

CAMPSITE IMPACTS AND THE LIMITS OF ACCEPTABLE CHANGE PLANNING
PROCESS: A CASE STUDY OF THE JEDEDIAH SMITH WILDERNESS

by

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ABSTRACT

The Limits of Acceptable Change (LAC) planning process is a means by which planners attempt to preserve naturalness while facilitating public use in federally designated wilderness areas. The biophysical condition of campsites is often used as one indicator of naturalness in LAC plans. Despite the emergence of scientific methods to monitor campsites, campsite standards often neglect to reflect the findings of this science. The LAC process was used in Wyoming's Jedediah Smith Wilderness, which is situated east of fast growing Teton County, Idaho and west of popular Grand Teton National Park. Teton County and many other Western counties next to wilderness have outgrown other counties further from wilderness. Grand Teton Park receives tens of thousands of backcountry campers that may access the Wilderness depending on the degree of connectivity between the two protected areas. Many other wildernesses also share borders with popular national parks. Campsites were analyzed for changes in biophysical condition and distribution from 2001 to 2006. A sample of the origins of Wilderness users was taken to determine campsite use by recent migrants and residents of Teton County and recreationists entering the Wilderness from Grand Teton Park. Existing campsite conditions improved but the distribution of campsites changed significantly. These findings show that indicators of campsite conditions need to focus not only on the biophysical condition of campsites, but also on the spatial aspects of campsite proliferation and recovery. Teton County residents rarely use the Wilderness for overnight outings and thus have little influence on campsite conditions. However, because these recent migrants and residents often day hike, opportunities for solitude may be diminished. The vast majority of recreationists entering from Grand Teton Park were found to be overnight campers. Therefore, these users have a relatively high degree of influence on campsite conditions.

INTRODUCTION

Federally designated wilderness is an important part of land use in the United States. It has grown from 9.1 million acres in 1964 to over 105 million acres today and occupies nearly 4.5 percent of the total area of the United States (Geary and Stokes 1999; Hendee and Dawson 2004). Wilderness can be viewed as one end of an environmental modification spectrum with urban areas at the other end of the spectrum (Hendee and Dawson 2002). Because wilderness is largely unmodified by human influences it fills a unique niche in the demand for recreation providing solitude and natural conditions.

The Wilderness Act of 1964 created the National Wilderness Preservation System (NWPS) and now includes wildernesses in all but six states. Four federal agencies are responsible for managing the NWPS: the Park Service, the Forest Service, the Bureau of Land Management and the Fish and Wildlife Service. In the contiguous forty eight states, the Forest Service manages the most acreage of wilderness with twenty nine million acres and the National Park Service manages ten million acres. Together, these two agencies manage the majority of wilderness in the contiguous forty eight states (Figure 1).

The Wilderness Act of 1964 (P.L. 88-577, Sec 2) states that wilderness is to be an area that is "... managed so as to preserve its natural condition" and "... administered for the use and enjoyment of the American people". Soon after the creation of the Wilderness Act, it became apparent that Congressional designation alone would not wholly protect wilderness areas (Hendee and Dawson 2002). The pressure to preserve natural

conditions has increased as the recreational use of wilderness has steadily grown since 1964 and is likely to increase unless limits are imposed (Cole 1996a).

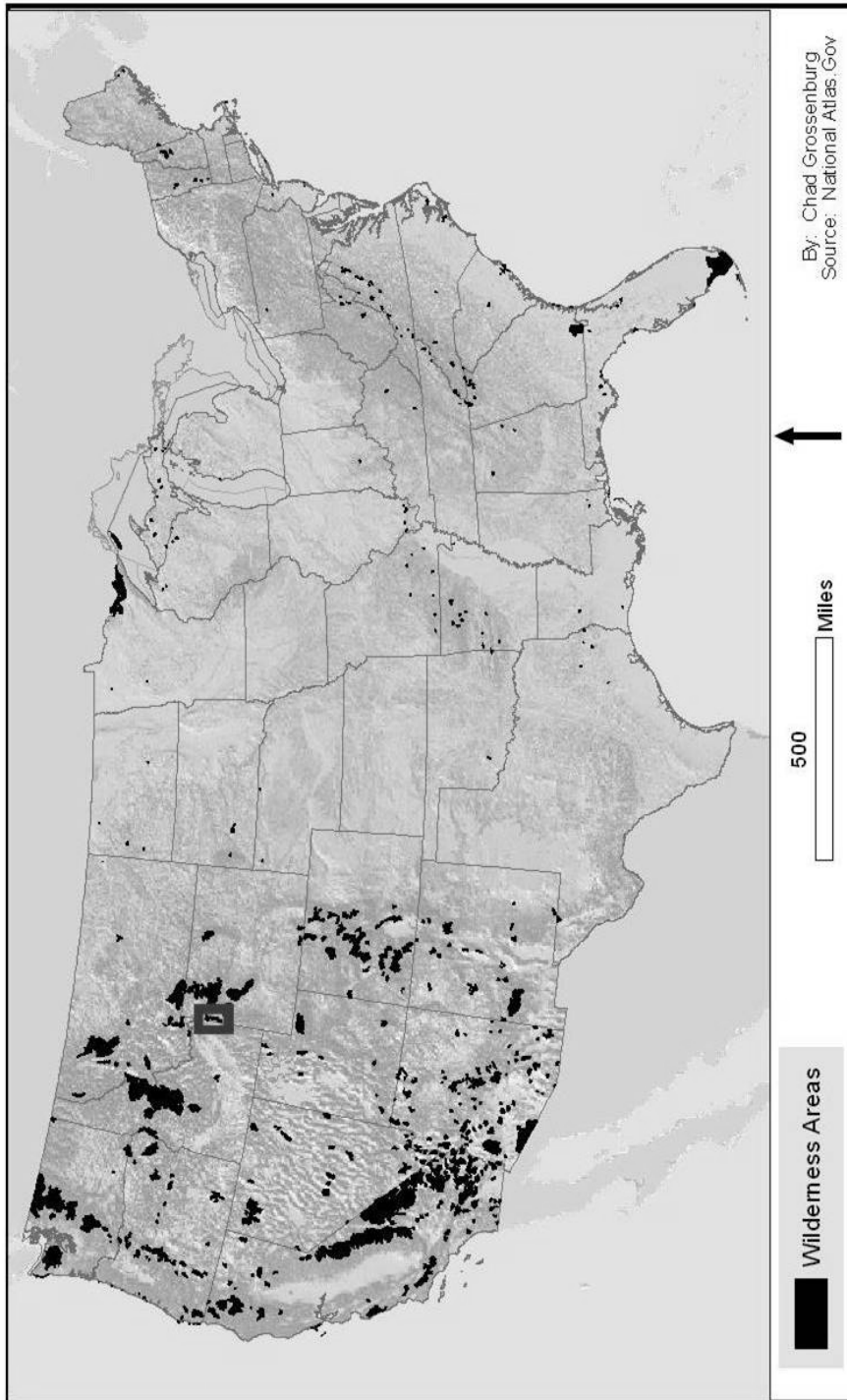


Figure 1. The National Wilderness Preservation System in the contiguous forty eight states with the Jedediah Smith Wilderness within the rectangle.

In order to preserve wilderness conditions, wilderness planning was developed as the process of looking forward to desired conditions and how to best achieve these conditions through consistent management. The Limits of Acceptable Change (LAC) planning process was devised in order for wilderness planners and managers to deal with the conflict created by the two competing goals of facilitating use while preserving natural conditions (Krumpe and McCool 1997).

One of the major ways in which the public influences natural conditions is from the impacts of camping (Cole 2002 & 1989; Leung and Marion 2000). An impact is any undesirable visitor related biophysical change of a wilderness resource (Leung and Marion 2000). Because the LAC process is an attempt to preserve natural conditions, the impact levels of campsites is often used as one indicator of quality. These indicators of quality are monitored by standards that define minimally acceptable conditions in specific settings. Inventorying and monitoring of these indicators provide information important for protecting and preserving wilderness conditions and for determining the effectiveness of management actions (Landres 1995).

Why is it important to study camping impacts and their role in the management of wilderness? First, it is difficult to plan for the professional management of wilderness, if we do not understand how it is influenced by recreation.

Neither the timber industry nor the public would accept a timber management program that did not rely heavily on stand survey data. In the same manner, it is time to increase the professionalism of wilderness management by basing that management on good inventory and monitoring data (Cole 1990, 186).

Second, wilderness provides a place to meet our demands for solitude and naturalness and the reduction of the amount or quality of wilderness lessens the diversity of land uses available to meet the widest range of recreational demands. Third, while wilderness managers and planners increasingly need assessments of visitor impacts and management assistance, the study of recreation impacts and their management has attracted a small number of scientists and students (Leung and Marion 2000).

The Jedediah Smith Wilderness has a geographic situation similar to many wildernesses across the West. This common geographic situation includes proximity to rapid amenity based population growth and to other federally protected lands. In the case of the Jedediah Smith Wilderness, it is situated between the fast growing Teton Valley to the west and popular Grand Teton National Park to the east. This research examines how this geographic situation and recreational use trends influence campsite impacts.

The purpose in undertaking this research is to discover the geography and trends that influence campsite impacts and to describe how this information may be used to formulate and adjust indicators and standards of wilderness quality in the Limits of Acceptable Change planning process. This goal can be achieved by asking a number of research questions:

1. Have campsite impacts increased in the Jedediah Smith Wilderness?
2. What percentage of overnight campers resides in the rapidly growing Teton Valley (Teton County, Idaho and the portion of Teton County, Wyoming west of the Teton Range) and what is their influence on campsite impacts?
3. What percentage of overnight campers enters the Wilderness from Grand Teton

Park and what is their influence on campsite impacts?

The first research question is the most important. Although many studies have focused on wilderness campsite impacts, none have been conducted on the west slope of the Teton Range. This research will not contribute to furthering the science of measuring campsite impacts, but it may contribute to the larger goal of analyzing recreation trends in the region and the West. In lieu of data on the number of overnight campers, this research will provide a way to analyze how the Teton Range has been used by overnight recreationists through time.

The first research question also forms the base of this study. Because some landscape changes happen over a very long period of time, people forget what the landscape used to look like. Jared Diamond (2005) calls this process "landscape amnesia". Campsite conditions can fall victim to landscape amnesia because they occur over a long period of time and we are unable to get a clear understanding of the type of use that actually causes changes to campsites (Shindler 1992). It is important to be able to understand how campsite conditions have changed through time in order to stem the "law of diminishing standards" or the continued decline of campsite conditions without manager's awareness (Shindler 1992). In order to set standards for campsite conditions, it is important to discover the distribution of campsites and how the conditions at these sites are changing through time. Standards should not be altered to mimic changes to resource conditions that have occurred over time in order to avoid costly management actions to improve conditions (Shelby, Stankey and Shindler 1992).

How does this research contribute to the field of geography? The discipline of

geography has a strong tradition of studying the relationship between humans and the environment. This tradition focuses on how the landscape is affected by human activities and how this altered landscape in turn influences human behavior. The diminished wilderness quality in many areas has shifted recreation activities requiring natural conditions and solitude to recreation uses with higher levels of impact and densities (Shindler 1992). The slow and steady decline of the quality of wilderness influences human behavior, whether we are able to realize it in the short term or not.

Contemporary geographers, like David Cole, have taken advantage of the human/environment lens and have become leaders in what many call the sub-field of recreation ecology. The human/environment tradition often combines geography's sub-disciplines of human and physical geography. The discipline of geography is well suited to examine how it is possible to facilitate public use of wilderness while preserving natural conditions.

