who is knowledgeable and diligent in his or her LNT practices. Understanding the key variables that influence visitor recreational behavior will greatly assist resource managers, who in the case of the National Park Service, are saddled with a dual mission: to provide for the enjoyment of current and future generations and to preserve the landscape and resources for all time (Dilsaver 1992).

It is possible that LNT awareness among park visitors may vary according to the season. Oftentimes avid wilderness users will visit areas in the off-peak season; that is, when overall visitation is low. Their visits may be scheduled to avoid insect populations or periods of peak visitation, and to experience the solitude offered within wilderness areas. Avid wilderness users may also be more knowledgeable of LNT guidelines due to their level of experience and frequency of exposure to wilderness area—a hypothesis to be tested in this project. The months of April, May, and early June, as well as September and October, are typically non-peak visitation months at Isle Royale. Sampling part of the visiting population in the spring and fall months may reveal episodes of higher LNT awareness and practice, and fewer cases of observable human impact on the landscape.

Human impact in wilderness areas has become an issue of concern for resource managers over the past three decades. Several studies have found that poor camping practices, pollution, conflicts with wildlife, and impacts to vegetation were all major problems (Washburne and Cole 1983; Hendee *et al*. 1990; Cole 1993, 1996). One study in particular established that 71% of wilderness resource managers identified impacts to vegetation, especially along trails, as the most prominent problem (Washburne and Cole 1983). The study also revealed that 62% of wilderness areas had problems with litter and pollution. Most often, these impacts occurred as a result of careless or thoughtless violations of regulations, such as littering, shortcutting trail switchbacks, building illegal wood fires, or basic unskilled actions and poor camping practices by visitors, such as burning garbage, building temporary shelters, or digging drainage ditches around tents (Hendee *et al*. 1990).

At Isle Royale National Park, resource managers have been collecting visitor impact information since the early 1990s. Specific projects include monitoring the impacts of off-trail or cross-country travel (1993-present) and documenting damage to campgrounds and along trails (Ferrel and Marion 1998). Trampling of vegetation, disruption and feeding of wildlife, disturbance of breeding habitats, and various forms of pollution have all contributed to the deterioration of this wilderness resource (Pers. Comm., Jack Oelfke 2001).

Trampling caused by off-trail hiking and widening of trails by visitors wishing to avoid obstacles such as mud puddles, pooled water, or fallen trees, have had localized impacts on vegetation (Cole *et al.* 1997). While the park's compact campsite design has helped to alleviate campsite impacts, non-park service "social" trails have formed around campsites and campgrounds. This also occurs with off-trail or cross-country traveling and camping (Pers. Comm., Jack Oelfke 2001). Figures 2 and 3 provide photographic evidence of impacts caused by off-trail hiking or obstacle avoidance practices (e.g., walking around a water or mud puddle).

Figure 2. Trail widening around a wet area due to visitor foot traffic along an Isle Royale trail. Photo by: Shannon Milanowski

Figure 3. Trail widening and vegetation damage at another location along an Isle Royale trail. Photo by: Shannon Milanowski

Wildlife is also affected in many ways. Violation of fishing laws, introduction of exotic species, intentional and unintentional disturbance of breeding habitat, inadvertent or intended feeding of wildlife, and the harassing of wildlife have all had a negative impact (Ream 1980;

Washburne and Cole 1983; Cole *et al*. 1987). The coaster brook trout (*Salvelinus fontinalis*) serves as a case in point. Although its harvest is regulated, there have been instances in which that regulation is violated by the intentional or unintentional harvest of the fish (Pers. Comm., Jack Oelfke 2001).

Wildlife breeding habitats and nesting sites are highly sensitive areas that experience, at times, detrimental levels of disturbance by humans. For instance, the common loon (*Gavia immer*) is listed as an endangered species in Michigan where the largest breeding population is found within the waterways of Isle Royale National Park. It is crucial for adult loons to remain on nest consistently for several weeks to insure successful incubation. However, if disturbance occurs, either through accidental discovery or due to visitor curiosity, adult loons may flush or leave the nest and eggs, possibly never returning to complete incubation of the eggs. Visitors are made aware of sensitive areas to be avoided in order to help reduce impact levels and increase hatch success. Nevertheless, curious visitors may want to observe a loon or loon nest (Pers. Comm., Jack Oelfke 2001).

The feeding of wildlife has also caused problems within the park's boundaries. Feeding wildlife, both intentionally and unintentionally, oftentimes results in the establishment of "habituated animals" (Washburne and Cole 1983; Cole *et al*. 1987). These tend to be species such as foxes or squirrels that reside near or in campgrounds, where human activity level is high and the availability of a food source is likely (figure 4). Feeding diminishes a creature's fear of humans, possibly resulting in animal aggressiveness. Many of these impacts can be attributed to lack of knowledge of current guidelines and regulations, as well as carelessness on the part of the visitor (Pers. Comm., Jack Oelfke 2001).

Figure 4. Red squirrel (*Tamiasciurus hudsonicus*) foraging for food at Daisy Farm campground, only a few feet from the researcher. Photo by: Shannon Milanowski

Carelessness also leads to litter and pollution problems (Washburne & Cole 1983; Cole et al. 1987). Littering and pollution are two common human impacts that can be observed within the park. Littering most often occurs when visitors fail to carry out all of their belongings including any refuse generated during their stay within the park. Examples of this include trash that has been buried, discarded along the trail, or left inside the privies (figures 5 and 6). In some areas, fires have been built (in the absence of a fire ring) to burn trash generated during an outing (figures 7-9). Oftentimes these fires do not completely eliminate trash, leaving behind tin foils, plastics, and other similar materials. Fires are only permitted in designated fire rings located at specific campgrounds. Illegal fires present a significant risk to vegetation in the area, not to mention visitor safety and experience in the park.

Figure 5. (left) Discarded clothing along the trail. Figure 6. (right) Discarded can of food found in the water at Hatchet Lake campground. Photo by: Shannon Milanowski

Figure 7. Illegal fire and ring constructed and recently used at Hatchet Lake campground. Photo by: Shannon Milanowski

Figure 8. Evidence of illegal fire and ring at Hatchet Lake.
Photo by: Shannon Milanowski

Figure 9. Site of illegal fire after rehabilitation. Photo by: Shannon Milanowski

Improper disposal of wastewater generated by dishwashing or bathing causes water pollution problems. Dishwashing deposits food particles and harmful soap residues directly into the water source, which can, in turn, be damaging to plants, fish, and animals within the area (Washburne and Cole 1983; Cole *et al*. 1987). Bathing with soap has the same effects as dishwashing, but it also affects other visitors who use the same source for drinking water. Powerboats may cause pollution by leaking oil and gasoline into the water and expelling exhaust into the air. The park service staff and 20-30% of visitors use powerboats as their primary form of transportation to, from, and around the island (Pers. Comm., Jack Oelfke 2001).

Noise disturbance is another form of human impact experienced at Isle Royale. One source of this disturbance is the powerboats described above. Many boats, boat generators, and building generators can be heard up to a few miles away at times, disturbing wildlife and influencing visitor experiences. The noise levels of individuals or groups also influence the experience of others visiting the park.

Carelessness and lack of consideration for the wilderness resource is evident throughout the park, taking such forms as campsite modification (e.g., nails in trees), graffiti, and deliberate damage to plants and trees in and near campgrounds (e.g., tree carving, cutting of live limbs), and along trails (figures 10-12). Direct impacts such as these detract from the area's aesthetic value and jeopardize its ecological integrity.

Figure 10. Defacing of park property in one of the many wooden shelters provided for visitors. Photo by: Shannon Milanowski

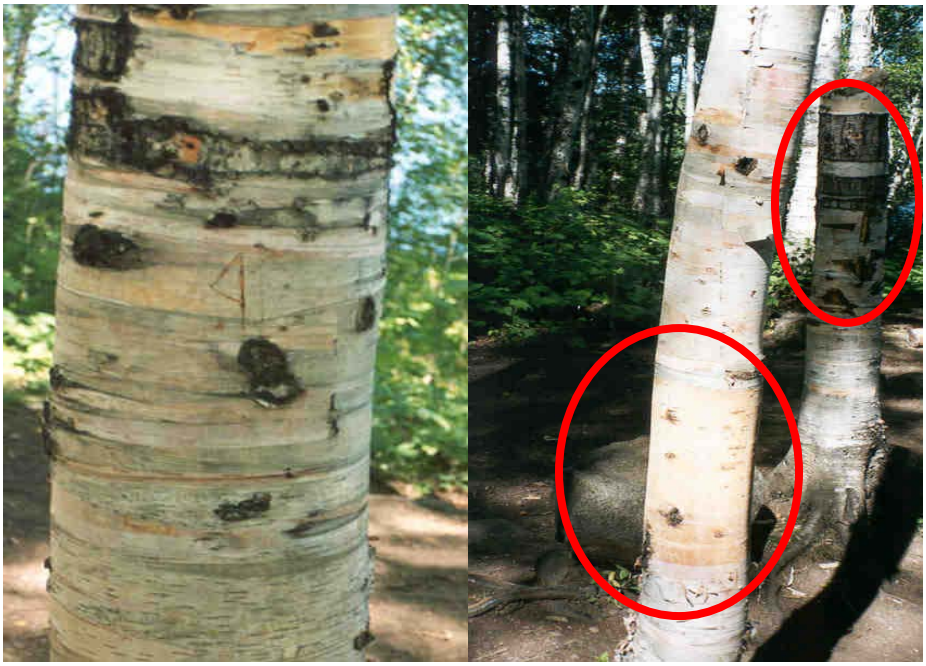

Figure 11. (left) Carving by visitors. Figure 12 (right) Exterior damage to a birch tree (as denoted by the red circles). This tree had been slit with a knife and stripped of nearly two feet of the first few layers of its bark.
Photo by: Shannon Milanowski

The impacts noted above all have the potential to seriously degrade ecosystems on Isle Royale and decrease the quality of the wilderness experience for visitors. This study will provide insight into visitor perceptions of what constitutes appropriate behavior and resource use, as well as the level of visitor awareness, understanding, and use of Leave-No-Trace land ethics within the park. The results will serve as a useful tool for park resource managers in educating visitors more effectively and stressing the importance of responsible land-use practice in wilderness areas.

The remainder of the thesis is divided into three chapters. In Chapter two, I explore the concept of wilderness as it was originally perceived, and then follow the progress of the wilderness movement from its origins to the present. Wilderness recreation trends and visitor characteristics are outlined and described, as well as factors that may influence recreational behavior. Specific ecological impacts resulting from recreational activity are reviewed and a detailed history of the movement toward and establishment of a minimum impact land use ethic is provided. Chapter Three consists of a statistical analysis of data collected in the field and a report of findings. In Chapter Four, I synthesize, interpret, and discuss the results, as well as offer concluding thoughts and directions for future research.

Chapter Two

Literature Review

2.1 Early Perceptions of Wilderness and the Wilderness Movement

The way we define and perceive wilderness today is different from the way it has been defined and perceived in the past. Two hundred and fifty years ago, people feared and despised wilderness. According to William Cronon (1996, 70), "To be wilderness then was to be 'deserted', 'savage', 'desolate', 'barren', and a 'wasteland', giving rise to feelings of bewilderment or terror." By the late 1960s, if not much earlier, a growing number of people had come to regard wilderness as "sacred space" (Graber 1976).

Over the years, a great many scholars have contributed to our understanding of wilderness. Clarence Glacken (1967, 1985), Roderick Frazier Nash (1967), and Stephen Fox (1981), in particular, have examined the wilderness concept and placed it within the broad context of the American Conservation Movement. As the following paragraphs clearly show, our perception and treatment of these "wild" spaces has shifted considerably since biblical times.

The very idea of "wilderness" is ancient, dating back to biblical times. The King James Version of the Holy Bible established wilderness as a place where God's blessing was absent, a place where it was easy for an individual to compromise his or her morality (Stankey 1989; Cronon 1996). The wilderness was also the place where Christ endured Satan's temptations for forty days (Cronon 1996). Wilderness, in the Judeo-Christian tradition, was a place of punishment and penitence (Hendee *et al*. 1990). It was a cursed land, and when God set out to punish, the wilderness was often the setting. For European colonists arriving in the "New World" wilderness was a dangerous place—one which harbored hostile Indians and deadly miasmas (Williams 1989). Wilderness was something that had to be subdued simply because survival depended upon it.