The use of the concept of carrying capacity, or the amount of use a resource can witness before it begins to deteriorate, is not unique to the field of geography but geographers have certainly taken advantage of the concept. It can be viewed as a measure of the relationship between humans and the environment. The LAC planning process has its roots in the concept and is a means for managing human's influence on the environment.

Answering the first research question may help wilderness planners and managers modify indicators and standards of wilderness quality. Despite the use of scientific methods to inventory and monitor campsite impacts, little progress has been achieved in

clearly defining acceptable standards of quality in the LAC process (Cole 2004a). A number of methods have been developed to monitor the impact to campsites, but many forest plans are not taking advantage of this science. Because the LAC process is used in most wilderness areas (McCoy et al. 1995), and most wilderness areas that receive overnight visitors should monitor campsite conditions (Cole 1989), this research may help planners take advantage of the science of campsite impact monitoring when writing indicators and standards for many wilderness areas.

The second research question arose out of the geographic situation of the Wilderness and its relationship with amenity based population growth. The relationship between the location of wilderness areas and amenity based growth has been the interest of geographers. Many of the fastest growing counties in the United States are adjacent to federally designated wilderness areas (Rudzitis 1996). This is certainly the case with Teton County, Idaho which is adjacent to the Jedediah Smith Wilderness.

Population growth near wilderness may have significant effects on the use and conditions in these areas (Stankey 2000, 16). Many people are worried about the effects this growth has on protected lands. The former director of the National Park Service, Russell E. Dickerson, expressed concern about the future of parks because he viewed them as being surrounded and threatened by rapid development (Rudzitis 1984). Nash (2001) proclaimed that wilderness is in danger of being loved to death partly by enthusiastic visitation.

By taking a sample of the origins of overnight users, this research may contribute to our understanding of how recent migrants and local residents use and impact campsites

in the very resource that may have, in part, attracted them to these places. Many of these new migrants and residents may influence natural conditions by camping in the Wilderness or they may spend more time day hiking and influencing social conditions. It is important to understand not only why people are moving to these counties, but what effect they have on wilderness conditions. This research may contribute to our understanding of the recreational habits of those migrating to and residing in areas near wilderness and what impacts are associated with rapid amenity based growth near wilderness.

The third research question developed because the Wilderness is situated west of Grand Teton Park. Different recreation policies and management programs between parks and wilderness areas can result in subtle but important differences in the cultural landscape on each side of the boundary. Most national parks require the use of designated campsites upon the receipt of a permit, while most national forest wilderness areas allow camping anywhere (with the exception of within a certain distance to a water source). Because the number of national forest wilderness campers is not restricted, wilderness areas without designated campsites may witness more campers and thus more impacts during times of high recreational demand. Protected areas, without designated campsites, may also see changes in the distribution of campsites because users may change their preferences on where they want to camp through time. The different backcountry camping policies may influence campsite conditions and the wilderness landscape.

Different areas within the Wilderness have different degrees of connectivity with

Grand Teton Park and thus different geographic situations. Some camping places have no trails connecting the Wilderness with the Park and others have many. Some camping places in the Wilderness are near popular destinations in the Park and others are not. Determining which areas in the Wilderness are used by recreationists entering from Grand Teton Park may result in the discovery of how these different geographic situations result in unique patterns of campsite use and impact.

By studying the spatial patterns of overnight use that exist between the two protected areas, this study may contribute to our understanding of the differences in the cultural landscape that emerge when de facto wilderness is divided by administrative boundaries. The Tetons are not the only mountains to be divided by administrative borders. The Buckhorn and Brothers Wildernesses share a common border with Olympic National Park in the Olympic Mountains. The Teton and Washakie Wildernesses abut Yellowstone National Park. In all of these cases, the National Park Service requires permits to stay at designated campsites, while the Forest Service does not. This research focuses on merely one range as a case study, but the results from this case study may shed light upon a larger geographic situation common in the American West.

LITERATURE REVIEW AND BACKGROUND

The Limits of Acceptable Change Planning Process

Even before the creation of the NWPS, researchers wondered how much biological and physical impact wilderness could take before its wilderness character eroded (Wellman 1987). This dilemma led researchers to the concept of recreation carrying capacity (Manning and Lime 2000). The concept embraces the idea that resources must be protected from excessive use to sustain long-term recreational and ecological value.

Hall and Page (2002) recognize four types of recreational carrying capacity: physical, ecological, economic and social. Wilderness planners are primarily concerned with social and ecological carrying capacity.

Physical carrying capacity refers to the amount of people a site may actually accommodate. The physical dimensions of a campsite may be large enough for twelve tents to be set up, but that type of density would most likely exceed the social and ecological carrying capacity of the site.

Economic carrying capacity seeks to define the degree of change that can occur at a site before a decrease in economic activity occurs. In the wilderness setting, economic carrying capacity is related to other types of carrying capacity. A site that has exceeded its social carrying capacity may very well exceed its economic carrying capacity as outfitters can no longer find clients willing to accept the conditions found at the site.

The Wilderness Act (PL 88-577, sec. 2c) states that wilderness is a place that has

"... outstanding opportunities for solitude". The notion of social carrying capacity recognizes that there is a maximum level of recreation use before there is a decline in the enjoyment of the participants. Because wilderness users are likely to be sensitive to overcrowding, social carrying capacity was first studied in wilderness (Shelby and Heberlein 1986). There is little doubt that planners must be concerned with the social carrying capacity of wilderness, but the concept is problematic. The meaning of solitude is subjective and what constitutes solitude for one person may seem like a crowded atmosphere to another. Hall (2001) has found that 52 percent of the 117 hikers interviewed in Shenandoah National Park cited crowding as a factor limiting their wilderness experience, but other researchers (Freimund and Cole 2001) doubt the value of surveys when it comes to our understanding of what solitude means to recreationists. Researchers may underestimate the visitor's ability to attain outstanding opportunities for solitude even within areas that have high densities of use (Freimund and Cole 2001).

Ecological carrying capacity is concerned with defining the maximum amount of impact to the physical environment before an unacceptable level of change is produced. The carrying capacity concept suggests a strong relationship between the amount of use and subsequent impact and when applying the concept to recreation, the amount of use alone is a poor determiner of the amount of impact (Hendee and Dawson 2002). A limit on the number of users based on ecological carrying capacity assumes that the user's behavior remains consistent through time, but as the behavior of recreationists change so do the subsequent impacts. It ignores the influence of "Leave No Trace" camping technique campaigns and any changes in the behavior of wilderness users. The same

number of wilderness campers today may very well have less ecological impact than the same number did ten or twenty years ago, due to changes in behavior.

Limits restricting the number of users may also ignore changes in the types of recreation that take place in wilderness and how this affects the recreational ecology of wilderness. For example, the ecological impact from campsites used by stock riders were found to be six times the size of sites used only by backpackers in the Bob Marshall Wilderness (Cole 1983), but the number of horseback riders has decreased nationwide (Cordell et al. 1999). Because the rates of use by overnight stock users may change through time, a carrying capacity limit may fail to adjust to changing recreation patterns. Managers relying on the carrying capacity concept may neglect to recognize the dynamic nature of recreational trends and may unnecessarily restrict users in attempts to limit ecological impacts.

The application of the carrying capacity concept to wilderness has received much attention from researchers, but the application of the concept has often resulted in frustration (Manning and Lime 2000). Vast amounts of research on environmental and social impacts have failed to find a consistent relationship with varying levels of use (McArthur 2000). The carrying capacity concept was borrowed from range and wildlife management (Wellman 1987) and it is intuitively easy to envision a certain number of elk that could graze a meadow before a point of diminishing health of the elk was reached. If one more calf added to the population results in a proportionally greater loss of body mass in the rest of the population, the carrying capacity has been exceeded (Shelby and Heberlein 1986). Applying the carrying capacity concept to recreation settings is not as

easy because we don't readily agree on the desired goals. We are willing to accept the carrying capacity on an elevator because we all agree that causing the elevator to malfunction as a result of too much weight is bad (Shelby and Heberlein 1986). Our values for wilderness characteristics are not so widely agreed upon. The concept's utility as a practical planning tool is weak. "What has not been found is the philosopher's stone many have sought, a technically clean and scientifically valid way of determining how much use is too much" (Wellman 1987, 249).

Increasing dissatisfaction with the recreation carrying capacity concept led researchers to a new conceptual system for managing wilderness called the Limits of Acceptable Change (LAC) in the 1980s (Stankey 1998). With the LAC system, planners acknowledge the role of objectives in the planning process and no longer try to determine how many recreationists is too many, but how much ecological or social change is acceptable. The LAC process focuses on conditions rather than on sheer number of users and is capable of accounting for changes in both the type and behavior of recreationists. LAC has been realized as a planning process of looking forward to desired conditions and how to best achieve those conditions through consistent management. The LAC process is now the most widely used wilderness planning process in the U.S., particularly in the West (McCoy, Krumpe and Allen 1995).

The LAC process requires planners to define the biophysical and social conditions desired and to come up with indicators of these conditions that can be monitored through time. If the indicators point to conditions not being met, managers can then implement various strategies to improve conditions. These strategies may include non-intrusive

procedures, such as naturalizing campsites, to more restrictive measures, such as limiting certain types of recreation in particular areas in order to minimize recreational impacts.

After USDA Forest Service researchers developed the LAC planning process, the National Park Service developed a similar system called the Visitor Experience and Resource Planning framework (Dvorak 2004). This planning framework was designed to better fit park settings and has expanded LAC concepts for use in developed recreation settings (Dvorak 2004).

Nine steps (Figure 2) were included in the original LAC system. The first step of the process is to describe the wilderness's unique values, opportunities and concerns and to analyze them in relation to recreational supply and demand regionally and nationally (Stankey et al. 1985).

The second step is to identify prescription zones representing varying conditions likely to be found in the wilderness. Originally, the term "zone" was not used because it was officially unacceptable in the Forest Service in the 1980s and the term "opportunity class" was used instead (Cole 1998). This original term is problematic as it lends more importance to the opportunity for solitude than it does to natural conditions, though both qualities are desired (Cole 1998). This step of the process also identifies floating prescription zones. These zones have no geographic representation but are descriptions of conditions that planners believe likely to be represented or restored in the wilderness. These zones may later fall down somewhere within the wilderness once conditions have been inventoried and mapped (in latter steps) or when conditions on the ground are restored by management actions.

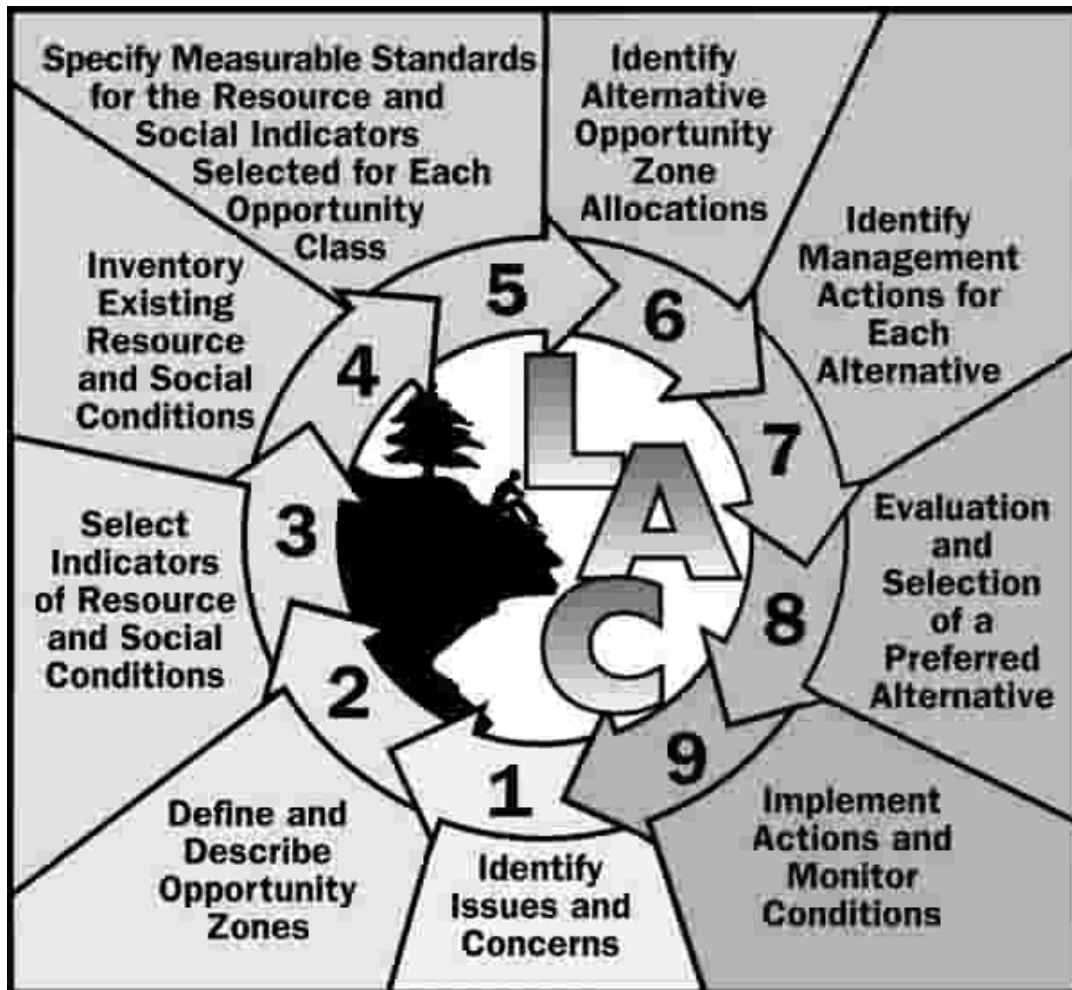


Figure 2. A cyclical representation of the nine steps in the LAC process.
Source: Eling, 2005

The third step is to identify indicators of the conditions that are to be found within the zones. Indicators are a means to analyze the conditions of different resources such as trails, campsites or water quality. It is important to consider what the unique characteristics and concerns of the wilderness are when determining what indicators to measure. Any wilderness that has overnight use, most likely needs to monitor campsites as an indicator of wilderness conditions (Cole 1989).

Step four in the LAC process is to conduct inventories of the resource and social conditions used as indicators. Inventories are required to map existing conditions and figure out where the prescription zones should be applied on the ground.

Step five is to create "standards" or measures of the indicators to determine if a particular resource condition is meeting the conditions established in the prescription zone. Standards should describe a gradation of conditions that can be applied to the varying prescriptions zones. These standards should define minimally acceptable conditions and should be measurable, ideally quantitatively (Stankey et al. 1985).

Step six requires the use of information collected in step one (area issues and concerns), step two (prescription zone descriptions) and step four (inventories of existing conditions) to determine where the floating prescription zones should fall onto the ground. Managers and the public are required to determine where different social and resource conditions are desired in the wilderness.

Step seven is to determine the management actions required to make current conditions meet the standards in each alternative prescription zone allocation. No management action may be needed if current conditions do not exceed the standards, but managers may elect to describe the possible array of actions necessary if conditions are later found to exceed standards.

Step eight is the selection of one alternative prescription zone allocation and the zone's associated management actions. Because the public plays a large role in deciding the final prescription zone allocations, the process ensures that important issues have been addressed (Stankey et al. 1985).

Step nine requires managers to monitor conditions to ensure they remain within the standards or to implement actions to make conditions meet standards.

Campsite Location, Density and Impact Levels
as Indicators and Standards in the LAC Process

In the LAC process, objectives are vague narrative statements defining the biophysical and social conditions to be provided (Cole and Stankey 1998; Manning and Lime 2000). Indicators of quality, singly or in combination, are more precise quantitative measures of the state of the desired biophysical or social environment as described in the objectives (Stankey et al., 1985). Standards of quality are statements of minimally acceptable condition for each indicator variable (Cole and Stankey 1998; Manning and Lime 2000)

Many studies have focused on the characteristics that make for good indicators of quality (Manning and Lime 2000; Stanky et al. 1985). Indicators of quality should be quantifiably measurable, reliable, significant, sensitive and repeatable (Merigliano 1990; Watson and Cole 1992). The causes of change that are to be detected by the indicator should be responsive to management action (Manning and Lime 2000; Watson and Cole 1992). Quantitative standards are valuable for making generalizations about the condition of wilderness resources and predicting future changes in conditions (Glaspell et al. 2003).

Watson and Cole (1992) found many problems with indicators in a review of a number of LAC plans. Many indicators were found to lack specificity and quantitative

measures. Of the twelve LAC plans with campsite condition used as an indicator, only four included a spatial aspect. For example, the Hells Canyon-Snake River Draft Plan for the Wallowa-Whitman National Forest uses the “level of campsite development” as an indicator of quality. Development refers to the human created features of the campsite, such as fire rings or log seats. This indicator may allow for hundreds of campsites that have one or less fire ring, but may be exceeded when only one campsite is found to have two fire rings. An example of an indicator that includes a spatial aspect is “the number of impacted sites, above a particular condition class, per 640 acres” used in the Bob Marshall Wilderness Complex LAC Plan for the Flathead National Forest.

Using campsite impacts as an indicator is part of the larger objective of attempting to limit ecological change and to preserve natural conditions. There is a lack of agreement among researchers as to the effectiveness of using campsite impact indicators as part of the objective to provide a quality wilderness visitor experience. This goal stems from the section 2(c) of the Wilderness Act (PL 88-577) which states wilderness is to be a place that "... appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticed". Cole (2004b & 2002) argues that campsite impacts indeed detract from the quality of the visitor experience and make good indicators of quality because campsite impacts are easily mitigated by management actions, such as rehabilitation or closing heavily impacted campsites. Through a small number of interviews, Ferrell, Hall and White (2001) found that visitors do not feel that campsite impacts have a negative effect on their wilderness experience. This finding conflicts with the assumptions of researchers and managers that campsite

impacts have a significant influence upon wilderness experience. Shindler and Shelby (1992) have found freedom from contact with other people is an important aspect of campsite selection, while resource impacts largely go unnoticed or unreported. Kearsley (2000) found that social rather than biophysical impacts were more widely noticed by recreationists in a study of tourism and wilderness quality in New Zealand's Native Forests. Based largely on perceived crowding, many recreationists are being displaced spatially and temporally and further displacement is likely with increasing international tourist visits (Kearsley 2000).

The creation of standards and subsequent monitoring of standards improved management consistency in many wilderness areas in the Northwest. With no baseline data on state of campsite impacts, each new manager would start with a slightly more degraded image of the natural conditions (Smith and Higgins 1992). Once standards were established and data collected on the state of campsite impacts, managers gained a valuable frame of reference to judge how campsite impacts were changing.

The Development of Camping Impact Research

Recreation impacts became an interest of researchers as early as the 1920s and 1930s, but it was not until the 1960s and 1970s that significant research took place owing to increased wilderness use and impacts (Leung and Marion 2000). The main resources that are impacted by camping are soil, vegetation, wildlife and water (Leung and Marion 2000). Research has consisted of studying vegetation trampling, trail impacts and how impact indicators are developed. Much research has focused on campsite impacts

because campsites receive the highest level of visitor impacts, particularly those related to inappropriate behavior (Leung and Marion 2000).

Many camping impact studies have focused on the relationship between the number of visitors and their effects on the biophysical conditions of campsites. This literature review focuses on how campsite conditions change through time, the spatial aspects of campsites and how campsite impacts are monitored.

The first campsite assessment and monitoring program began in 1972 in Yosemite National Park with the combined goals of describing both the range and distribution of camping impacts (Boyers, Fincher and van Wagtendonk 2000). Though problems occurred because different parameters were used to collect data over the years, the program has been key in helping managers reduce the impacts of campsites in the Yosemite Wilderness (Boyers, Fincher and van Wagtendonk 2000).

Previous research has found that campsite numbers and impacts vary through time. Cole (1993) has found that the number of campsites and the degree of recreational impact have increased in the Lee Metcalf, Selway-Bitterroot and Eagle Cap wildernesses in a twelve to sixteen year time period. Conversely, Cole and Hall (1992) have found that recreational impacts had already reached peak levels by 1981, in a study of campsite conditions from 1981-1990 in the Bob Marshall Wilderness.

Others have found that the campsite impacts vary from wilderness to wilderness. McEwen et al. (1996) found that both campsite densities and impact intensities in four wildernesses in the South-Central United States were relatively low in comparison to other wildernesses. Impacts were the greatest on sites near streams and sites used by both

stock and hiking groups (McEwan et al. 1996). Many studies have found that camping impacts only affect a small fraction of the area within wilderness (Leung and Marion 2000).

Rocheftort and Swinney (2000) found condition class surveys provided the most complete impact inventories. Compared to two other systems used in Mount Rainier National Park, the condition class surveys described the broadest spectrum of impacts and provided the best quantitative description of impacts to soil and vegetation (Rocheftort and Swinney 2000).

Amenity Based Growth and Wilderness

Over fifty years ago, the geographer Edward Ullman (1954) published a paper titled “Amenities as a Factor in Regional Growth”. Ullman proclaimed that “for the first time in the world’s history pleasant living conditions instead of more narrowly defined economic advantages are becoming the sparks that generate significant population increase, particularly in the United States” (Ullman 1954, 119). For the most part, Ullman was concerned with the fast growing states of California and Arizona which had become the “...frontier of comfort, in contrast with the frontier of hardship” (Ullman 1954, 119). Ullman (1954) analyzed the influence of climate, a relative increase in the retired population and the growth of foot loose workers as possible reasons for amenity based growth. Ullman’s point was not that California’s dramatic growth was solely an effect of amenity based migration; instead he wanted to make us aware of its influence. He made the call for a better understanding of the force of amenity based growth and

tried to convince us that its influence may be more powerful in the future. There is little doubt that this force's influence has increased and that the desired amenities themselves have shifted, but amenity based growth remains poorly understood, particularly when we look at its relationship with wilderness.

Counties adjacent to wilderness areas or national parks have grown dramatically in recent decades. Rudzitis (1996) has found that in the 1960s, counties with or adjacent to wilderness grew at a lesser rate than metropolitan areas, but they still outgrew other non-metropolitan counties. During the 1970s, counties with or adjacent to wilderness grew faster than metropolitan and non-metropolitan counties. The 1980s witnessed wilderness counties growing at a rate over six times faster than other non metropolitan counties and twice as fast as metropolitan counties.

Many researchers and planners were surprised by the statistics showing rural growth in the 1970s (Rudzitis 1996). Despite the work of geographers like Ullman, we are often surprised when people chose to migrate for reasons other than economics. Traditionally, growth models of rural places near wilderness have focused on the export of natural resources or on the economic base model (Rudzitis 2000, 21). Geographers like Gundars Rudzitis (2000) question the usefulness of migration models based on economics and support the use of a quality of life model to better understand Western migration patterns. This model hinges on the idea that people largely migrate not for economic reasons, but for place characteristics that they believe will improve their quality of life (Rudzitis 2000).

Others look at wilderness and migration from a humanist perspective and doubt

whether any models can help us predict the migration patterns of wilderness counties. Dustin (2000) believes that individual place notions associated with wilderness are so unique that "...the resulting maps, while richly textured and finely detailed are not likely to be very useful for predictive purposes" (Dustin 2000, 56).