By the middle of the 19th century, attitudes toward wilderness had begun to change. The uniqueness of wilderness served as an inspiration for many. People sought out such places in search of solitude, beauty, and spirituality (Vickery 1986). Transcendentalism, in particular, advanced the cause of wilderness appreciation, with individuals such as Ralph Waldo Emerson, Henry David Thoreau, and John Muir emerging as powerful advocates. Their passion and commitment to the cause of wilderness appreciation cannot be overstated. In *My First Summer in the Sierras,* for example, John Muir writes: "No description of Heaven that I have ever heard or read of seems half so fine" (Muir 1911, 211). Sigurd Olson would pick up where Muir left off, writing about his enlightening experiences in the wilderness regions of northern Minnesota and Ontario (Olson 1945, 1958, 1976).

Deep concern for America's remaining wilderness sparked a preservation movement beginning in the mid to late 1800s. Artist George Catlin was among the first to call for the establishment of "a nation's park, containing man and bear, in all the wild and freshness of nature's beauty" (quoted in Nash 1982, 101). Thoreau supported this concept, stating in *Atlantic Monthly* in 1858, "why should not we…have our national preserves…in which the bear and panther, and some even of the hunter race, may still exist" (quoted in Nash 1982, 102). Muir expressed his approval emphatically in such works as *The Mountains of California* (1894)*, Our National Parks* (1902)*,* and *Steep Trails* (1918).

If Muir and Catlin were responsible for initiating the preservation movement, Robert Marshall, Aldo Leopold, and Howard Zahniser were responsible for carrying the banner into the 20th century. Marshall, who worked for the U. S. Forest Service, believed wilderness areas were living ecological mosaics and that their preservation would protect tree and plant species that added significant aesthetic value to the landscape (Marshall 1933). Leopold, who also spent his career working for the Forest Service, stressed the importance of seeing the richness in biological systems, acknowledging how every living thing, including humans, is interwoven into a complex

and diverse community of life. In his seminal work, *A Sand County Almanac*, published posthumously in 1949, Leopold discusses the value of wilderness, as well as the importance of wilderness ethics and preservation. Together, Marshall and Leopold would found the Wilderness Society and establish the nation's first protected wilderness area, the Gila Wilderness Complex (Fox 1981).

Though controversy simmered over the idea of wilderness preservation, the movement continued to gather momentum. In 1954, the most comprehensive study of preservation issues was undertaken by James Gilligan of the University of Michigan (Allin 1982). This research exposed the sheer lack of protection offered the nation's wild areas by federal land managing agencies. With publication of these findings, wilderness supporters recognized the need for national wilderness preservation policies.

With Howard Zahniser at the helm, the Wilderness Society was the first to respond to the need. Zahniser took it upon himself to formulate a philosophy of wilderness preservation and develop a program for its protection through legislation (Roth 1988). In 1955, he drafted the first wilderness bill, proposing a "national wilderness preservation system" comprised of current federal land and offering the first concrete definition of what constituted "wilderness." Nine years and eighteen hearings later, President Lyndon Johnson signed the Wilderness Act into law, preserving wilderness areas and their characteristics for all time (Allin 1982). The following is the legal definition of "wilderness" according to the Wilderness Act of 1964:

> A wilderness, in contrast with those areas where man and his works dominate the landscape, is thereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined as an area of undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation, which is protected and managed to preserve its natural conditions and which 1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work

> substantially unnoticeable, 2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation, 3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and 4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value (U.S. Congress 1964).

The wilderness areas receiving automatic designation by the Wilderness Act and lands later designated for protection, are managed by the same agencies having original jurisdiction over the area. These agencies include the National Park Service (NPS), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), and the Bureau of Land Management (BLM). Currently, the NPS manages 13% of all federal lands and 42% of the National Wilderness Preservation System (NWPS); the USFS manages 30% of federal lands and 33% of the NWPS; the BLM manages 42% of federal lands and 5% of the NWPS; and the USFWS manages 15% of federal lands and 20% of the NWPS (NWPS 2001). As the nation's system of wilderness areas grew, new opportunities were created for outdoor enthusiasts, continuing a trend in recreation the roots of which can be traced to the latter portion of the 19th century.

The idea of wilderness took a more controversial turn when scholars such as Cronon described wilderness as "socially constructed" for human benefit (Cronon 1996). Cronon suggests that the idea and creation of wilderness merely forgives us the homes we actually inhabit and our convenient lifestyles, all the while allowing us to proclaim wilderness and simplicity as the basis of who we are (Cronon 1996). Spence (1999) also contributes to this idea when he states that wilderness is idealized or shaped by human imagination and expectations of what it should be. For example, as the idea of wilderness became more associated with purity, devoid of a human imprint, untouched by civilization, and unchanging or timeless, the drive to keep it that way also increased (Botkin 1990; Spence 1999). John McPhee (1971) engages this controversial

aspect of wilderness preservation and the efforts of preservation advocate David Brower, in his work *Encounters with the Archdruid.*

2.2 Wilderness Recreation Trends and Visitor Characteristics

With the designation of numerous new wilderness areas, visitation to such places gained popularity. Recreation trend data suggest that use of wilderness areas has risen steadily since 1964. The 1990s, in particular, saw a great increase in activity (Cole 1996b). Cole (1996a) estimates that recreational use of wilderness areas has increased nearly six times since passage of the Wilderness Act of 1964. While most of this increase can be attributed to the addition of new wilderness acreage, recreational use of the original 54 wilderness areas has also risen, increasing 86% between 1965 and 1994 (Cole 1996a). In 1989, nearly 90% of the U. S. population participated in outdoor recreation, with nearly half of those people engaging in such activities as camping, canoeing, kayaking, fishing, hunting, hiking, horseback riding, bicycling, wildlife observation, winter skiing and visiting prehistoric sites (Cordell and Siehl 1989). Wilderness areas in national forests accounted for about 85% of this use, while wilderness use in the national parks made up for most of the remainder. Only very light use of wilderness areas was recorded on lands administered by the FWS and BLM (Lucas 1989).

Studies show that wilderness visits tend to be short, with average lengths of stay ranging from two to three days. Rarely do these visits exceed five days. Trips of seven or more days are uncommon (Lucas 1979). Recent trends suggest that long weekend trips are favored over extended vacations (Roggenbuck and Lucas 1987; Lucas and McCool 1988; Lucas 1989; Cordell and Siehl 1989; Cole 1996b). While summer is the main recreational-use season, wilderness visitors are increasingly scheduling their visits for the spring and fall (Lucas and McCool 1988; Lucas 1989).

The most common mode of travel in almost all wilderness areas studied was hiking. Studies of Forest Service wilderness areas estimate that less than 20% of visitors participate in off-trail traveling (Lucas and McCool 1988). In areas largely associated with water recreation, such as the Boundary Waters Canoe Area, nearly 80% of visitors use canoes and much of the remaining visiting population travel by motorboat where permitted (Roggenbuck and Lucas 1987; Lucas 1989). Other wilderness activities such as fishing, photography, nature study, swimming, and wildlife observation, are also common (Roggenbuck and Lucas 1987; Lucas 1989).

Understanding recreation use trends and patterns in wilderness areas is important. However, understanding visitor demographics and characteristics is the key to improving management programs. In an early visitor characteristic study, Lucas (1979) investigated visitor use patterns, attitudes, and characteristics in nine western wilderness areas. He examined such variables as age, gender, rural versus urban upbringing, educational attainment, income, outdoor experience, occupation, and general vacationing patterns. Over the past few decades, several other studies have corroborated his findings.

On average, wilderness users tend to be younger than the general population, with 30-50% of visitors being aged 25 or younger and 30-50% falling between the ages of 26 and 45 (Lucas 1979; Lucas 1989; Hendee *et al*. 1990; Cole 1996a, 1996b). Nearly 75% of visitors are male (Lucas 1979, 1989; Hendee *et al.* 1990; Cole 1996a). However, Cole (1996b) states that the proportion of female visitors has increased in recent years to nearly 34%.

The most frequented wilderness areas are relatively close to large population centers (Roggenbuck and Lucas 1987). Thus, most wilderness visitors were found to reside in the general vicinity of the wilderness areas in which they visit (Lucas 1979, 1989; Roggenbuck and Lucas 1987). Approximately 45-90% of these visitors lived in areas with a population of at least 5,000 people. Of those visitors, most were from small to medium-sized cities with populations between 5,000 and 1,000,000 people (Lucas 1979, 1989; Hendee *et al*. 1990; Cole 1996a, 1996b).

In contrast, childhood residence was much less urban, with 21% of visitors growing up in rural areas (Lucas 1979).

Educational background seems to distinguish most wilderness visitors from the general population. It was found that 60-85% of wilderness visitors have attended college, and 20-40% were pursuing or had completed graduate studies (Lucas 1979, 1989; Hendee *et al*. 1990; Cole 1996a, 1996b). Lucas (1989) found that backpackers, on average, had higher education levels and that summer visitors had achieved higher educational attainment than fall visitors. With regard to income, a majority of wilderness visitors were found to be moderately above the U.S. median income level, a possible result of higher educational attainment (Lucas 1979, 1989; Hendee *et al*. 1990).

Previous wilderness experience appears to influence recreational use, skill knowledge, and behavior. Roggenbuck and Lucas (1985) noted that between one-third and one-half of wilderness users had their first wilderness visit before age 16. Lucas (1989) found that 73-89% of visitors had been to wilderness areas before, and 39-70% had visited the specific study area previously. A 1994 U.S. Department of Interior survey of visitors to national park wilderness areas reported an average of only 7% of visitors being highly experienced in outdoor recreation and 21% as beginners having no previous wilderness experience (Marion and Roggenbuck 1994). A recent trend now shows that the proportion of visitors having previous wilderness experience is increasing (Cole 1996b).

"Wilderness importance" or "value to individuals" was found to play a significant role in recreational use. Lucas (1979) found over 90% of wilderness visitors stated that wilderness areas were very important to them, with a majority of those visitors, 67-81%, reporting having extremely high importance. Rudzitis and Johansen (1991) found that 53% of individuals residing in the same county as wilderness areas in the West agreed that the presence of the wilderness area influenced their decision to stay in or move to the area. Lucas (1979) found many visitors

engaged in wilderness recreation because of the natural, primitive opportunities, solitude and isolation, and the unmodified surroundings (Lucas 1979). Fishing, hiking, "escaping civilization," and viewing scenery were also common responses.

2.3 Resource Perception and Factors Affecting Visitor Behavior

The way in which an individual or society perceives or defines a resource influences the way in which that resource will be utilized. According to Harold Brookfield (1969), we "treat" as we "perceive." Put another way, we view our surroundings through a social and cultural lens (Cutter and Renwick 1999). With regard to natural resources, Judith Rees (1989) reminds us that, "although resources are products of the physical system they are defined by human ability and need, not by nature" (Rees 1989, 365). She suggests that resources only become valuable when humans assign a use or value to them, reinforcing the idea that natural resources are social constructions. Of course, different interest groups value natural resources in different ways, a condition that often leads to conflict (Geores 1996; Proctor 1996).

Several studies examined visitor attitudes and perceptions, recreational behavior, and awareness and practice of encouraged land use guidelines. Hendee and Harris (1970) found that there were significant differences in wilderness perceptions between visitors and managers. Stankey (1973) evaluated visitors according to how well their definitions of wilderness coincided with the definition in the Wilderness Act of 1964. Thus, differing perception of wilderness may result in differing ideas of appropriate use and behavior. In fact, visitor attitudes, preferences, and behaviors are often related to demographic visitor characteristics such as education, urban or rural upbringing, preferred recreational activity, and level of wilderness experience (Manning 1999). For example, some urban residents may feel nostalgia or attraction to wilderness because of a rural upbringing (Lucas 1989).