Lorah (2000) found that Western counties with large of amounts of federally designated wilderness have shown not only higher population growth rates, but also higher rates of income and employment growth. Kwang-Koo and others (2005) found that proximity to natural amenities, such as Forest Service land, did not have a strong association with population, employment or income growth in a study of counties near the Great Lakes. Thus, the relationship between federal lands such as wilderness and amenity based growth may have something to do with the characteristics of the West that the upper Mid-west lacks.

Wilderness Use through Time

The fastest growth in the recreational use of Forest Service wild lands occurred following World War II and prior to the creation of the Wilderness Act in 1964. During this time period, recreational use of de facto wilderness increased sevenfold (Cordell and others 1990). Following the passing of the Wilderness Act in 1964, Cole (1996a) found that wilderness use increased at a rapid clip during the 1960s and 1970s. During the 1980s, wilderness use only increased at a rate of about 1 percent per year. The use intensity (amount of use per acre) of federally designated wilderness was cut in half in the 1980s, with the introduction of fifty six million acres of Alaska land. Cole (1996a)

found dramatic wilderness use growth rates in the early 1990s. Backcountry permit data from Grand Teton Park and Glacier National Park showed the highest rates of overnight use in the Park's histories in 1994 (Cole 1996a). Cole (1996a) concluded that, on the whole, wilderness recreation use was increasing.

Cole (1996a) largely relied on records of overnight use of parks and wilderness for his analysis, and he made a call for the need for a better way to estimate day use of wilderness. Cole (1996a, 10) declared, "It is widely assumed that day use of wilderness is increasing more rapidly than overnight use; however, this assumption has not been rigorously tested." That assumption continues today. Hammitt and Schuster (2000) believe day use will account for the biggest increase in wilderness use by volume in the coming years. Increasing popularity of wilderness recreation and the lack of long periods of leisure time may be the most significant factors for the increase (Hammitt and Schuster 2000). Similarly, Chavez (2000) sees day hiking as the recreational use that may define wilderness use in the twenty first century owing to time constraints and the desire for wilderness access close to home. Day hiking has been predicted to grow at a slighter higher rate of about 150 percent from 2000 to 2040 (Cordell et al. 1990).

Hall (2001) has pointed out that while use limits pertain only to overnight users of wilderness they are often created to promote opportunities for solitude which are affected by day users of wilderness as well. Wilderness managers and researchers have tended to view day use as non-threatening to wilderness values (Hall 2001). Thus, limits on overnight use of wilderness are more common than limits on the amount of day use.

STUDY AREA

The 123,000 acre Jedediah Smith Wilderness was officially designated in 1984. It lies on the western slope of the Teton Range and borders Grand Teton National Park on its east side (Figure 3). The Teton Range is roughly forty miles long north to south and fifteen miles wide west to east. Elevations in the Wilderness vary from 2,000 meters (6,416 feet) up to 3,385 meters (11,106 feet). Within the Wilderness, there are 175 miles of trails, many of which cross the administrative border into Grand Teton Park. The fast growing Teton Valley is to the west of the Wilderness and contains the towns of Driggs and Victor (Figure 3). The majority of the Teton Valley lies within the borders of Teton County, Idaho. A small portion of Teton County, Wyoming is west of the Teton Range and comprises a small part of the Teton Valley as well. The Wilderness is managed by the Caribou-Targhee National Forest with district offices in both Driggs and Ashton, Idaho.

Geology

The Tetons formed as a result of both normal and reverse faulting (Love, Reed and Pierce 2003). The spectacular and dramatic eastern slope of the range is the normal fault scarp easily viewed from Grand Teton Park. The Jedediah Smith Wilderness is located west of both the normal Teton fault and the reverse Buck Mountain fault, resulting in a less dramatic slope. Glaciation helped create the fourteen drainage basins on the western slope of the Tetons, many of which have the characteristic U-shaped

valley (USDA Forest Service, 1991). Although the last major glacial period ended roughly 15,000 years ago, high elevation glaciers still play a role in the changing landscape of the Tetons (Love, Reed and Pierce 2003).

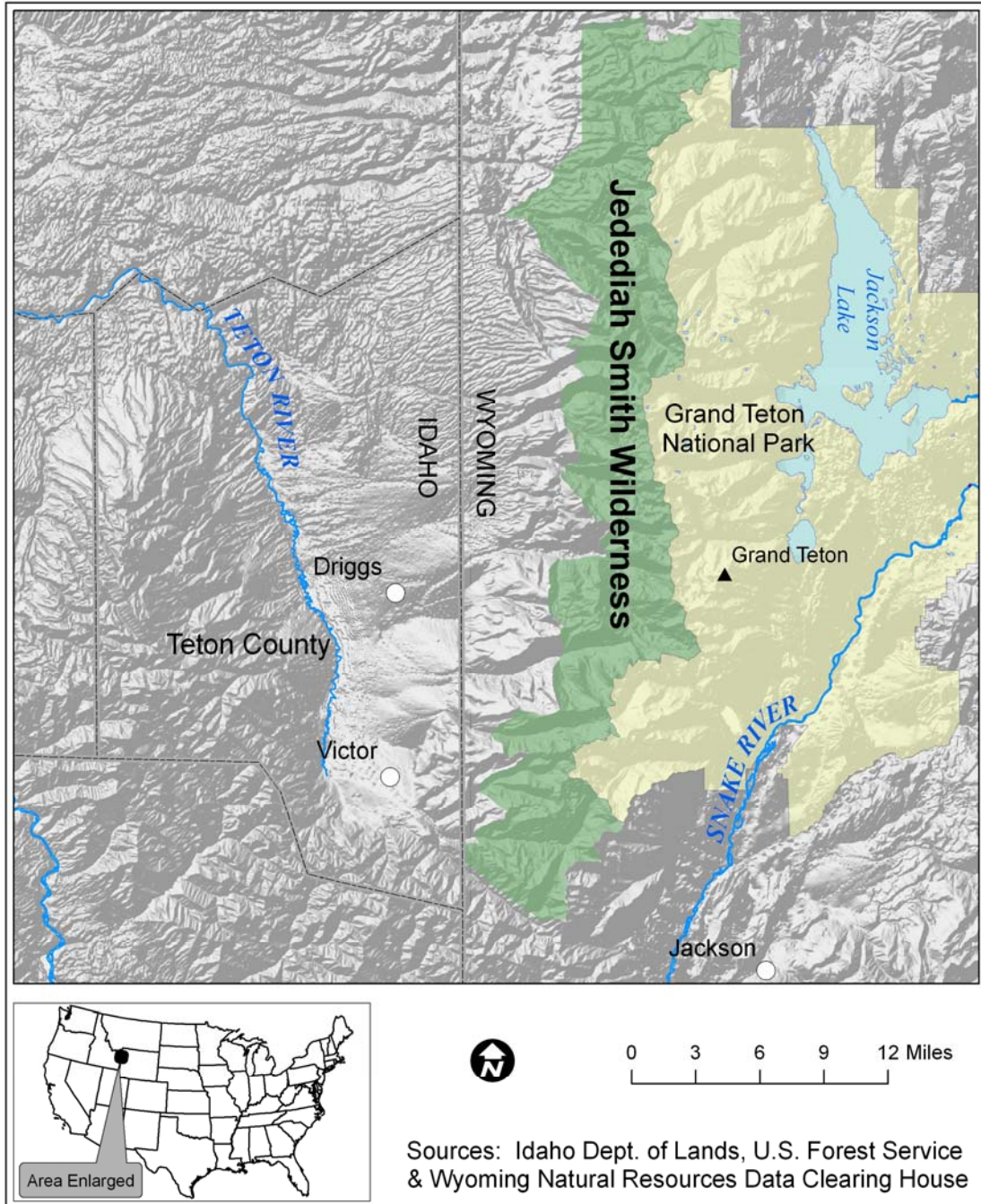


Figure 3. The Location of the Jedediah Smith Wilderness. (Map by Author)

Vegetation

The lower portions of the canyons and north and east facing slopes below roughly 2,743 meters (9,000 feet) tend to be forested with lodgepole pine (*Pinus contorta*), Douglas-fir (*Pseudotsuga menziesii*), Engelmann spruce (*Picea Engelmannii*) and sub alpine fir (*Abies lasiocarpa*) (United States Department of Agriculture, Forest Service 1991). Lodgepole pine is more common on the west slopes than on the east slopes of the Tetons (Knight 1994, 236). The south and west-facing slopes tend to have fewer trees and more grasses and forbs. Between roughly 2,438 meters (8,000 feet) and 2,743 meters (9,000 feet) subalpine fir and large grass and forb meadows dominate (United States Department of Agriculture, Forest Service 1991). Above 2,743 meters, (9000 feet), whitebark pine (*Pinus albicaulis*) and subalpine fir krummholz are common along with grassy mountain meadows (United States Department of Agriculture, Forest Service 1991). Low-lying grasses, shrubs, and lichen make up the majority of vegetation that can take hold in the harsh and rocky tundra above timberline.

Visitor Use

There are no data available on the number of annual overnight users, but the USDA Forest Service's (2001) National Visitor Use Monitoring Program has estimated that 210,000 annual visits occur in the wilderness. This is just about 10 percent of the estimated 2.2 million annual visitors to the Caribou-Targhee National Forest. The majority (over 93 percent) of those Wilderness visitors are white in race/ethnicity. The

average length of stay in the Wilderness is almost thirty five hours which is greater than the average visit to the Targhee National Forest of twenty five hours. This longer stay can be explained by the fact that backpacking and horse packing are major recreational uses in the Wilderness that often involve overnight stays. Of the people visiting the Caribou-Targhee National Forest, an estimated 48 percent participate in viewing natural features and scenery, 16 percent engage in hunting, 10 percent in fishing, 7 percent in hiking, 2 percent in horseback riding and 1 percent in backpacking.

Increases in Regional Population and Recreation Use

The geographic situation of the Wilderness influences both recreational demand and recreational impacts. The Jedediah Smith Wilderness's eastern border is shared with Grand Teton Park and use in the park increased dramatically in the early 1990s (Figure 4). Overnight campers in Grand Teton Park need to get permits for designated sites, while camping permits are not required and designated campsites do not exist on the wilderness side of the boundary. Twelve trails cross the administrative boundary, many of them in popular areas near the highest peaks in the Tetons, such as the Grand Teton, the Middle Teton and Buck Mountain.

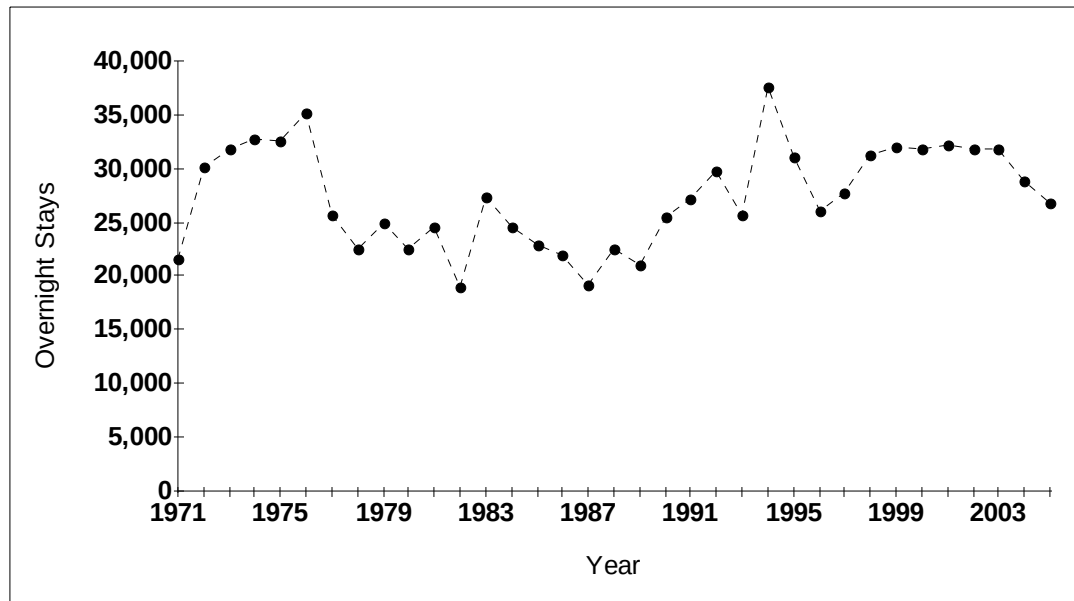


Figure 4. Backcountry use in Grand Teton National Park from 1971 to 2005.
Sources: Cole, 1996 and pers com. Spletter, Beth. May 27, 2006. Grand Teton National Park Backcountry Permit Office. via email.

Another important aspect of the Wilderness's geographic situation is its proximity to the nearby Teton Valley. The amenities provided by the Wilderness and the beauty of the Tetons have, in part, influenced the rapid growth in the region. The Teton Valley is made up of all of Teton County, Idaho and the portion of Teton County, Wyoming west of the Teton Range. Teton County in Idaho has doubled in population in the last sixteen years (Figure 5) resulting in it being one of the fastest growing counties in the greater Yellowstone area. The term "greater Yellowstone area" refers to the roughly eighteen million acres of land in northwest Wyoming, southwest Montana and east-central Idaho with Yellowstone National Park at its core.

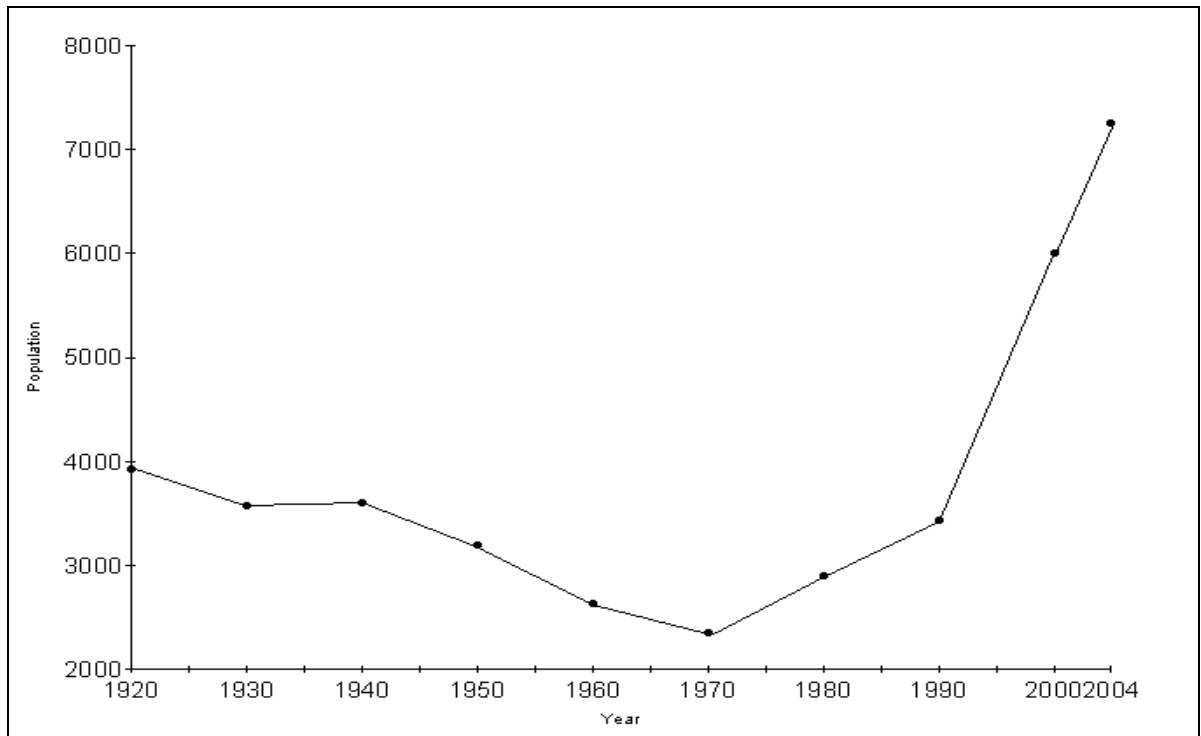


Figure 5. The population of Teton County, Idaho from 1920 through 2004.
Source: U.S. Census Bureau (2000 & 2005).

Prescription Zones

The Limits of Acceptable Change planning process has been used in the wilderness and has resulted in the creation of three different prescription zones (Figure 6). The prescription zones descriptions indicate that the numerically lower zones should have better opportunities for solitude and more natural conditions (fewer recreational and managerial impacts).



Figure 6. Prescription zones in the Jedediah Smith Wilderness. (Map by Author)

The 1.1.6 prescription zone applies to the largest portion of the Wilderness. According to the 1997 Targhee National Forest Revised Plan (hereby referred to as the "forest plan", USDA Forest Service 1997) the opportunity for individuals or small groups to experience high quality wilderness-dependent educational experiences exist in this zone. The effects from human and camping activities are not supposed to be noticeable to most visitors, with the exception of bear proof food storage boxes. Within this zone, a low level of recreation use should occur owing to rugged terrain, a lack of system trails and signing. Essentially, the 1.1.6 prescription zone is managed to provide a wilderness experience with a high degree of solitude and natural conditions.

The 1.1.7 prescription zone or opportunity class II zone is supposed to provide a moderate opportunity for individuals and medium sized groups to experience a quality wilderness-related educational experience. The effects of human and camping activities are to be somewhat evident to visitors and moderate amounts of use occur. Directional and resource signs may be present as well as moderate to high use by outfitter and guides.

The 1.1.8 prescription zone or opportunity class III zone applies to the smallest portion of the Wilderness. The effects of human and camping activities are present along with very noticeable trail treads. Opportunities should exist for individuals and large groups to experience a quality wilderness experience. Within this zone, recreation use is the highest of the three zones. Visitors to this zone should count on meeting many other users which may slow their progress and may impact their solitude expectations.

Six indicators (step three in the LAC process) have been selected to measure wilderness conditions in the three prescription zones (Bogle 2004). Two of the indicators

were created in the attempt to measure social conditions: 1) the number of occupied campsites users may see from their campsite and 2) the number of encounters per mile with other parties along user-created routes or trails. Two of the indicators were created to measure ecological conditions: 3) the condition of individual campsites (vegetation impact and loss) and 4) the condition of user-created routes and segments (width of user created trails). The last two indicators may arguably measure both ecological and social conditions: 5) the number of substantiated complaints about outfitters and grazing permittees from the public and other permittees and 6) the number of violations by type. Complaints about outfitters may concern issues of ecological impact or impacts of a social nature. Violation types may be social in nature, such as groups with twenty or more people or ecological, such as maintaining a campfire in a restricted area.

DATA SOURCES AND METHODOLOGY

Data collected from 2001 through 2005 with the Wilderness Campsite Inventory and Monitoring Program (WCIMP) and from previous campsite inventories were used to determine if campsite impacts increased through time. A census of the location and ecological impacts of campsites was completed in 2005 and presented the opportunity to evaluate recent trends in recreation ecology. The WCIMP was developed and fully implemented in the 2001 field season (Lien 2001). Wilderness rangers systematically searched for campsites prioritized by time, accessibility and topography. Searches were concentrated in relatively flat areas that facilitate camping and within 300 feet of a water source, trail (official or social) and bear proof food storage boxes. Areas without these qualities were given a lesser priority in the amount of time and effort searching for campsites. Campsites were most often recognized by the presence of a fire ring or scar. Campsites were given a unique identifier or campsite code (see appendix A for the meanings of the campsite codes).

Prior to 2004, campsite location was recorded by transcribing the universal transverse Mercator (UTM) coordinates to the WCIMP site characteristics portion of the monitoring form (Figure 7). Other geographic characteristics of the campsite were recorded as well, including: elevation, distance to water source, distance to system trails and the type of users.

1-Trail:	_____
2-Site Number:	_____
3-Management Prescription:	_____
4-Watershed:	_____
5-UTM Coordinates:	_____
6-Date:	_____
7-Weather:	_____
8-Inventoried by:	_____
9-Elevation :	_____ (nearest 100ft)
10-Distance to nearest water (feet):	_____
Type: 1-River/Creek	_____ 3-Spring _____
2-Lake	_____ 4-Other _____
11-Distance to nearest trail (feet):	_____
12-Distance to trailhead and name of trailhead:	_____
13-Number of occupied campsites users may see from their site	_____
14-Facilities:	
(write number of each on blank and locate on campsite map)	
Fire ring:	_____ Hitching rail: _____
Primitive Seat:	_____ Corral: _____
Constructed Seat:	_____ Toilet: _____
Table/shelf/counter:	_____ Other: _____
15-Type of users (Circle):	
1-Foot 2-Stock 3-Cavers 4-Climbers 5-Fisherpeople	
16-Campsite Desirability (Circle):	
1-Good 2-Marginal 3-Poor Why: _____	
17-Historic Use (Circle): 1-Recent (fresh ashes) 2-Several years ago (old ashes)	
3-Many Years Ago (overgrown)	

Figure 7. Location and site characteristics portion of the WCIPM form.

Source: Perri 2000.

Campsite condition data were collected using the condition class section of the WCIMP form (Figure 8). This section of the campsite inventory form is very similar to Cole's (1983) condition class section of the campsite inventory monitoring form used in the Bob Marshall Wilderness of Montana.

Impact evaluation-compare similar areas, same species, slope, rockiness and canopy cover

(18) Vegetation cover (Circle one)		(19) Mineral Soil Exposure (Circle one)	
On campsite	Undisturbed site	On campsite	Undisturbed site
1. 0-5%	1. 0-5%	1. 0-5%	1. 0-5%
2. 6-25%	2. 6-25%	2. 6-25%	2. 6-25%
3. 26-50%	3. 26-50%	3. 26-50%	3. 26-50%
4. 51-75%	4. 51-75%	4. 51-75%	4. 51-75%
5. 76-100%	5. 76-100%	5. 76-100%	5. 76-100%

RATINGS (circle on category)
Use information from questions 18 and 19 to answer questions 20 and 21

	1	2	3
(20) Vegetation Loss	No difference in coverage	Difference one coverage class	Difference two or more coverage class
(21) Mineral Soil Increase	No difference in coverage	Difference one coverage class	Difference two or more coverage class
(22) Tree Damage: No. of trees scarred or felled_____	No more than broken lower branches	1-8 scarred trees or 1-3 badly scarred or felled	>8 scarred trees or >3 badly scarred or felled
(23) Root Exposure: No. of trees with roots Exposed_____	None	1-6 trees with roots exposed	>6 trees with roots exposed
(24) Development:	None	1 fire ring with or without primitive log seat	> fire ring or other major development
(25) Cleanliness: No. of fire scars_____	No more than scattered from 1 fire ring	Remnants of >1 fire ring, some liter or manure	Human waste, much liter or manure
(26) Social Trails: No. of trails_____	No more than 1 discernable trail	2-3 discernable max 1 well worn	>3 Discernable or more than 1 well worn
(27) Camp Area: Estimated Area_____	<500 ft ²	500-2000 ft ²	>2000 ft ²
(28) Barren Core Camp Area: Estimated Area_____	<50 ft ²	50-500 ft ²	>500 ft ²

Figure 8. The condition class survey of the Wilderness Campsite Monitoring Program Form (WCIPM).