A major influence on wilderness perception and associated behavior is previous experience (Stankey and Schreyer 1985). Visitors with previous wilderness experience have been found to be more sensitive both ecologically and socially (Hammitt and Cole 1987; Hendee *et al.* 1990). For example, certain visitor behaviors such as littering or trampling of vegetation may not be considered inappropriate behavior by novice campers, yet more experienced visitors are likely to recognize the potential impacts caused by each action (Hammitt and Cole 1987). In addition, a person with previous wilderness experience might ascribe greater value to that environment as experiences increase (Stankey and Schreyer 1985). For instance, backpackers who are highly specialized or experienced were found to maintain a more primitive or rugged perception of what wilderness should be, and associate these characteristics with a quality outdoor experience (Virden and Schreyer 1988).

Basic knowledge and awareness of guidelines is another factor influencing visitor behavior. Often visitors are simply unaware of certain skills and techniques that are encouraged to reduce impact and disturbance to the resource. Recent studies have found that education programs significantly affect visitor knowledge and subsequent behavior, and that these programs are generally more effective with visitors who are less experienced and who are less knowledgeable (Manning 1999). For example, Kernan and Drogin (1995) examined the rate of visitor compliance with low-impact guidelines in Mount Rainier National Park, Washington. The visitors were given a short interpretive presentation on park guidelines for minimum impact recreation and its importance, and were observed during their time in the park. The authors found that of the individuals who did not receive the interpretive talk, only 36% of visitors complied with park guidelines. Of those visitors who received the talk, 58% complied with guidelines, showing and increase in awareness and compliance as a result of education efforts (Kernan and Drogin 1995).

The simple availability of minimum impact information in a wilderness area may help to influence behavior. Marion and others (1994) reported that three-fourths of all parks make minimum impact educational programs and literature available at visitor centers and ranger stations. Meanwhile, Lucas (1985) found an increase in visitor knowledge of recommended low-impact camping practices in Bob Marshall Wilderness complex. Thus, through education, managers work to create a minimum impact ethic—one which can be encouraged in all wilderness areas (Hammitt and Cole 1987; Hendee *et al.* 1990).

2.4 Impacts Sustained From Recreation

Unfortunately, present levels of recreational activity have caused ecological problems in nearly all wilderness areas. Hammitt and Cole (1987) describe ecological resource impact as a disturbance to a natural or wilderness area because of recreational use. It often refers to a change or deterioration in the ecological conditions of an area (Hammitt and Cole 1987). Cole and Landres (1996) argue that since much of the value of wilderness resides in its natural aspects, all human activity having the potential to alter these aspects should be considered damaging and detrimental to the ecosystem. Recreational use—particularly backpacking and wilderness camping—and its management are considered the most prominent contributors to ecological resource impacts (Cole 1992; Cole and Landres 1996).

There are several specific human activities contributing to the ecological degradation of wilderness ecosystems. They include physical site alteration and disturbance via trampling by humans and packstock; impacts associated with packstock grazing; the collection and burning of wood for campfires; disturbance to native fauna in all its forms; and pollution of waters as a result of inappropriate waste disposal practices (Hendee *et al*. 1990; Cole and Landres 1996). The impacts of these activities are manifested in a variety of ways, including vegetation loss, soil

exposure, tree and seedling damage, and wildlife disturbance (Cole 1982, 1987; Cole *et al*. 1997; Hammitt and Cole 1987; Hendee *et al.* 1990; Cole and Landres 1996; Farrel and Marion 1998).

Trampling and the collection and burning of firewood have been identified as primary causes of soil loss and vegetation damage (Cole 1987). Trampling activities cause abrasion of vegetation by crushing, bruising, and uprooting plants, with bare ground appearing even after only light use (Cole 1982). Trampling causes surface soil abrasion and compaction, reduces water percolation and infiltration rates, increases erosion, and adversely affects microbiota living within the soil (Cole 1982, 1987; Cole *et al.* 1987; Hammitt and Cole 1987; Hendee *et al*. 1990). Firewood collection contributes to trampling and plays a significant role in disturbing populations of invertebrates, small mammals, and birds (Hammitt and Cole 1987; Hendee *et al*. 1990). Campfires severely affect soils by destroying organic matter, changing soil chemistry, and through sterilization (Cole 1987; Hammitt and Cole 1987; Hendee *et al*. 1990).

Alteration and destruction of habitats have a negative effect on wildlife, particularly small mammals (Ream 1980; Cole *et al*. 1987; Hendee *et al*. 1990). Wildlife disturbance can result in stress or excitement, exertion, disruption of nesting and breeding activities, reduced reproductive capacity, or displacement to other habitats (Hammitt and Cole 1987; Hendee *et al.* 1990).

The effects of recreation on water resources and aquatic ecosystems are often more extensive, even though point sources of impact remain highly localized. Even in less frequented watersheds, improper disposal of human wastes has contributed to the spread of water-borne intestinal parasites, such as *Giardia spp.* (Suk *et al.* 1987). Aquatic systems typically occupy a small proportion of the land surface and are highly attractive for certain uses. In some wilderness areas, recreation use and its attendant pollution may alter the properties of water bodies, including

increases in plant and algal blooms. Algal blooms and impacts associated with the introduction of exotic fish species serve as examples (Hammitt and Cole 1987).

As the preceding paragraphs have shown, the scope of the problem is great and the impacts are far reaching. As wilderness recreation remains steady, resource managers have turned to minimum impact land use guidelines to reduce impacts. All wilderness visitors are strongly encouraged to adopt them.

2.5 Leave No Trace Land Ethic

Leave No Trace is an educational program dedicated to building awareness, appreciation, and respect for federal lands available for public recreation (NOLS 2000). The program, developed and directed by the non-profit 501 (c)(3) organization, Leave No Trace, Inc., strives to educate visitors about their recreational impacts and assists them in learning minimal impact techniques to be used while traveling and camping in America's public lands. It is based on seven major principles: 1) plan ahead and be prepared; 2) camp and travel on durable surfaces; 3) dispose of waste properly; 4) leave what is found; 5) minimize the use of fires; 6) respect wildlife; 7) and be considerate of other visitors (NOLS 2000). The program unites the four federal land managing agencies—USFS, NPS, USFWS, and the BLM—with outdoor retailers, user groups, manufacturers, educators, corporations, and individuals committed to protecting and sustaining the quality of public lands (NOLS 2000). By linking many organizations, agencies, companies, and individuals, the program is able to reach and educate a variety of public land users. However, the program that exists today is the product of much collaboration and cooperation among land managing agencies, and reflects visitor impact research conducted over nearly four decades.

Visitor use of all types of public lands continues to increase. Between the years 1924 to 1999, for example, approximately 895.4 million visited America's national forests. Similarly,

visitors to national parks increased from 33 million in 1950 to 287 million in 1999 (Marion and Reid 2001). During the 1960s alone, primitive area and wilderness recreation increased three-fold (Marion and Reid 2001). Since sustaining the quality of the natural resource and providing recreational experiences are the primary goals of federal land resource managers, the dramatic increase in visitation numbers to public lands prompted research on visitor impacts. Those impacts include littering, trampling of vegetation, change in species composition, erosion, and compaction, all of which affect the aesthetic value of the area and the outdoor experience of others. The challenge for resource managers was to eliminate the avoidable impacts and minimize the unavoidable ones.

In the late 1960s and early 1970s, USFS and NPS resource managers realized that strict enforcement of land use regulations was counter productive. Many visitors felt antagonized by regulations that restricted their outdoor experiences. Since many of the impacts stemming from visitation were not intentional but occurred due to a lack of knowledge or awareness, it was apparent that a program was needed to educate visitors about the consequences of human impacts to public lands (Bradley 1979).

In the late 1970s, wilderness resource managers introduced a program featuring "No Trace" camping and travel techniques developed by the USFS. The purpose was to educate the public on minimal impact camping and sustainable practices within public recreation lands (Marion and Reid 2001). The success of the program encouraged interagency cooperation, and in 1987, the USFS, NPS, and BLM coordinated a Leave No Trace Land Ethics pamphlet to be distributed to visitors. The USFWS would join the program later (Marion and Reid 2001).

In the 1990s, the USFS formed a partnership with the National Outdoor Leadership School (NOLS) to develop a written wildland ethics curriculum for visitors to be known as the Leave No Trace Land Ethic (or LNT Land Ethic). NOLS, a non-profit school founded in 1965, is

considered the leader in developing and teaching minimal impact traveling and camping techniques. In 1991, the partnership welcomed an official activation of the LNT Land Ethic by the USFS, creating a model to encourage participation by other agencies. As a result, NOLS, the USFS, NPS, BLM, and USFWS signed a new agreement in 1994. The goal was to teach minimal impact techniques and promote their use in wilderness areas (Marion and Reid 2001).

Although NOLS supplied the materials and training, responsibility for disseminating information on LNT rested squarely with the agencies. Working in conjunction with NOLS, the agencies worked toward the development of a nationally-recognized system to educate the public. However, funding constraints prompted the formation of Leave No Trace, Inc. in 1994, a non-profit educational program that could gain financial support through donations and fundraising activities.

Leave No Trace, Inc. has been highly successful at developing and distributing minimal impact information with the assistance and cooperation of the land managing agencies mentioned above. The program has published a series of "skills" and "ethics" booklets containing information on minimal impact techniques for numerous environments. Available to the general public, a total of 16 booklets have been published to date. The mission of the program is to inspire responsible outdoor recreation through education, research, and partnerships, and the majority of agencies responsible for wilderness resources provide informational programs aimed at educating visitors about such practices (Hammitt and Cole 1987).

A survey of the existing literature supports that there are several reoccurring trends among wilderness visitors. For instance, many wilderness visitors are primarily 40 years of age or younger, had a rural upbringing, currently live in relative close proximity to a wilderness area, possess some sort of college education, and have had previous wilderness experience. As these trends remain consistent throughout wilderness visitor studies, it is expected that heightened awareness of LNT guidelines is influenced by the following variables and will emerge when

compared with such variables as age, previous exposure to wilderness, rural/urban upbringing, and educational attainment.

Chapter Three

Methodology and Results

3.1 Introduction

A visitor questionnaire was administered to gather data for each of the hypothesized variables. Specific information regarding visitors' personal background and preferences, outdoor experience, and awareness of LNT within wilderness areas was gathered during the 2001 operating season. While some questions are based on Lucas' 1980 study of visitors in nine western wilderness areas, others were developed based on their hypothesized significance in explaining levels of visitor awareness of LNT principles for the Great Lakes region (Goodrich 2000).

The Federal Office of Management and Budget, Ohio University, and the Resource Management Division at ISRO approved the questionnaire for data collection during the periods 8-23 May, 11-28 July, and 14-27 September 2001. During these times, the questionnaire was randomly distributed to visitors (18 years and older) at campgrounds and boat mooring sites along the park's trail system. In some cases, passengers on the island ferry *M.V. Ranger III* were surveyed while in transit to and from the island. Field notes and photographs were also taken to provide supporting information for the study.

Following collection, the data were evaluated and prepared for statistical analysis to test for possible trends or correlations with visitor background, preferences, outdoor experience, and/or LNT awareness. The data consist of both quantitative and qualitative variables. The quantitative data, such as age, age first exposed to camping, and number of wilderness areas visited by the individual, were analyzed in the numeric form in which they were collected. The qualitative data, including gender, educational attainment, student status, years of study in natural science, town size of childhood residence, current town size, household income, previous visits to

ISRO, number of wilderness trips taken, number of days spent on wilderness trips, time taken to plan trips, knowledge of LNT, wilderness value to individual, and self-rated level of outdoor skills, cannot be analyzed statistically unless they are coded using a binary (0, 1) or other simple numeric systems (e.g., scale of 1 to 4). A sample of the questionnaire and the coding systems used can be found in Appendix A.

To determine the mean for each variable, the data were entered into Microsoft EXCEL® and the descriptive statistic function in the data analysis package was applied. The data were analyzed for all collection periods combined and for each period independently.

3.2 Visitor Description Statistics for Spring, Summer, and Fall Combined

A total of 168 surveys were collected throughout the spring, summer, and fall sampling periods at ISRO. A total of 126 males and 42 females were surveyed (figure 13). The ratio of males (75%) to females (25%) is consistent with previous wilderness visitor characteristic studies (Lucas 1979, 1989; Cole 1996a).