Source: Perri 2000

The condition class survey of the WCIMP collects impact data using nine parameters:

1. *Vegetation loss* was determined by the difference of vegetation cover on the campsite and a comparatively similar undisturbed nearby site. One of five vegetation cover classes (vegetation cover as a percent of ground cover) was assigned to both the campsite and the undisturbed area. The undisturbed area was selected considering similarities with the campsite in slope, canopy cover and vegetation type. The impact level of vegetation loss was determined by the difference between the two site's cover classes.

2. *Mineral soil increase* was determined by the difference in the amount of mineral soil on the campsite and comparatively similar unused nearby site. Again, one of five cover classes was assigned to the campsite and the undisturbed area.

3. *Tree Damage* was determined by assigning to the campsite one of three levels of damage by recording the number of scarred or damaged trees.

4. *Root Exposure* was determined by recording the number of trees with exposed roots and assigning damage into one of three classes. Exposed roots were attributed to campers when there is stock hitching damage to the tree or when there are other obvious signs of camping, such as a fire ring near the tree.

5. *Development* of the campsite was recorded in one of three categories ranging from no development to two or more fire rings or other development. The most common form of development at a campsite was the presence of a rock fire ring or fire scar

without rocks. Other forms of development included: primitive log seats, constructed furniture, hitching posts or rails and wall tent poles or rails. Another form of development are bear proof food storage boxes which have been placed, by the Forest Service, in certain areas to provide the safe storage of food from bears.

6. *Cleanliness* of the campsite was assigned one rating out of three categories from simply showing the signs from one fire (blackened logs or ash) to the presence of much litter or human waste. This parameter is among the most temporary of impacts, and is given less weight in the final impact index.

7. *Social Trails* were assigned one of three ratings based on quantity and width. The ratings range from no more than one discernable social trail to the presence of greater than three discernable or well worn social trails.

8. *Camp Area* was given a rating in one of three categories based on the square footage of area with impacted vegetation. This area includes the bare mineral soil portion of the campsite typically found around the fire ring and any areas displaying vegetation or soil impact from tent placement, trampling or stock hitching. Camp area was estimated by pacing the length and width of a rectangular shaped campsite or radius if the campsite was circular. Campsites with irregular shapes were measured by visually observing the impacted area and coming up with an estimate.

9. *Barren Core Camp Area* was given a rating based on the square footage of the campsite devoid of vegetation. This typically includes the mineral soil portion of the campsite around the fire ring and areas that are covered only in duff or organic litter. The same methods as in parameter #8 were used to measure the barren camp core area. In the

cases where two barren core areas were geographically separated, the areas of each were combined. This scenario often occurs in camps used by stock groups, where there is one barren core area around the fire ring and another where stock has been hitched to trees or picketed.

Finally the ratings of each parameter were used to come up with an overall impact rating or condition class score for each campsite (Figure 9). This index was also taken from Cole's (1989) study of the Bob Marshall Wilderness. The rating (1 to 3) for each parameter is multiplied by the weight or importance of each parameter. For example, *camp area* is given the most weight (4), because the impacts are long term and comprise the greatest areal extent. Conversely, *cleanliness* is given the least weight (1), because the impacts of litter and fire scars can be easily cleaned up. This condition class score is basically a measure of the cumulative impacts found at the campsites.

Parameter	Weight	Rating	Impact Index
20-vegetation loss	2		
21-mineral soil increase	3		
22-tree damage	2		
23-root exposure	3		
24-development	1		
25-cleanliness	1		
26-social trails	2		
27-camp area	4		
28-barren core area	2		

Summary Rating = sum of ratings/ # of parameters (9)_____

Figure 9. The condition class score calculation table
Source: Perri 2000.

Another index used to analyze campsite conditions through time was the Frissell

(1978) index (Figure 10). This index is best used to map and get a rough idea of an overall impact condition at a certain point in time (Cole 2002). This index has been used, in part, in studies by Cole (1993; 1996), and McEwan and others (1996). Frissell's (1978) index divides the state of campsite conditions into five classes. These classes do not provide information about the exact amount of particular resource deterioration. Cole (1989) has found these classes to be precise and repeatable estimates of a campsite's condition. There is a high degree of correlation between these classes and with measures of specific resource conditions, such as the amount of bare mineral soil and vegetation loss (Cole 1989).

Class 1-Ground vegetation flattened but not permanently injured. Minimal physical change except for possibly a simple rock fireplace. Class 2-Ground vegetation worn away around fireplace or center of activity. Class 3-Ground vegetation lost on most of site, but humus and litter still present in all but a few areas. Class 4-Bare mineral soil widespread. Tree roots exposed on surface. Class 5-Soil erosion obvious. Trees reduced in vigor or dead

Figure 10. Frissell (1978) Campsite Classification Index.

In the 2004 field season, the WCIMP form was converted into a data dictionary in the Pathfinder Office software and uploaded into a handheld Trimble GeoExplorer GPS unit. The collection of data with the Trimble GPS unit in 2004 and 2005 reduced user error because the UTM location no longer had to be transcribed to the WCIMP form. The field data was downloaded into the Pathfinder Office software and differentially corrected making the locations of sites accurate to within one meter.

In addition to the completion of the WCIMP form, photographic documentation

was conducted for each site. A hand drawn map using an established set of symbols was created to reference photo points and the geography of the site for future monitoring.

Campsite Monitoring and GIS Database Creation

The first task was to organize the campsite impact and location data collected from the WCIMP. In order to facilitate the analysis of campsite conditions through time, a GIS database was created. The unique ability of a GIS to store and analyze the location and ecological condition of natural resources provides one of the best ways to evaluate and comprehend the status and trends of resource conditions (Landres et al. 2001). Data stored by what Landres et al. (2001) call the traditional "shoebox" means is difficult to analyze and at risk of being lost in the case of staff relocation and retirement. The creation of a campsite database could be viewed as project specific. That is, it could be used to answer the question of whether campsites impacts have changed temporally and spatially and then discarded. Instead, the goal was to design a database that could be used by Jedediah Smith Wilderness managers well into the future and possibly assist other wilderness managers design a GIS campsite database. While the level of analysis by wilderness managers will vary with management objectives, campsite distribution and condition trends will most likely be examined in any inventory and monitoring system (Cole 1989).

In order to create a database that remains valuable through time, a data model that allowed for relatively simple analysis and data manipulation was needed. Longly et al. (2005) define a model as a set of constructs for describing and representing selected

aspects of the real world in a computer. Essentially, a GIS data model is an abstraction of reality that facilitates analysis of the relationship between explanatory variables and the distribution of certain phenomena (Chou 1997).

One of the most common uses of a GIS is to facilitate the inventorying of the location and condition of resources (Landres et al. 2001). Creating a GIS feature class of campsites with the condition attributes found during the initial inventory is a relatively simple process. A feature class is collection of objects of the same type (Longley et al. 2005). In the case of this project, the main feature class consists of campsites that are represented by points. During field data collection, the location of a campsite may be recorded by a GPS automatically and the biophysical conditions can be either recorded on paper or entered into a GPS as well. Once back in the office, these data may be uploaded or manually entered into a GIS. The result would be the traditional GIS spatial database in which each campsite inventory would consist of the location of the campsite and the attributes recorded (Figure 11).

Recording the results of campsite monitoring could follow the same process, but would eventually result in large and cumbersome data structure that would impede both analysis and database maintenance. Once the monitoring process has begun, existing campsites no longer vary spatially, but the biophysical attributes of campsites vary temporally. A spatial database will no longer suffice and a spatio-temporal database is required. This fact is the most important aspect to consider when designing a GIS data model for campsite monitoring. Recording the results of campsite monitoring as if they were inventory data would result in a database with multiple representations of the same

object (campsites) when only campsite conditions changed through time (Figure 12). It would not only require more digital storage space, but impede database maintenance and analysis.

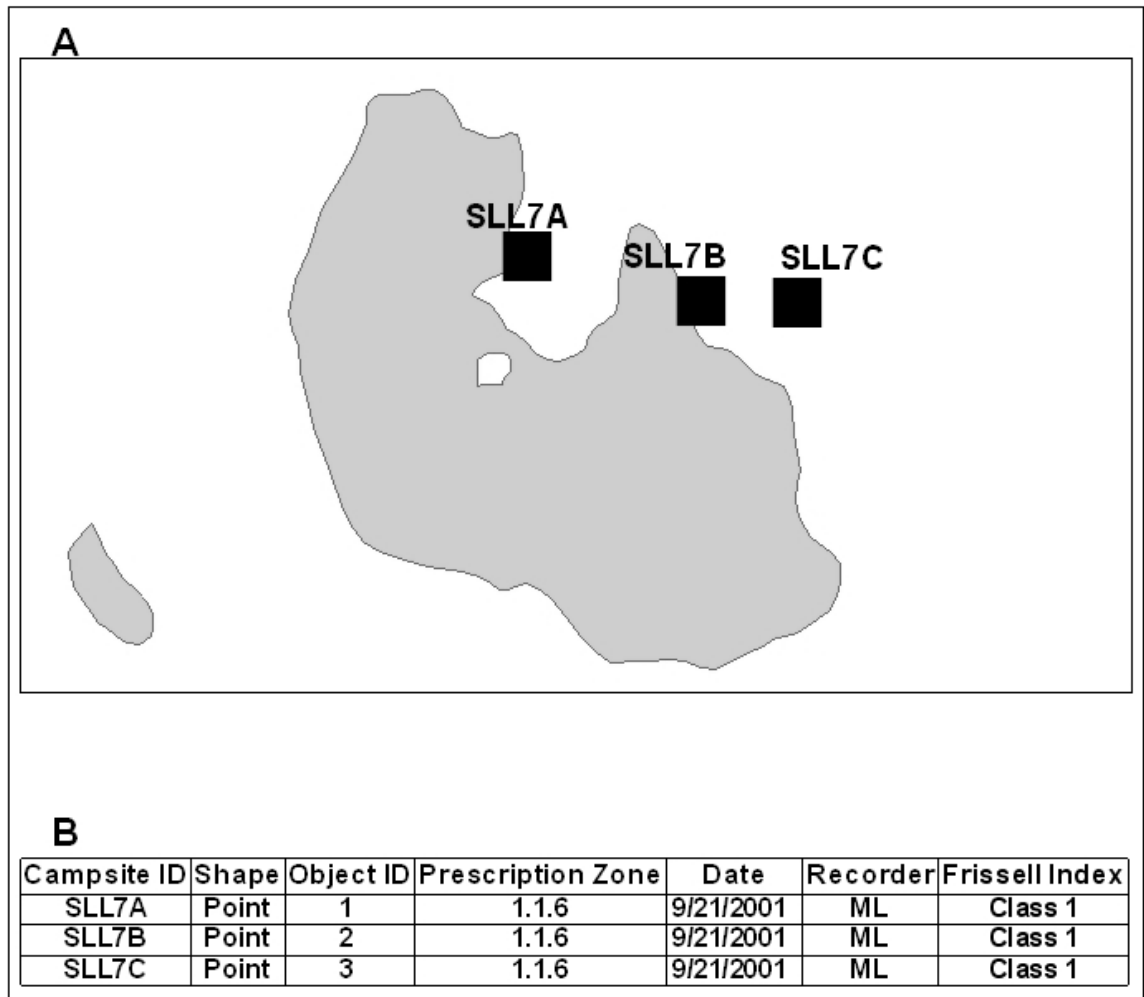


Figure 11. Example of a GIS feature class map. **A.** Initial inventory map showing the location of individual objects of the campsite feature class in relation to other features (lakes). **B.** The attribute table of the campsite feature class.

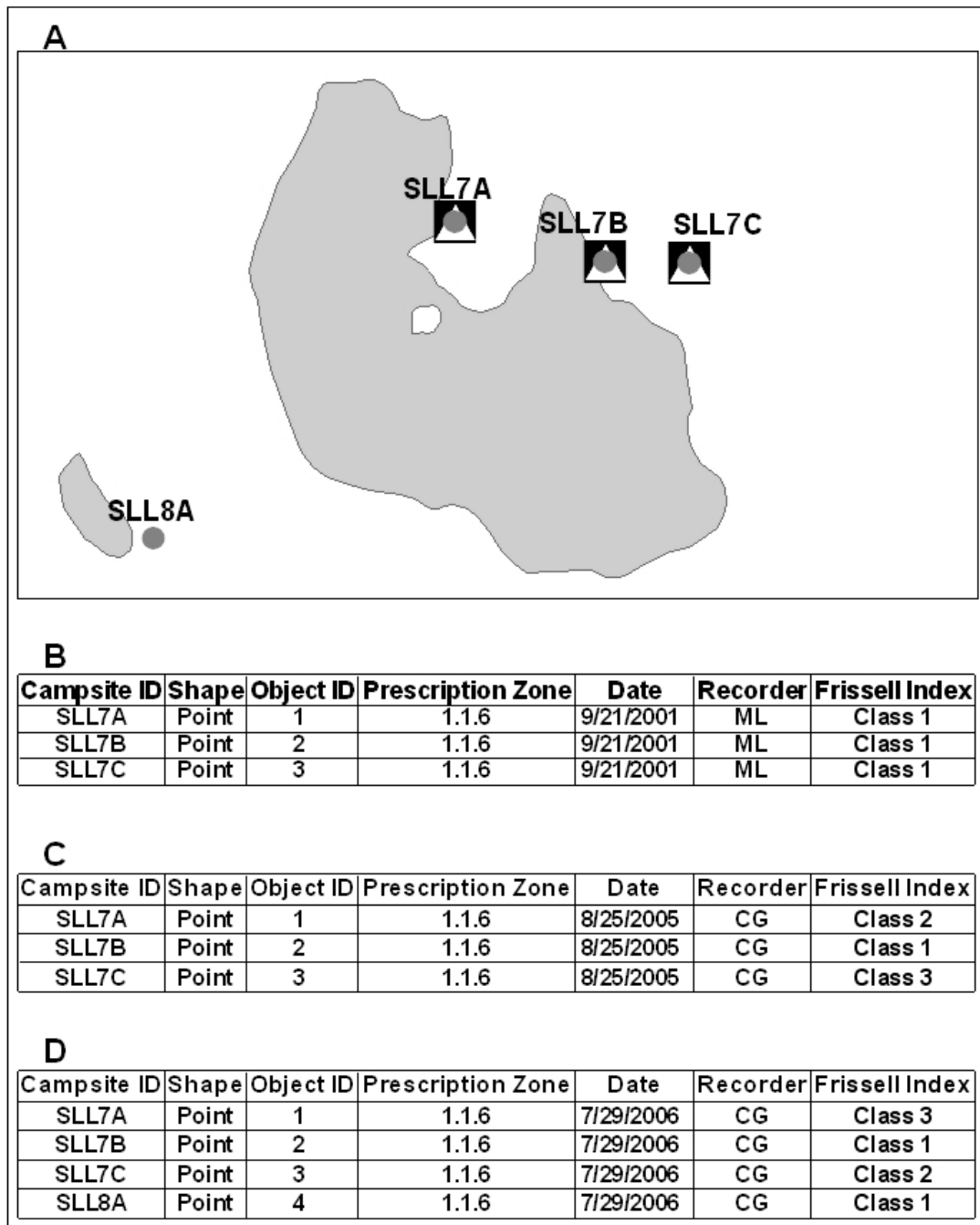


Figure 12. Example of GIS map with multiple representations of the same object. **A.** Monitoring map showing a number of different symbols representing the same geographical object (campsites), but recorded at different points in time. **B.** The attribute table of the initial 2001 inventory of campsites represented by the squares. **C.** The attribute table of campsites from the 2005 monitoring process and represented by the triangles. **D.** The attribute table of campsites from the 2006 monitoring process represented by the circles

Instead of creating a new point feature during each subsequent monitoring season, it is best to have one feature class that stores the location of the campsites and contains little more than the campsite identification number in its attribute table. Each subsequent monitoring season's data of the conditions of these campsites may be stored in a table that is related to the feature class. The thing that the feature class and the table have in common is the campsite identification code. Both the feature class's attribute table and the campsite condition monitoring data's attribute table have the campsite identification code as a field. This field is the key field and may be used to relate or tie the two tables together. This is an example of a spatio-temporal relational data model (Figure 13) which allows for easy data manipulation or the insertion, deletion, modification and retrieval of data (Longly et al. 1999).

A relational database also facilitates normalization. Normalization is the process by which data redundancies are eliminated in order for the database to be easily maintained (Longley et al, 1999). For example, initially in the WCIMP, the prescription zone was recorded during each inventory and subsequent monitoring of a campsite. The resulting monitoring data attribute table contains the prescription zone multiple times for each campsite. Because the prescription zone is part of the relative geography of the campsite and not one of the monitoring parameters, it is best to store the prescription zone data in the attribute table of the campsite feature class (Figure 14).

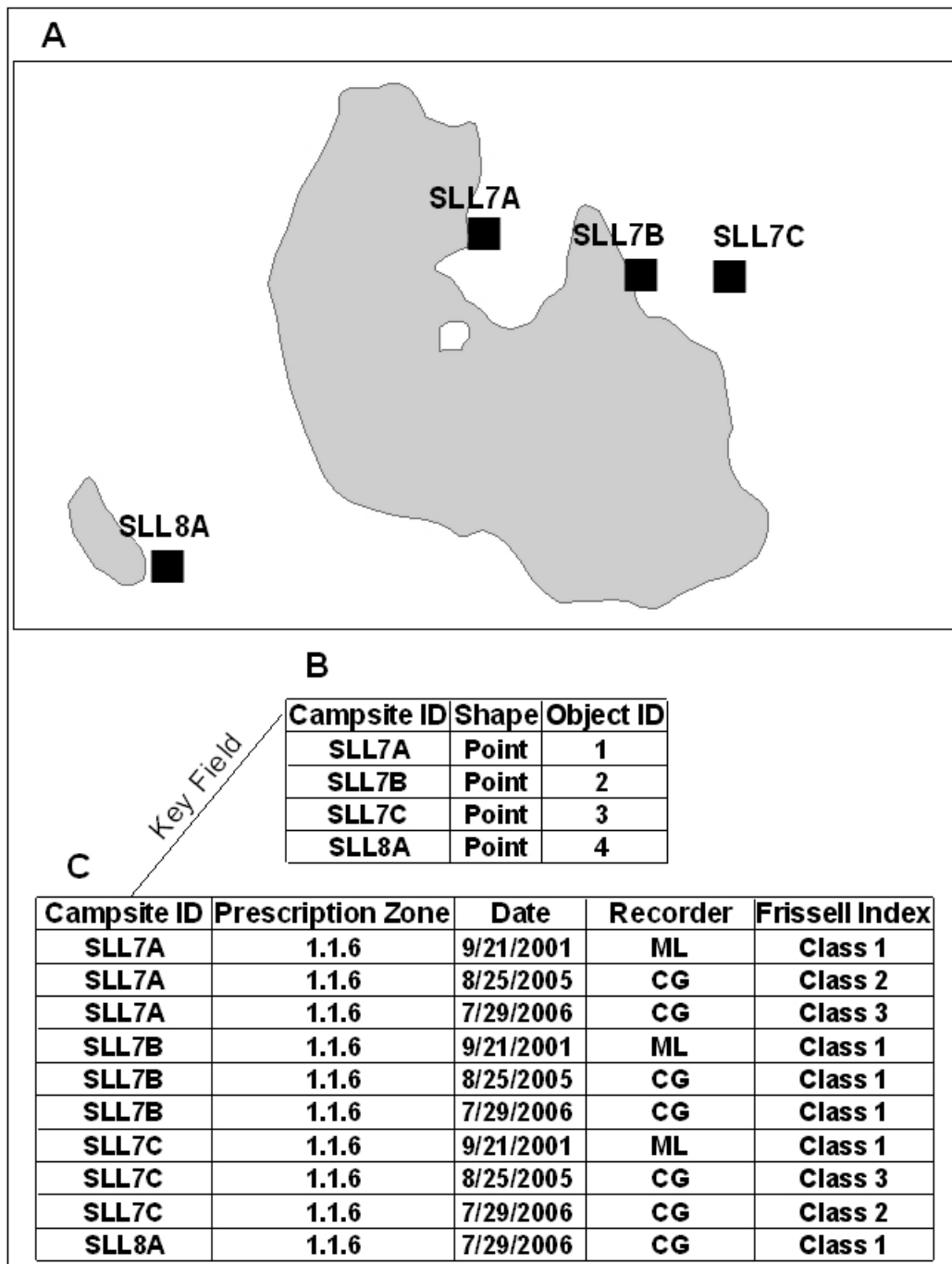


Figure 13. Example of a spatio-temporal relational GIS data model for campsite monitoring. **A.** Map showing the location of individual objects of the campsite feature class. **B.** The attribute table of the campsite feature class. **C.** The campsite condition monitoring data table is related to the campsite feature class by the key field of "Campsite ID".

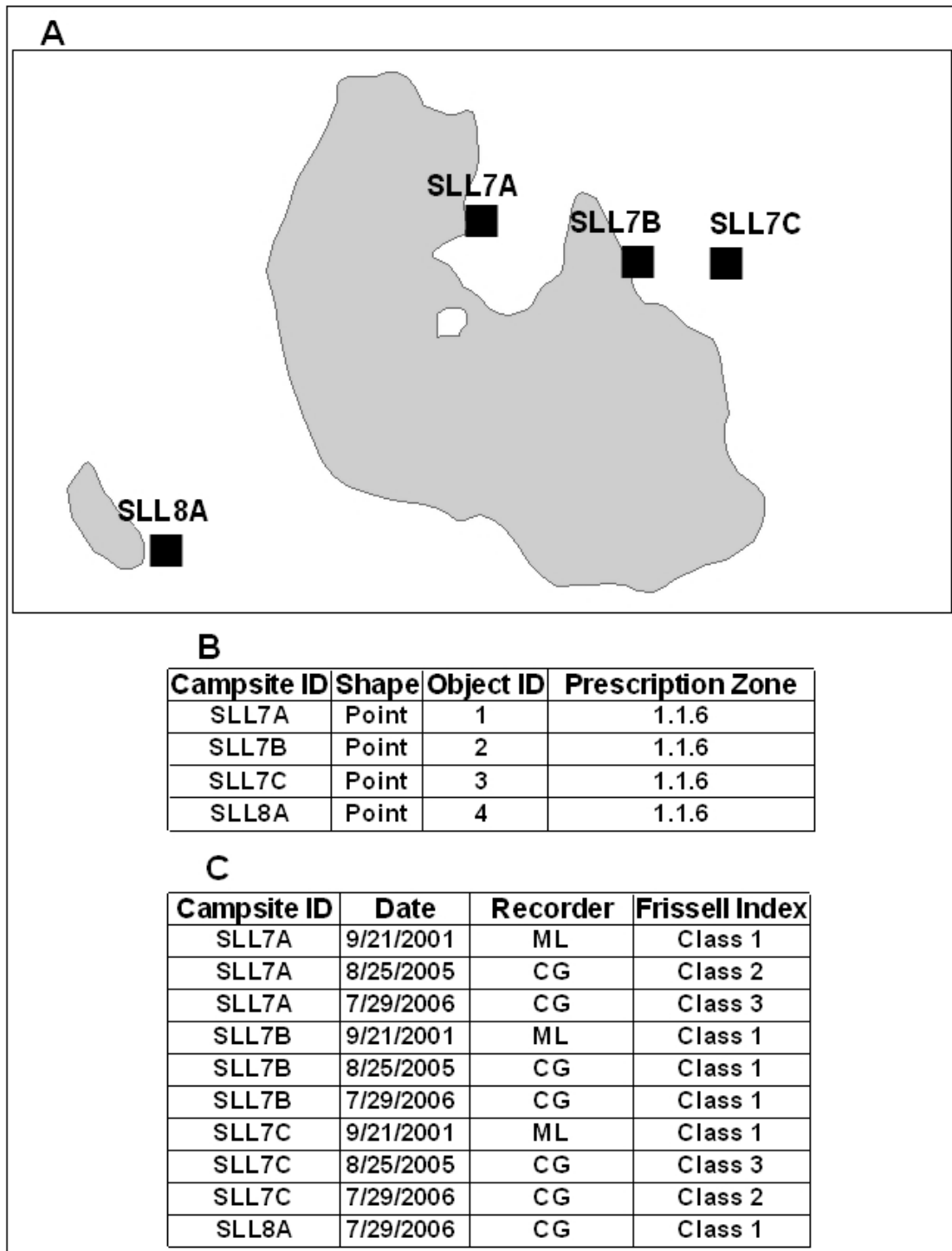


Figure 14. **A.** Example of normalized spatio-temporal GIS data model showing the location of individual objects of the campsite feature class. **B.** The attribute table of the campsite feature class with the field "Prescription Zone" stored only once per campsite. **C.** The monitoring date attribute table with the "Prescription Zone" field removed.