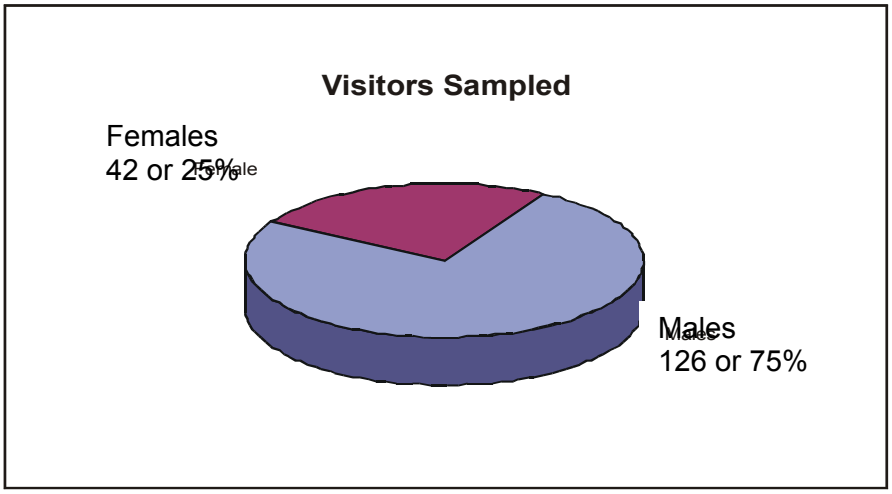

Figure 13. Ratio of males to females visiting ISRO for all seasons combined.

A binary code, using 0 and 1 to create an interpretable division in the visitor responses, was used for 11 of the background, preference, and experience variables collected. This was done to simplify the analysis and to show general trends in the overall population surveyed. As a result of analysis using a binary system of coding for variables, the means of each variable are statistically understood as a percentage. For example, the mean for "educational attainment" resulted in .7916 of visitors surveyed as answering yes (coded as 1) to having some sort of college degree. This was then translated into 79% of visitors obtained a college degree.

The qualitative variables "value of wilderness to individual" and "self-rated level of outdoor skills" were coded using a simple 1 to 5 scale for the former (1 signifying extreme importance and 5 signifying no importance) and a 1 to 4 scale for the latter (1 for beginner and 4 for master/instructor level skills). In calculating the mean for this type of coded data, the result is rarely a whole number.

The quantitative variables, "age," "age first exposed to camping," and "total number of wilderness areas visited by the individual," were analyzed in their numeric form. Table 1 shows descriptive statistical results, including the means and percentages calculated for each variable during all seasons.

On average, visitors to ISRO during the 2001 visitor season were in their early thirties, with nearly four-fifths holding college degrees of some kind. Nearly 30% were students at the time of the survey and over half had college education in the natural sciences. Forty-eight percent earned more than $50,000 per year, 65% spent their childhood in larger cities, and nearly three-quarters currently lived in larger cities with populations above 5,000. The visitors were exposed to camping during childhood and had visited several wilderness areas prior to this trip. Over half of the visitors had taken seven or more wilderness trips, with nearly 80% spending six or fewer days per trip. Two-thirds of visitors planned more than two months in advance and nearly three-quarters of visitors admitted to familiarity with LNT guidelines.

Descriptive Visitor Statistics Spring, Summer, Fall 2001 Sampling Periods Isle Royale National Park, Michigan			
Category	**Mean**	**Percentage**	
Age	34 yrs *		
Educational Attainment		79% college degree	21% GED or below
Student Status		27% students	73% non-students
Natural Science Education		56.5% college study	43.5% high school or below
Household Income		48% above $50,000	52% below $50,000
Size of Current Residence		28% rural areas or small town**	72% cities ***
Size of Childhood Residence		35% rural areas or small town**	65% cities***
Previous Visit to ISRO		64.8% first visit	35.2% visited before
Age First Exposed to Camping	9.6 yrs		
Number Wilderness Areas Visited	7.5		
Days Spent Per Trip		55.6% 7 or more trips	44.4% 6 or less trips
Time Taken to Plan		21.7% 7 or more days	78.3% 6 or less days
Stated Familiarity with LNT		73.7% yes	26.3% no

Table 1. Descriptive visitor statistics for all seasons based on combined data sets from the three sampling periods. Starred items: * Minimum age 18, maximum 71; ** Population size less than or equal to 5,000; * Population size greater than 5,000.**

Differences Between Men and Women Throughout All Seasons

The data were sorted by gender to test for possible trends or patterns that may occur. A few differences between males and females emerged. Though the average ages of both males and

females were virtually the same, the males were exposed to camping at an earlier age than the females. Eighty-two percent of males held a college degree of some kind, while 69% of females had college degrees. Thirty-one percent of females admitted to no familiarity with LNT, while 25% of males were not familiar with LNT. On average, males rated themselves "very experienced" for level of outdoor skills, while women rated themselves "intermediate."

3.3 Seasonal Analysis

Spring Visitor Season

The data were separated into their respective seasonal sampling sets and analyzed for any correlation that may be associated with seasonal visitation. The spring sampling period produced 51 observations, including 41 males and 10 females. The data were first analyzed with male and female responses combined, and then separate from one another. The data were coded based on the response categories for each variable. Table 2 shows the mean for each variable calculated for the spring data set.

At 1.3, "importance of wilderness to the individual" was rated either extremely important or very important. The average "level of self-rated outdoor skills" fell between very experienced and intermediate at a value of 2.4. This information was not included in Table 2 due to the difficulty in determining the separation point between extreme/very important and intermediate/very experienced.

As illustrated in the following table, the average visitor to Isle Royale during the spring months is in his or her mid-thirties, holds a bachelor's degree of some kind, and has at least two years of natural science education in both high school and college. He or she earns anywhere from $25,000 to $50,000 per year, spent his or her childhood in a small city, and currently lives in the same size city. He or she was exposed to camping during childhood, visited numerous

wilderness areas prior to this visit, spent four to six days on each wilderness trip, and plans at least two weeks to two months before each trip. Sixty-one percent are first time visitors to the park. On average, the visitors claim some familiarity with LNT, greatly value wilderness as individuals, and possess intermediate to very experienced outdoor skills.

Descriptive Visitor Statistics for Isle Royale National Park, Michigan Spring 2001 Sampling Period			
Category	**Mean**	**Percentage**	
Age	32.8 yrs		
Educational Attainment	4-year degree		
Student Status		33% students	67% non-students
Natural Science Education	2 yrs high school-- 2 yrs college		
Household Income	$25,000--$50,000		
Size of Current Residence	City (Pop. 5,000-50,000)		
Size of Childhood Residence	City (Pop. 5,000-50,000)		
Previous Visit to ISRO		61% first visit	39% visited before
Age First Exposed to Camping	9 yrs		
Number Wilderness Areas Visited	8		
Number Trips to Wilderness Areas	7-9 trips		
Days Spent Per Trip	4-6 days		
Time Taken to Plan	2 weeks to 2 months		
Stated Familiarity with LNT		69.6% yes	29.4% no

Table 2. Descriptive statistics of visitors to Isle Royale during Spring 2001.

Differences Between Males and Females in Spring

There were only slight differences between males and females. The average age for males was 33.3 years, while the average for females was 30.4 years. The average age men were first exposed to camping was 7.9, while the average age for females was 12.5. While the mean number of wilderness areas visited by males was 7.7, the number visited by females was 6.8. Finally, when asked to rate themselves on the level of outdoor skills each possessed, the males, at 2.6, rated themselves somewhere between intermediate and very experienced, while the females, at 1.8, rated themselves between beginner and intermediate.

Summer Visitor Season

The summer sampling period produced 68 observations/surveys, consisting of 53 males and 15 females. The data were coded, calculated, and interpreted based on respective response categories. Table 3 shows the means and percentages for each variable for the summer data set with males and females combined.

Visitors to ISRO during the summer months were generally in their mid-thirties, possessed a two to four year college degree, and had at least two years of natural science education in high school or college. They earned $50,000 to $75,000 per year, spent their childhood in a town (population less than 5,000), and currently live in a city (population 5,000-50,000). They were exposed to camping during childhood and have visited more than five wilderness areas prior to this trip. Nearly 70% were first time visitors to ISRO. On average, they spent a week on a wilderness trip and planned at least three months in advance for each excursion. They claimed familiarity with LNT, held the highest value for wilderness (1.3), and rated themselves to be intermediate in outdoor skills (2.4).

Descriptive Visitor Statistics for Isle Royale National Park, Michigan Summer 2001 Sampling Period			
Category	**Mean**	**Percentage**	
Age	35.2 yrs		
Educational Attainment	2 to 4-year degree		
Student Status		25% students	75% non-students
Natural Science Education	2 yrs high school--2 yrs college		
Household Income	$50,000--$75,000		
Size of Current Residence	City (Pop. 5,000-50,000)		
Size of Childhood Residence	Small town (Pop. Less than 5,000)		
Previous Visit to ISRO		69% first visit	31% visited before
Age First Exposed to Camping	10.2 yrs		
Number Wilderness Areas Visited	6.4		
Number Trips to Wilderness Areas	7-9 trips		
Days Spent Per Trip	4-6 days		
Time Taken to Plan	3 to 5 months		
Stated Familiarity with LNT		79% yes	21% no

Table 3. Descriptive statistics of visitors to Isle Royale during summer 2001.

Differences Between Males and Females in Summer

Slight differences between males and females were uncovered, none of which were substantial. Females had slightly more experience in natural science studies than males. In addition, a higher percentage of females resided in smaller towns. The average age of females first exposed to camping was 13.3 years, while the average for males was 9.1 years.

Fall Visitor Season

The fall sampling period produced 49 observations, 35 males and 14 females. As with the data sets for spring and summer, the fall data were coded and calculated based on respective response categories. The means and percentages for each variable, males and females combined, can be viewed in Table 4.

Visitors to ISRO during the fall season were generally in their early thirties, possessed a two to four-year college degree, and had at least two years of natural science education in high school or college. They earned anywhere from $25,000 to $50,000 per year, grew up in a small city, and currently reside in a small city. They were first exposed to camping during childhood and have visited numerous wilderness areas prior to this trip. Nearly two-thirds were first time visitors to ISRO. On average, they spent four to six days on each wilderness trip, planned anywhere from two weeks to five months for each trip, and claimed familiarity with LNT. Wilderness value to the individual was rated very important to extremely important (1.4), while the average outdoor skill rating was intermediate (2.24). There were no significant differences between males and females in any categories for the fall sampling period.

Descriptive Visitor Statistics for Isle Royale National Park, Michigan Fall 2001 Sampling Period			
Category	**Mean**	**Percentage**	
Age	33.6 yrs		
Educational Attainment	2 to 4-year degree		
Student Status		24.5% students	74.5% non-students
Natural Science Education	2 yrs high school--2 yrs college		
Household Income	$25,000--$50,000		
Size of Current Residence	Small city (pop. 5,001-50,000)		
Size of Childhood Residence	Town (pop. 1,000-5,000)		
Previous Visit to ISRO		63% first visit	27% visited before
Age First Exposed to Camping	9.6 yrs		
Number Wilderness Areas Visited	9.2		
Number Trips to Wilderness Areas	7-9 trips		
Days Spent Per Trip	4-6 days		
Time Taken to Plan	between 2 weeks to 2 months and 3-5 months*		
Stated Familiarity with LNT		70% yes	30% no

Table 4. Descriptive statistics for visitors to Isle Royale during fall 2001 operating season. Starred item: * Mean fell directly between the two categories.

3.4 Regression Analysis of Variables

To obtain descriptive statistics for the visitors to ISRO, the information collected via the questionnaire was first analyzed in Microsoft EXCEL™. The data were then evaluated using linear regression analysis (α=0.05), a statistical test that analyzes the data for linear relationships between two or more independent variables (age, household income, years exposure to camping,

education degree, etc.) and the dependent variable (awareness test scores). If the mean of each or any independent variable displays a P-value of .05 or lower, a significant relationship exists between any or all of the independent variables and the dependent variable. More specifically, it is possible for one or more of the independent variables to influence the dependent variable.

The dependent variable, "awareness test score," was developed from the second part of the visitor questionnaire. It consisted of eleven questions and tested the visitors' knowledge of LNT principles. Each visitor was assigned a score based on a 100-point scale, with each question worth approximately nine points. The result was an awareness test score for each individual sampled.

As with the descriptive statistical analysis, the data were divided by sampling period (spring, summer, and fall) and tested using regression analysis. The data were also analyzed as a combined set to test for any trends or relationships among the variables and the awareness test scores. As with the descriptive statistics, the dependent variables in the data set were coded using a binary system (0, 1) to more clearly display trends or relationships among the independent variables and awareness test scores. This binary system of coding allows for statistical analysis of qualitative data. Variables coded included: gender; educational attainment; size of childhood residence; size of current residence; years of study in natural sciences; student status; household income; total number of wilderness trips taken; average days spent on a wilderness trip; and individual's stated familiarity with LNT.

Spring Season Analysis

All variables for the spring data set were tested against male and female awareness scores. The regression revealed only one significant relationship among the variables tested. The “student status” variable was significant for the spring ($p=0.05$), indicating that those visitors

currently in school scored lower on the awareness test (test score=67.7) than those visitors not currently in school (test score=76.4). Those variables with p-values greater than .05 confirm their non-significance in predicting awareness test scores. Table 5 is a summary of P-values for the independent variables tested for the spring data set.

A regression analysis was conducted on the independent variables "years of exposure to camping" and "age" to identify possible relationships with "awareness test scores." "Number of years exposed to camping" was determined by subtracting the "age first exposed to camping" from "age" of the visitor. This was done to better show the length of time each individual has been exposed or involved with camping or similar types of recreation. "Number of years exposed to camping" was hypothesized to be a more accurate gauge of outdoor experience and would, perhaps, reveal more of a trend as compared to the age at which the individual was first exposed to such activities. "Age first exposed to camping" was excluded due to its use in constructing the "years of exposure to camping" variable.

“Years of exposure to camping” was not significant in predicting “awareness test scores” ($p=0.499$; $R^2=0.010$). This suggests that “years of exposure to camping” is, at most, only 10% responsible for predicting awareness test scores. The same regression was performed using "age" and "awareness test scores.” “Age” was not significant in predicting awareness test scores ($p=0.884$; $R^2=0.001$).

The data were tested for gender differences or relationships among the independent variables, as well as for differences in the awareness test scores. No significant difference was evident when comparing the awareness test scores of males and females. There is a high probability that the non-significance of the variables can be attributed to the small proportion of females (10) to males (41) within the data set, as ten would not be considered large enough to be powerful.

Independent Variable Significance Isle Royale National Park, Michigan Spring Sampling Period 2001	
Variable	**P-Value**
Gender	0.351
Educational Attainment	0.313
Student Status	0.05*
Natural Science Education	0.844
Household Income	0.758
Size of Current Residence	0.365
Size of Childhood Residence	0.67
Previous Visits to ISRO	0.459
Number Wilderness Areas Visited	0.322
Total Number Wilderness Trips Taken	0.567
Days Spent on a Wilderness Trip	0.731
Time Taken to Plan	0.387
Wilderness Value to Individual	0.372
Stated Familiarity with LNT	0.120
Stated Level of Outdoor Skills	0.407

Table 5. P-values for the independent variables tested in an ANOVA with the dependent variable "awareness test scores" in the Spring 2001 sampling period. A variable must have a P-value below .05 to be considered significant. (*) Indicates a significant relationship with awareness test scores.

Summer and Fall Season Analysis

The pattern of non-significance for spring was repeated for both summer and fall. These results show that only one variable from summer and one from fall had a significant effect on visitor awareness test scores. "Previous visits to ISRO" was significant in predicting a portion of the variance in awareness test scores for the summer season ($p=0.016$), suggesting that previous visits to the park contributed to greater awareness of LNT. "Gender" was significant in predicting a portion of the variance in awareness test scores for the fall season ($p=0.048$), suggesting a link between gender and greater awareness of LNT. However, it should be noted that sample size for females during summer and fall seasons was small (14 in summer, 15 in fall), compared to male sample sizes (39 in summer, 53 in fall). Table 6 shows the P-values for the independent variables tested in the summer and fall sampling periods.

Regression analysis was conducted for summer and fall, testing "years of exposure to camping" and "age of individuals" as possible predictors of awareness test scores. Neither "years of exposure to camping" ($p=0.142$; $R^2=0.034$), nor "age" ($p=0.083$; $R^2=0.073$) was significant. The fall season mirrored the results of the summer, as both "age" and "years of exposure to camping" were non-significant in predicting awareness test scores for the fall season (age: $p=0.315$; $R^2=0.021$) (years of exposure: $p=0.613$; $R^2=0.005$).

Independent Variable Significance Summer and Fall Sampling Periods 2001		
Variable	**Summer P-Value**	**Fall P-value**
Gender	0.226	0.048*
Educational Attainment	0.526	0.595
Student Status	0.608	0.707
Natural Science Education	0.780	0.252
Household Income	0.151	0.992
Size of Current Residence	0.540	0.505
Size of Childhood Residence	0.241	0.913
Previous Visits to ISRO	0.016*	0.299
Number Wilderness Areas Visited	0.871	0.237
Total Number Wilderness Trips Taken	0.328	0.874
Days Spent on a Wilderness Trip	0.884	0.385
Time Taken to Plan	0.641	0.407
Wilderness Value to Individual	0.307	0.074
Stated Familiarity with LNT	0.753	0.537
Stated Level of Outdoor Skills	0.190	0.838

Table 6. P-values for the summer and fall 2001 sampling periods. There were no variables showing a significant relationship to the awareness test scores.
(*) Indicates a significant relationship with awareness test scores.

All Seasons Combined

It has been shown that as the number of observations in a data set increases, the strength of the statistical testing also increases (Mendenhall and Cincich 1996). For this reason, the data sets were combined, yielding a total of 168 observations.

As with the individual sampling periods, a regression analysis was conducted on the variables to identify any relationship among the independent variables and awareness test scores. Table 7 shows P-values for the variables tested for all sampling periods combined. Only one independent variable, "value of wilderness to the individual," revealed a significant relationship to awareness test scores. Though it is possible that other relationships exist, only “value of wilderness to the individual” may be considered statistically valid with respect to visitor test scores.

Regression analysis was also conducted comparing "years of exposure to camping" and "age" to "awareness test scores." "Years of exposure to camping" was not significant ($p=0.109$; $R^2=0.016$), confirming a non-significant relationship with awareness test scores. "Age" was also not significant in predicting “awareness test scores” ($p=0.091$; $R^2=0.018$).

Independent Variable Significance Isle Royale National Park, Michigan Spring, Summer, Fall Sampling Periods 2001	
Variable	**P-Value**
Gender	0.225
Educational Attainment	0.619
Student Status	0.646
Natural Science Education	0.585
Household Income	0.407
Size of Current Residence	0.601
Size of Childhood Residence	0.295
Previous Visits to ISRO	0.319
Number Wilderness Areas Visited	0.606
Total Number Wilderness Trips Taken	0.984
Days Spent on a Wilderness Trip	0.14
Time Taken to Plan	0.14
Wilderness Value to Individual	0.008*
Stated Familiarity with LNT	0.091
Stated Level of Outdoor Skills	0.844

Table 7. P-values for each variable tested in an ANOVA with the dependent variable "awareness test scores." (*) Indicates P-values that show a significant relationship between the variable and the awareness test scores.

The combined data set was tested as a whole to identify possible relationships that may exist among independent variables, as well as any relationship that may link a single independent

variable with awareness test scores. For example, test scores by gender, years of exposure to camping, mode of travel, and seasons were individually compared to LNT test scores to expose any significant relationships. Figure 14 displays the mean awareness test scores for each sampling period.

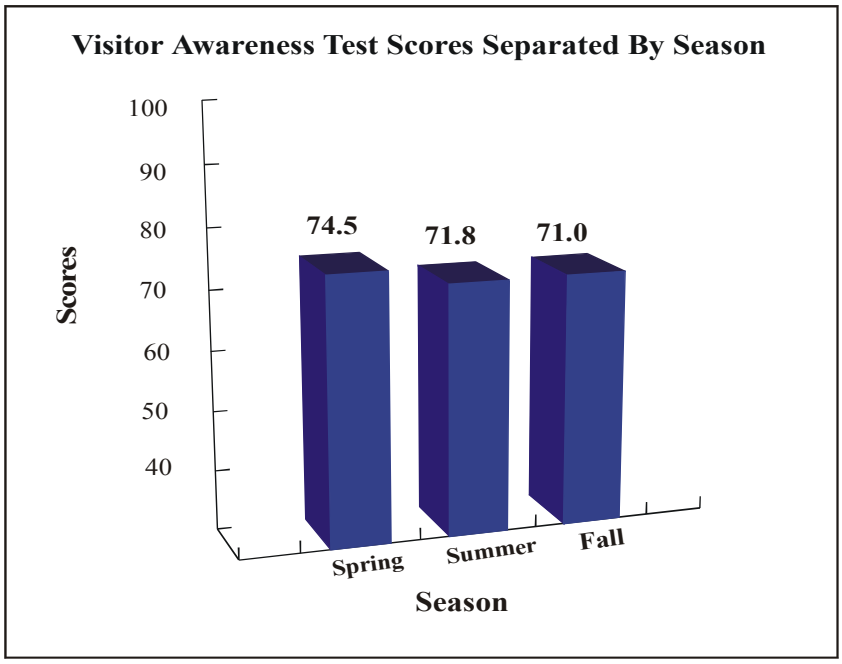

Figure 14. Displays the average visitor LNT awareness test scores for each period sampled during the 2001 recreation season.

Descriptive statistics revealed no differences between males and females with respect to LNT test scores for individual sampling periods or as a combined data set. No differences were found among the seasons when it came to years of exposure to camping. When comparing "years of exposure" for males and females, females had a lower average number of years exposure to camping (20.8 years) than did males (24.9 years) ($p=0.0051$). It should be noted that there were several outlying cases in which the ages of select individuals were significantly higher than the majority of the data set. To reduce the influence of these outliers, the three highest ages for males

and females were deleted from the set. The averages were recalculated to be 24.2 years for males and 19.1 years for females (p=0.011) (Figure 15). No significant relationship was uncovered when comparing male and female awareness test scores and "years of exposure to camping."

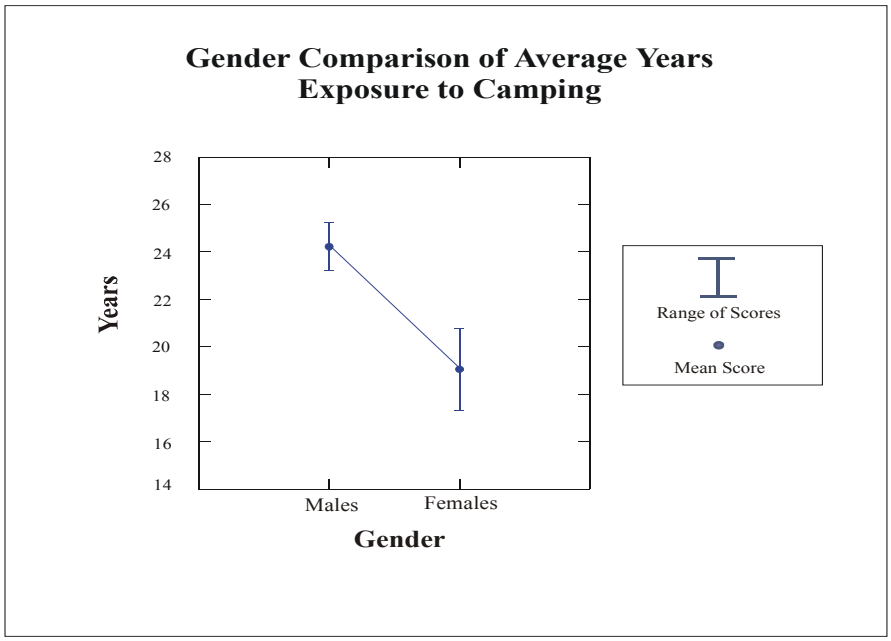

Figure 15. Average years of exposure to camping for both males and females visiting ISRO during the 2001 recreational season.

Differences in test scores based on four user types-hikers, canoeists, sail-boaters, and recreational motor-boaters-were also considered. The only significant difference detected was between the test scores of hikers and motor-boaters. The average test score for the motor-boaters were lower than the average score for hikers (p=0.004). When viewed on a graph (Figure 16), there appears to be a trend in differences between motor-boaters and canoeists/sail-boaters. However, statistically the relationship is not significant. This may be due to the small sample size of canoeists and sail-boaters compared to motor-boaters.

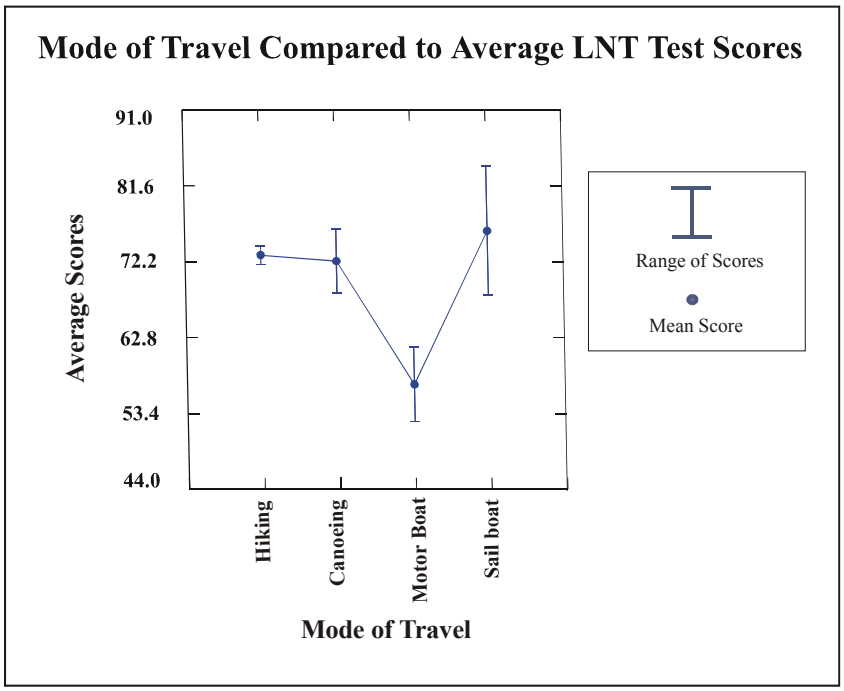

Figure 16. Average LNT awareness test score for visitors compared to the visitor mode of travel.

"Total number of trips taken to wilderness areas" was compared with LNT awareness test scores to test for a significant relationship. The only significant relationship occurred between those individuals having taken 7-9 total wilderness trips (LNT test score=77.5) and those individuals having taken 4-6 total trips (LNT test score=68.9) (p=0.058). Figure 17 shows the average awareness test score compared to the average number of wilderness areas visited by individuals. No significant relationship was revealed when testing "gender" against "trips taken" and "awareness test scores."

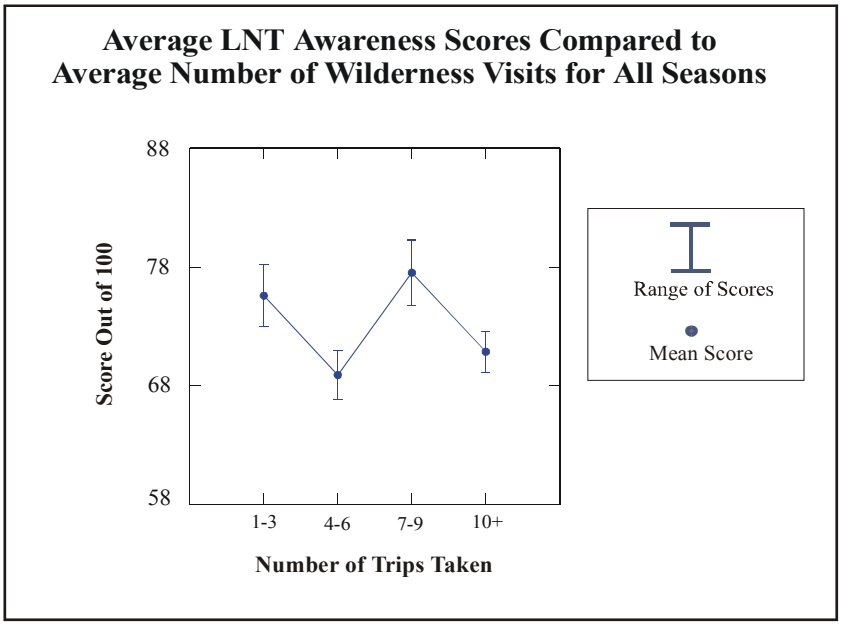

Figure 17. Average number of wilderness trips taken by individuals to the average LNT awareness test scores for all sampling periods combined.

"Total number of wilderness trips taken" was also tested with "years of exposure to camping." As might be expected, "years of exposure" had a positive relationship with the number of trips taken. The regression generally shows that as years of exposure increase, the number of wilderness trips taken also increases.

The "years of exposure" variable was also compared with "self-rated level of outdoor skills." Those individuals having the highest number of years of exposure to camping rated themselves as "very" experienced. However, their scores indicate that they are statistically not different from those individuals rating themselves as "intermediate" or "beginner." Furthermore, on average, males seemed to rate themselves higher in outdoor skills (2.5) than females (2) ($p=0.001$). Figure 18 displays the comparison of self-rated skills for males and females.

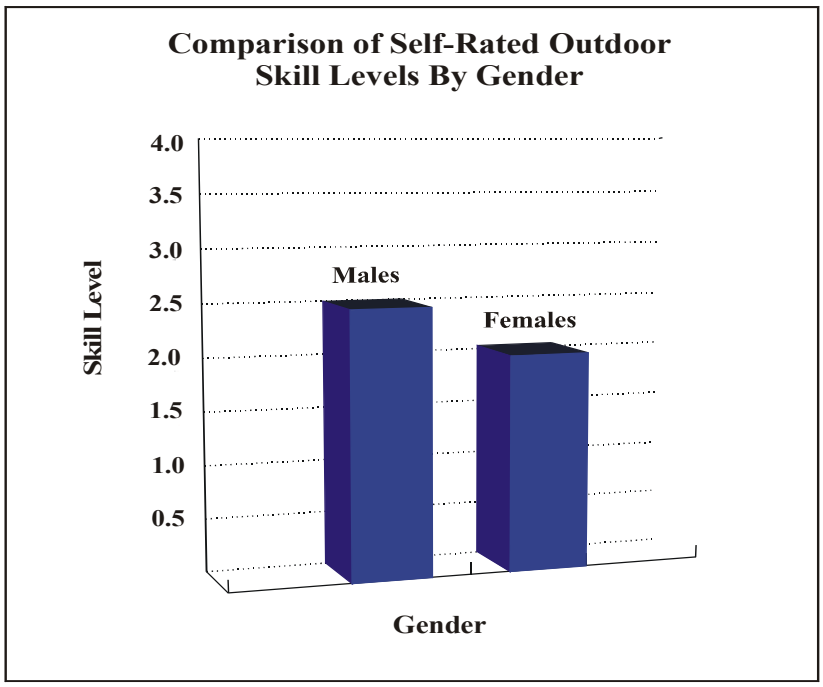

Figure 18. Comparison of male and female self-rated outdoor skill levels for all sampling periods.

A series of tests was performed focusing on the responses of group leaders and of visitors surveyed before and after the park orientation. These tests were conducted primarily to determine the effectiveness of the park orientation. Group leaders, in particular, were surveyed for LNT awareness due to the influence they wield over young visitors to the park. On average, group leaders received an average awareness test score of 80.2. However, this sample size was small and may not be significant. Individuals surveyed before the park orientation, which incorporates LNT principles, were compared to those surveyed after the orientation. Those who received the park orientation had an average awareness test score of 74, while those who were contacted before had an average test score of 67.3. This was not enough of a difference in test scores to exhibit a statistical significance. Again, it should be noted, that the sample size for those surveyed before the orientation was small.

Chapter Four

Discussion and Conclusion

4.1 Introduction

This thesis has shown that wilderness areas today must blend the interests of social, ecological, and managerial concerns in order to meet the demands of the general public. To truly understand these unique places, we must take into account not only their natural history and biology, but also changing patterns of land use (Bolle 1991). More specifically, we must examine the attitudes and practices of wilderness area visitors. Only then can we gain insight into the biological and social dynamics associated with these areas.

Working knowledge of visitor characteristics, perceptions, and behaviors allows agency personnel to better manage the wilderness resource, as well as monitor the effects of recreational activity on the ecological integrity of the area. Thus, they may be better equipped to minimize ecological impacts to the resource by developing appropriate informational programs for visitor awareness education.

The goal of this research has been to identify and assess visitor characteristics at Isle Royale National Park, and to investigate awareness of Leave-No-Trace low-impact camping techniques—guidelines that are strongly encouraged in all wilderness areas. It was hypothesized that certain visitor characteristics, such as number of years of exposure to camping, age, rural versus urban upbringing, income, educational attainment, and previous wilderness experience, influence familiarity with LNT guidelines. If so, then such information could be used to predict visitor awareness of LNT, at least to some extent. Certain characteristics could then be isolated and targeted for structured educational programs.

4.2 Visitor Characteristics for Isle Royale National Park

Comparisons were made among three sampling periods—spring, summer, and fall, and also between male and female visitors. Of the 168 individuals surveyed, 75% were males and 25% females, figures comparable to those found in other wilderness area studies (Lucas 1979, 1989; Cole 1996a). Of these visitors, the average age was 34 years and 80% of visitors held a college degree of some kind, again confirming the results of previous wilderness studies (Lucas 1979, 1989; Hendee *et al*. 1990; Cole 1996a, 1996b). Forty-eight percent of visitors observed at ISRO earned more than $50,000 per year, a result that is supported by Lucas (1979; 1989). Nearly three-fourths of visitors sampled currently lived in cities with populations above 5,000, while 25% of visitors grew up in rural settings. These findings correspond closely with previous studies of current and childhood residences of wilderness visitors (Lucas 1979, 1989; Hendee *et al*. 1990; Cole 1996a, 1996b). The visitors sampled were exposed to camping during childhood and had visited several wilderness areas prior to this trip (Roggenbuck & Lucas 1985, 1989). Over half of the visitors had taken seven or more wilderness trips, with nearly 80% spending six or fewer days per trip, figures that are mirrored in several other studies. As the results show, the average visitor to Isle Royale National Park is well-educated and maintains an above average income.

4.3 Predicting Visitor Leave No Trace Awareness

While visitor characteristics for ISRO were consistent with those of other wilderness areas, levels of LNT awareness presented puzzling results, requiring more involved interpretation and extrapolation. Overall, there was no difference in visitor awareness of LNT principles among the seasons sampled. The average test score for all seasons combined was 72.4, suggesting that, on average, three of the test questions were answered incorrectly. The average awareness of LNT for visitors to Isle Royale National Park was determined to be moderate.

The results of this project show that visitor awareness of LNT low-impact camping techniques cannot be consistently predicted using the selected variables. Very few of the variables were found to be significant, and those found significant were not consistent among the sampling periods. This non-significance is likely attributable to several factors including: differences in perceptions and interpretations of the questions asked; high variation within the data; missing data in various categories; unequal or small sample sizes (males versus females); and the broad nature of some categories. In addition, some non-significance may also be attributed to individuals recording stated behavior that is contradictory to their actual behavior. This situation reaffirms the idea that people often judge themselves by their beliefs or ideals and others by their actions. One such instance occurred when a visitor was observed bathing and shaving with soap in a lake in the park. When surveyed, this individual received a perfect score on the awareness test. It is possible individuals may be apprehensive about stating actions honestly for fear of reprimand, punishment, or citation.

It is clear that when dealing with human subjects, there is a high probability that differences in perceptions and interpretations will occur among the individuals sampled. The way in which one individual interprets or perceives a question or situation may differ substantially from the way another individual interprets or perceives it, causing variation within the data collected (Virden & Schreyer 1988). It is possible to minimize such discrepancies through more detailed question structure, yet it remains that people think, process, and reason differently from one another. As stated previously, an individual views his or her surroundings through a socially and culturally constructed lens, thus leading to the formation of a variety of opinions, viewpoints, and perceptions (Cutter & Renwick 1999). Such diversity in thought can lead to difficulties in the interpretation and quantification of the data collected.

High variation in the data posed an interesting quandary when statistical analysis was instituted. For instance, the variables “age” and “number of years an individual was exposed to

camping" exhibited no distinct patterns when compared with awareness test scores, as both younger and older visitors had high or low numbers of years exposed to camping, as well as high and low awareness test scores. In any one case, there was the possibility of observing a young visitor having few years of exposure to camping, but scoring very high or very low on the awareness test. On the other hand, an older visitor, having several more years of exposure to camping, may have scored high or low on the awareness test. In all likelihood, the amount of variation found within the data inhibited any power for "age" and "years of exposure to camping" to predict visitor awareness of LNT. Due to extreme variation in the data of these two variables, it was found that neither proved significant as a predictor for visitor awareness of LNT.

Missing data, which occurred for different variables on several surveys, also posed a problem for statistical analysis to a certain extent. In some instances, for example, age or age in which the individual was first exposed to camping was left blank on the survey. These two variables were important in determining "number of years of exposure to camping" for each individual. Those observations, including the awareness test scores, could not be used in statistical analysis and were removed from the sample during specific variable tests due to the lack of information.

It is also possible that visitors are aware of proper behavior, but for some unknown reason, they do not necessarily comply with guidelines. One possibility may be that since many of the LNT guidelines require some degree of extra effort, visitors may tend toward what may, to them, be considered simpler or less meticulous behavior. For example, several bags of trash were found in pit toilets throughout the park, and litter was found along trails and near campsites. Instead of carrying trash out to a proper dumping facility, visitors discarded it into pit toilets, burned it, or disposed of it in the woods along trails and campsites. Actions may also be influenced by "traditional" camping techniques taught and learned in past decades, yet not updated as times change and regulations are modified. A good example of this can be found in

past Boy Scout handbooks. Techniques such as building shelters out of logs and downed trees, washing dishes in water sources, cutting conifer boughs for bedding, and digging trenches around tents for water drainage were once offered as helpful tips to ensure a successful camping trip in backcountry areas (Hillcourt 1979). Though steps have been taken to update such techniques, the quantity of new information may be such that it takes longer to reach the various groups participating in wilderness recreation. In short, actual behavior may differ slightly or dramatically from what the visitor states on the survey.

Non-significance may also be ascribed to unequal sample sizes when comparing males and females. Though sample sizes for each sampling period were large enough for statistical analysis, the ratio of female to male observations was much smaller. For example, gender was found to play a role in predicting awareness test scores in the fall sampling period, where the average score for females was nearly 6 points higher than for males. However, the sample size for females was 14, much smaller than that for males at 35 observations. This circumstance may have distorted the results.

The nature of the questions included on the survey presented some difficulties with respect to quantification and analysis. The questions were designed so that answer categories were broad. This was done to ensure that visitors did not feel uncomfortable divulging a great deal of personal information. However, this broadness may have allowed for too much overlap in the data, therefore causing high variation. More detailed categories would allow for separation among data and possibly display more trends or predictors of LNT awareness.

4.4 Speculations into Predicting LNT Awareness

Several patterns arose from the results that allow for speculation as to the factors that influence visitor awareness and knowledge of minimum impact guidelines. For example, during the fall sampling period, women were found to have a later exposure to camping than men, but a

higher average LNT awareness score (females: 76.7; males: 68.5). One possibility for this may be that as women engage in outdoor recreation at a later age, more responsibility and preparation may be taken in learning proper camping techniques and/or safety information before embarking on such a trip. It is also a possibility that those individuals, both male and female, having later initial exposure to camping may take extra care in learning and preparing for a wilderness trip.

The notion that previous visits to the park influence awareness of LNT proved to be significant during the summer sampling period and may be due to several circumstances. Those visitors having been to the park previously (31% of visitors sampled during summer) were likely exposed to planning information and low-impact camping techniques. Peak visitation occurs during the months of June, July, and August, suggesting that summer trips to the park are more feasible and popular for many visitors. However, because of such popularity, summer excursions require substantial planning to secure passage to and from the park. Therefore, those individuals having visited previously should be aware of preparation needs and guidelines. The statistical results show that summer visitors, on average, plan three to five months ahead of time as opposed to the spring and fall when visitors planned just two weeks to two months ahead. Though average awareness scores were not different for the spring and fall sampling periods, those visitors having previously visited the park maintained a higher average awareness than the rest of the visitors included in the summer sampling, as well as the spring and fall periods. There is high probability that those individuals having previous experience in a wilderness area will have a greater familiarity with LNT.

It may be safe to assume that advanced preparation is taken to avoid uncomfortable or dangerous situations and ensure a pleasurable trip. Information for beginners, as well as for advanced outdoor recreationists, is readily available through websites, books, pamphlets, and numerous visitor centers, all of which were listed by visitors claiming familiarity with LNT as important sources of information concerning low-impact camping techniques.

4.5 Recommendations to Isle Royale Park Managers

Reflecting upon the primary questions of this study, the degree in which the park's visiting population is aware of LNT principles has been found to be moderate, with few noteworthy differences among visitors sampled during the spring, summer, and fall seasons. Contrary to the original hypothesis, the variables "previous exposure to wilderness areas," "outdoor experience and skills," "rural/urban upbringing," "educational attainment," "age," "household income," "years of exposure to camping," "exposure to natural science studies," and "gender" were not found to influence visitor LNT awareness at ISRO at any particular time during the seasons sampled.

The results of this project show that predicting visitor awareness is difficult due to the variety of backgrounds, educational attainment levels, and interests of those visiting the park. Anticipating behavior that may be detrimental to the resource is even more of a challenge. It would be unwise to assume that targeting a certain group of users will help to curb ecological impact due to recreation. It is more likely that a broad educational program will achieve the desired results. Ecological impacts to the resource are often the result of unknowing behavior (Hendee *et al*. 1990). A greater emphasis on education should increase visitor knowledge and change subsequent behavior so that impacts are diminished (see Kernan and Drogin 1995; Manning 1999). However, one problem noted while conducting surveys was the lack of attention paid by visitors during park orientations. Either due to excitement, preoccupation, motion sickness during the ferry ride, or anxiousness to begin their outing, visitors failed to absorb much of what was conveyed during the orientation sessions.

One remedy for this would be to involve all visitors in a detailed, interactive LNT guidelines orientation, using case-in-point examples of proper behavior and techniques in wilderness areas. Kernan and Drogin (1995) found a 20% increase in visitor compliance with guidelines as a result of a specific awareness orientation. A fully interactive visitor orientation

explaining and illustrating the purpose of each guideline could result in greater visitor understanding and compliance at ISRO. For example, involving the visitors directly using a question and answer game would allow for open communication, participation, and interaction with one another, as well as, park personnel. At the time of this study, only one visitor center on ISRO was actively using this technique. To be successful, an enthusiastic effort is needed park-wide.

Another education option, though much more regulatory in nature, might be to distribute supplemental LNT information to individuals at the time of reservation, especially before arriving at the park. The material should include a document requiring comprehension of all included information and completion of an LNT worksheet that is signed and presented to park officials upon arrival. This process should be completed by all individuals wishing to participate in a wilderness excursion. Failure to produce the signed document upon arrival suspends access until another is completed. This document must be carried throughout the trip and presented upon request if there is question concerning detrimental behavior. Though this is a somewhat more invasive approach to education and regulation, it allows for information to be distributed to each visitor, ensures they have read and comprehended it, and provides proof that they have completed some form of LNT awareness training specific to the park. It would be more difficult to claim ignorance of such guidelines if information is supplied directly and completion is required for access to the park.

4.6 Lessons Learned and Possible Improvements

Over the course of the past 18 months, I have learned some valuable lessons with regard to conducting scientific research. To begin with, I learned that quantification of visitor knowledge data is an intricate, delicate, and difficult process. The use of broad categories on the visitor questionnaire tended to blend the data together, causing overlap and variation within and

among several categories. Better care could have been taken in the design of questions and accompanying answer categories to minimize the possibility of high variation in the data. Refinement in this area would also allow for the clarification of any existing trends.

Interpreting the highly varied data required a great deal of reflection and creative speculation as to what may actually be occurring at ISRO. Formulating reasons and explanations for visitor behavior became difficult, making it necessary to approach the results from numerous angles. When dealing with the human side of resource management, the uniqueness of each individual's thoughts and behavior presents a wide range of possible explanations for behavior. Therefore, interpretation is difficult, increasing the probability of failing to recognize potential explanations. Construction of survey methods that collect easily quantified data may alleviate some uncertainty.

Another possible amendment to the project involves the use of categorical statistical tests. Regression analysis methods were used to test for predictive relationships within the data. Since much of the data was categorical, the use of dummy variables was implemented to administer the tests. This action, in itself, reduced the detail and power within the data, and broadens the answer categories. On the other hand, if a Chi-squared goodness-of-fit test had been implemented, it is possible that more detailed relationships between the independent variables and visitor awareness test scores may have become apparent. However, due to the nature of the data, it is highly likely that no substantial differences in results would occur with the use of a Chi-squared test.

4.7 Future Research

Although a reliable prediction of visitor awareness of LNT was not identified, this study was able to allow some insight into visitor characteristics for the park. Such information is helpful to managers in understanding the social dynamics of the resource, and may ultimately

serve as a beginning point for constructing educational programs on awareness and ecological impacts to wilderness areas.

This research did reveal that it is difficult to understand the visiting population as a whole, due to the high variation in preferences, perceptions, and characteristics. There is a great possibility that visitor awareness of LNT cannot be predicted by any one or more variables. This indicates that a broad-scale educational program should be implemented and administered to all who participate in recreational activities at Isle Royale National Park. Future research on the effectiveness of educational programs will be needed to understand the preparedness of visitors coming to the park.

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Appendix A

Date: _____

Visitor Questionnaire

This questionnaire is part of a Master's thesis project focused on visitor habits in designated wilderness areas. No personal identification is requested. **ALL INFORMATION IS ANONYMOUS**.

1. Please indicate with a check mark which category applies to you. Male ____ Female ____

2. Your age at your last birthday? _____

3. What is the highest educational degree you have attained?

- ☐ High school/GED
- ☐ Two-year college/Associate degree
- ☐ Bachelor of Arts/Science
- ☐ Master of Arts/Science
- ☐ Other graduate degree (nursing, law, medical, fine arts, etc.)
- ☐ PhD

4. Are you currently a student? Yes ___ No ___

5. How much education or experience have you had in the environmental sciences (i.e.: ecology, plant and wildlife biology, resource management, chemistry, geology, geography, etc.) ? Please indicate which category best applies to you.

- ☐ No education or experience
- ☐ 1 to 2 years in high school
- ☐ 1 to 2 years in college (bachelor level)
- ☐ More than 2 years in college (bachelor level)
- ☐ More than 2 years in high school
- ☐ Post-graduate study in environmental sciences

6. Which category best describes your household income?

- ☐ Below $25,000
- ☐ $25,000 to $49,999
- ☐ $50,000 to $75,000
- ☐ Above $75,000

7. Where do you live currently? And where did you live *most* of your life before age 18? (Check one box in each column) (If you live or used to live in a suburb, check the box that applies to the size of the whole metropolitan area).

	Where do you live?	Before age 18?
A. On a farm	☐	☐
B. Rural or small town (under 1,000 population)	☐	☐
C. Town (1,000 to 4,999 population)	☐	☐
D. Small city (5,000 to 49,999 population)	☐	☐
E. Medium city (50,000 to 499,999 population)	☐	☐
F. Large city (over 500,000 population)	☐	☐

8. At what age would you say you were first exposed to camping? _____

9. Have you visited *this* wilderness area before? Yes ____ No ____ If yes, year of first visit? _____

10. Approximately how many wilderness areas have you visited? _____

11. Approximately how many trips to wilderness areas have you made? And what is the average number of days you spend on a wilderness trip?

Number of trips	Average number of days spent on a trip
☐ 1 to 3	☐ 1 to 3
☐ 4 to 6	☐ 4 to 6
☐ 7 to 9	☐ 7 to 9
☐ 10 or more	☐ 10 or more

11. What is your ***main*** reason for choosing to visit this type of area (a wilderness area) for this trip?

_____
_____
_____

12. Why did you choose to come at this time of year? _____

_____
_____
_____

13. How far in advance do you plan for your wilderness trips?

☐ Less than 2 weeks
☐ 2 weeks to 2 months
☐ 3 to 5 months
☐ More than 6 months
☐ Other, specify _____

14. How important or valuable are wilderness areas to you personally?

- ☐ Extremely important
- ☐ Very important
- ☐ Fairly important
- ☐ Not very important
- ☐ Not at all important

Why or why not? _____
_____
_____
_____
_____

15. If you could rank the level of your outdoor skills or capabilities, at what level would you consider yourself? (i.e.: reading topographical maps, using a compass, knowledge of edible plants, wilderness first aid, etc.)

- ☐ Beginner
- ☐ Intermediate
- ☐ Very experienced
- ☐ Master/ Wilderness Instructor level

16. Please list, in any order, the three outdoor activities you most often partake in. (Can apply to any location, wilderness or non-wilderness)

1. _____ 2. _____ 3. _____

17. Have you ever heard or read about specific visitor land use practices applying to wilderness areas?
Yes ___ No ___ If so, where (i.e.: pamphlet, friend, class, internet, park ranger, etc.)
_____
_____

Please respond to the following questions in a way that would best describe your personal actions and opinions about each situation.

1. While walking along a trail, you encounter areas where water has pooled across the trail. What would you normally do:

- ☐ Walk along the edge of the puddle
- ☐ Walk directly through the puddle
- ☐ Find an alternate route through the woods
- ☐ Other, specify _____

2. While hiking or backpacking, how often do you stay on recognized trails?

☐ Always
☐ Almost always
☐ Occasionally
☐ Seldom
☐ Never

Why? _____
_____
_____
_____
_____

3. How do you normally clean your dishes and cookware after a meal in the backcountry? Do you:

☐ Take them to the nearest water source and clean them at water's edge
☐ Clean them at the campsite
☐ Clean them away from the campsite
☐ Other, specify _____

4. What do you usually do with the refuse and garbage, both organic and inorganic, that is generated during your wilderness trip (i.e.: food wrappers and packaging, food remnants such as apple cores or orange peels, etc)?

☐ Burn or bury it
☐ Pack it out to the nearest dumping facility
☐ Deposit it in an outhouse
☐ Other, specify _____

5. Have you ever taken small items or objects as a memento from the wilderness areas you have visited? (i.e.: feathers, stones, plants, small relics, bones, etc.) Yes ___ No ___

6. Do you feel modification of wilderness campsites is appropriate? (i.e.: nails in trees, makeshift tables and benches, clothes lines, etc.)

☐ Strongly agree
☐ Agree
☐ Indifferent
☐ Disagree
☐ Strongly disagree

Please explain your answer: _____
_____
_____
_____
_____

7. Have you ever had food or personal items taken from your campsite by wildlife? Yes ___ No ___

Where or how do you normally store your food while on a wilderness trip? _____
_____
_____

8. Have you ever been within 75 – 100 feet of any wildlife, particularly large mammals?

Yes ___ No ___

If so, was the distance intentional or unintentional? (i.e.: the animal surprised you, you closed distance for a better view, etc.) Intentional ___ Unintentional ___

Please explain: _____
_____
_____
_____

9. When you are off-trail hiking and camping, in which area would you most likely set up camp?

- ☐ Vegetated, soft surface
- ☐ Even, hard surface
- ☐ Previously used site
- ☐ Other, specify _____

10. How important to you is 'natural quiet' while in a wilderness area? (i.e.: the absence of human noise such as loud talking or yelling, clanging of pots and pans, boat motors, etc.)

- ☐ Extremely important
- ☐ Very important
- ☐ Fairly important
- ☐ Not very important
- ☐ Not at all important

Why or why not? _____
_____
_____
_____
_____

11. Do you normally have a fire while on a wilderness trip? Yes ___ No ___

If so, is the size of the fire large or small? Large ___ Small ___
What types of fuel do you primarily use?

- ☐ Small dead brush and twigs from the forest floor
- ☐ Larger dead logs
- ☐ Limbs from standing dead trees
- ☐ Limbs from living trees
- ☐ Other, specify _____

12. Do you agree or disagree with the restriction of visitor access to sensitive habitats in order to protect ecological processes? (i.e.: nesting species such as loons or bald eagles, wolf dens, areas in need of rehabilitation, etc.)

☐ Strongly agree
☐ Agree
☐ Indifferent
☐ Disagree
☐ Strongly disagree

Why or why not? _____
_____
_____
_____
_____

Appendix B

Date: _____

Visitor Questionnaire

Binary codes

Category codes

This questionnaire is part of a Master's thesis project focused on visitor habits in designated wilderness areas. No personal identification is requested. **ALL INFORMATION IS ANONYMOUS**.

1. Please indicate with a check mark which category applies to you. 0 0 Male ____ 1 1 Female ____

2. Your age at your last birthday? _____

3. What is the highest educational degree you have attained?

0	1 ☐	High school/GED
1	2 ☐	Two-year college/Associate degree
1	3 ☐	Bachelor of Arts/Science
1	4 ☐	Master of Arts/Science
1	5 ☐	Other graduate degree (nursing, law, medical, fine arts, etc.)
1	6 ☐	PhD

4. Are you currently a student? 0 0 Yes ___ 1 1 No ___

5. How much education or experience have you had in the environmental sciences (i.e.: ecology, plant and wildlife biology, resource management, chemistry, geology, geography, etc.) ? Please indicate which category best applies to you.

0 1	☐	No education or experience	1 4	☐	1 to 2 years in college (bachelor level)
0 2	☐	1 to 2 years in high school	1 5	☐	More than 2 years in college
0 3	☐	More than 2 years in high school	1 6	☐	Post-graduate study

6. Which category best describes your household income?

0	1 ☐	Below $25,000
0	2 ☐	$25,000 to $49,999
1	3 ☐	$50,000 to $75,000
1	4 ☐	Above $75,000

7. Where do you live currently? And where did you live *most* of your life before age 18? (Check one box in each column) (If you live or used to live in a suburb, check the box that applies to the size of the whole metropolitan area).

	Where do you live?		Before age 18?
A. On a farm	☐ 1	1	☐
B. Rural or small town (under 1,000 population)	☐ 1	2	☐
C. Town (1,000 to 5,000 population)	☐ 1	3	☐
D. Small city (5,001 to 50,000 population)	☐ 0	4	☐
E. Medium city (50,001 to 500,000 population)	☐ 0	5	☐
F. Large city (over 500,000 population)	☐ 0	6	☐

8. At what age would you say you were first exposed to camping? _____

0 1

9. Have you visited *this* wilderness area before? Yes ____ No ____ If yes, year of first visit? _____

10. Approximately how many wilderness areas have you visited? _____

11. Approximately how many trips to wilderness areas have you made? And what is the average number of days you spend on a wilderness trip?

Number of trips			Average number of days spent on a trip		
0	1 ☐	1 to 3	0	1 ☐	1 to 3
0	2 ☐	4 to 6	0	2 ☐	4 to 6
1	3 ☐	7 to 9	1	3 ☐	7 to 9
1	4 ☐	10 or more	1	4 ☐	10 or more

11. What is your ***main*** reason for choosing to visit this type of area (a wilderness area) for this trip?

_____
_____
_____

12. Why did you choose to come at this time of year? _____

_____
_____
_____

13. How far in advance do you plan for your wilderness trips?

0	1	☐	Less than 2 weeks
0	2	☐	2 weeks to 2 months
1	3	☐	3 to 5 months
1	4	☐	More than 6 months
		☐	Other, specify _____

14. How important or valuable are wilderness areas to you personally?

1	☐	Extremely important	Why or why not? _____
2	☐	Very important	_____
3	☐	Fairly important	_____
4	☐	Not very important	_____
5	☐	Not at all important	_____

15. If you could rank the level of your outdoor skills or capabilities, at what level would you consider yourself? (i.e.: reading topographical maps, using a compass, knowledge of edible plants, wilderness first aid, etc.)

1	☐	Beginner
2	☐	Intermediate
3	☐	Very experienced
4	☐	Master/ Wilderness Instructor level

16. Please list, in any order, the three outdoor activities you most often partake in. (Can apply to any location, wilderness or non-wilderness)

1. _____ 2. _____ 3. _____

17. Have you ever heard or read about specific visitor land use practices applying to wilderness areas?

0 1

Yes ___ No ___ If so, where (i.e.: pamphlet, friend, class, internet, park ranger, etc.)

_____

_____

Please respond to the following questions in a way that would best describe your personal actions and opinions about each situation.

1. While walking along a trail, you encounter areas where water has pooled across the trail. What would you normally do:

- [x] Walk along the edge of the puddle
- [ ] Walk directly through the puddle
- [ ] Find an alternate route through the woods
- [ ] Other, specify _____

2. While hiking or backpacking, how often do you stay on recognized trails?

- [x] Always — Why? _____
- [ ] Almost always — _____
- [ ] Occasionally — _____
- [ ] Seldom — _____
- [ ] Never — _____

3. How do you normally clean your dishes and cookware after a meal in the backcountry? Do you:

- [ ] Take them to the nearest water source and clean them at water's edge
- [ ] Clean them at the campsite
- [x] Clean them away from the campsite
- [ ] Other, specify _____

4. What do you usually do with the refuse and garbage, both organic and inorganic, that is generated during your wilderness trip (i.e.: food wrappers and packaging, food remnants such as apple cores or orange peels, etc)?

- [ ] Burn or bury it
- [x] Pack it out to the nearest dumping facility
- [ ] Deposit it in an outhouse
- [ ] Other, specify _____

5. Have you ever taken small items or objects as a memento from the wilderness areas you have visited? (i.e.: feathers, stones, plants, small relics, bones, etc.) Yes ___ No _X__

6. Do you feel modification of wilderness campsites is appropriate? (i.e.: nails in trees, makeshift tables and benches, clothes lines, etc.)

- [ ] Strongly agree — Please explain your answer: _____
- [ ] Agree — _____
- [ ] Indifferent — _____
- [x] Disagree/ Strongly disagree — _____
  _____

7. Have you ever had food or personal items taken from your campsite by wildlife? Yes ___ No _X__

Where or how do you normally store your food while on a wilderness trip? _____
_____
_____

8. Have you ever been within 75 – 100 feet of any wildlife, particularly large mammals?

Yes ___ No ___

If so, was the distance intentional or unintentional? (i.e.: the animal surprised you, you closed distance for a better view, etc.) Intentional ___ Unintentional ___

Please explain: _____
_____
_____
_____

9. When you are off-trail hiking and camping, in which area would you most likely set up camp?

- ☐ Vegetated, soft surface
- ☐ Even, hard surface
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10. How important to you is 'natural quiet' while in a wilderness area? (i.e.: the absence of human noise such as loud talking or yelling, clanging of pots and pans, boat motors, etc.)

- ☐ Extremely important
- ☐ Very important
- ☐ Fairly important
- ☐ Not very important
- ☐ Not at all important

Why or why not? _____
_____
_____
_____
_____

11. Do you normally have a fire while on a wilderness trip? Yes ___ No ___

If so, is the size of the fire large or small? Large ___ Small ___
What types of fuel do you primarily use?

- ☐ Small dead brush and twigs from the forest floor
- ☐ Larger dead logs
- ☐ Limbs from standing dead trees
- ☐ Limbs from living trees
- ☐ Other, specify _____

12. Do you agree or disagree with the restriction of visitor access to sensitive habitats in order to protect ecological processes? (i.e.: nesting species such as loons or bald eagles, wolf dens, areas in need of rehabilitation, etc.)

☐ Strongly agree
☐ Agree
☐ Indifferent
☐ Disagree
☐ Strongly disagree

Why or why not? _____
_____
_____
_____
_____