Moving the prescription zone field to the campsite feature class table results in the data being stored only once per campsite instead of once for every monitoring visit to a campsite, resulting in a smaller database. Most importantly, storing the prescription zone field in the campsite feature class table will result in significantly less effort to maintain the database. Because prescription zones are culturally created modifiable areal units, they may be adjusted in future forest plans. In such a case, a normalized database would be much easier to update because the data would only have to be changed once per campsite, instead of once for every monitoring entry.

A spatial-temporal data base was created in which the locations of campsites were saved as points at make up the main feature class. The initial inventories and subsequent monitoring data were entered in to a table that can be related or tied to the campsite feature class. This data base has a structure that allows for relatively easy analysis and the elimination of redundancy. Creating the database was difficult because of many problems presented in the next section.

Data Compilation

Data gathered from the WCIMP were in many different formats and stored in many different binders at the Teton Basin Ranger District. Compiling the data presented many problems including those related to the location of campsites.

From 2001 to 2003, a recreational grade Trimble Scout GPS unit was used to record the location of campsites. This particular GPS unit is not very accurate and can

display a location dozens of meters from the true location. Another problem developed because campsite location was recorded by looking at the display screen of the GPS unit and then transcribing the universal transverse Mercator coordinates to paper. Five campsite inventories conducted in 2001 in Alaska Basin were unusable because a number was transposed or missing when recording the universal transverse Mercator coordinates. This presents a problem when trying to figure out the number of new campsites that have formed since then. A campsite first found in 2001 may be assumed to have not existed because of this problem. To mitigate this problem cluster samples were selected in areas in which all the campsites had universal transverse Mercator coordinates without errors.

Another problem developed because the locations of some campsites were recorded with a GPS without identifying or recording the name of the campsites. In 2003, the location of some campsites near Green Lake were recorded as points and labeled “FR” for fire ring. These data were saved on compact discs at the Teton Basin Ranger District and later analyzed in a GIS in 2006. An enlarged photocopy of a USGS quadrangle for the same area was found that had campsite points with labels that corresponded with the fire ring points. The campsite condition data from these inventories were located in the same binder as the USGS quadrangle photocopy. Points in the campsite feature class were created using the fire ring points and the data from the campsite inventories were entered into the monitoring attribute table. This process left room for error because of the difficulty of interpreting which fire ring points corresponded with which campsite points on the photocopy of the USGS quadrangle. Nevertheless, because both the fire ring points in the GIS and the points labeled on the

USGS quadrangle photocopy had similar geographies it was possible to determine with a high degree of certainty the correct location of the campsites in which the inventories took place.

Attribute and Parameter Data Issues

Previous to 2004, the possible entries in the "type of use" parameter in the location and site characteristics portion of the WCIPM form (Figure 7) consisted of "foot, stock, cavers, climber and fisher people". A campsite is often used by more than one type of user and thus wilderness rangers using the hard copy WCIPM form often selected more than one type of user. Because the WCIPM forms were converted to a digital data dictionary usable in a handheld GPS unit in 2004, many problems developed because of the different means of recording data. The data dictionary was designed so that only one entry could be selected. From 2004 to 2006, what appeared to be the most dominant type of user of the site was selected. For instance, if a campsite with manure and significant tree damage from stock hitching was found, the selection "stock" was most likely selected as the "type of use". At other campsites where no evidence of stock was visible, "foot" was probably selected as the type of use. Only "one type of use" was entered into the campsite database from data collected prior to 2004, even though two or more selections were made during the field inventory. The first entry selected was the one that was entered into the database. Therefore when analyzing the data prior to 2004, the "type of use" parameter will show more "foot" entries and fewer "stock" entries than the data collectors actually recorded. When analyzing the data collected from 2004 to 2006, the

type of use field will display the type of use the wilderness ranger thought most prevalent at the campsite. The type of use parameter was not part of Cole's (1983) condition class survey and was added to the WCIMP condition class survey by wilderness rangers who thought this data would be helpful. Because this data was compromised, it was not used in any part this research or analysis.

The location and site characteristics portion of the WCIMP (Figure 7) also includes three other parameters that were not originally part of Cole's (1983) condition class survey. They are "Campsite Desirability", "Historic Use" and "Action Taken". Some campsite inventory forms used in 2001 did not include these parameters, but often information concerning these parameters was included in the "Comments" section of the WCIMP location and site characteristics form. For example, the campsite inventory for campsite ID number "MSC1", lacks the parameter of "Campsite Desirability" and "Historic Use", but the comments "marginal site due to slope" and "not used recently" were written on the inventory form. When entering these inventory data into the campsite database, this information was used to enter in "Marginal" into the "Campsite Desirability" parameter and "Several years ago" into the "Historic Use" parameter. When no comments were included, no data were entered. This data were not used in any part of this analysis but may prove useful in the future.

Study Areas and Cluster Sampling

There are two aspects required to determine campsite impacts through time; the biophysical condition of campsites and the number of campsites. Changes in the

biophysical conditions of previously existing campsites were analyzed from the data collected during the initial inventory and the subsequent monitoring of the campsite. Secondly, the number and condition of new campsites and the complete recovery of previously existing campsites were factored into overall campsite impacts as well. In order to determine if new campsites appeared, cluster samples were selected in which all campsites had previously been found. Four areas within the Wilderness, Alaska Basin, the Green Lakes area, the Moose Creek area and the South Leigh Lakes area, were used as study areas in which these cluster samples were located (Figure 15).

These places make good study areas because the campsites they contain had not been inventoried for a four or five year period. Cole (1989 & 2002) has found that five years is the best amount of time to allow between inventories, because significant changes become measurable, yet it allows enough time for managers to identify rapidly deteriorating sites.

They also make good study areas because they each have a unique geographic situation. Alaska Basin has a very high degree of connectivity with Grand Teton Park with three trails between the two protected areas. The Moose Creek area has one trail that connects it to the Park while the Green Lakes area has none. The South Leigh Lakes area has no maintained trails whatsoever. These different degrees of connectivity with the Park make it possible to analyze how recreationists from the Park influence campsite conditions.

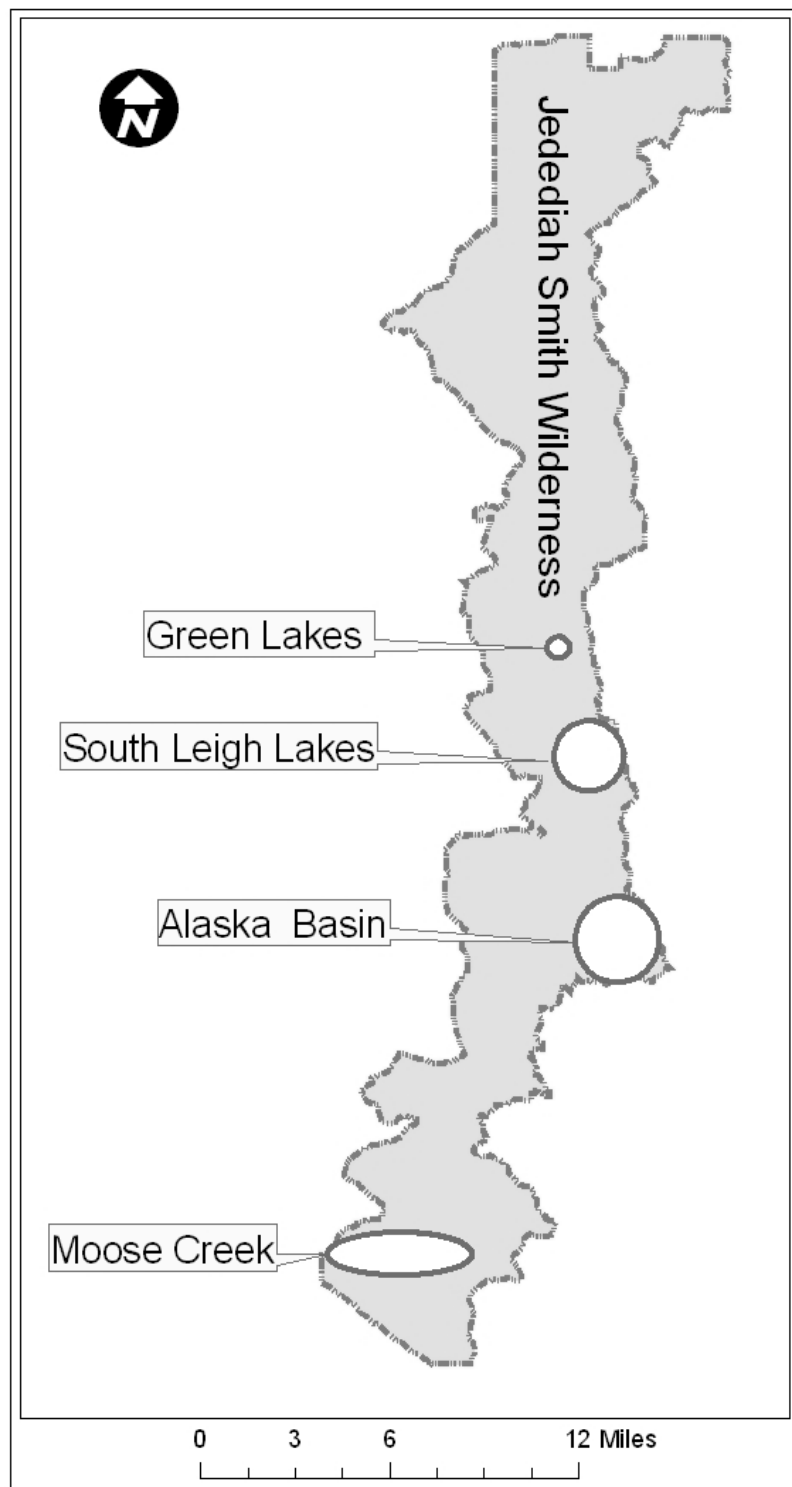


Figure 15. Study areas location map. (Map by Author)

A clustered sample design was used because of the prohibitive aspect of traveling to all 168 campsites inventoried in 2001. Samples taken from a cluster design are useful to make generalizations about other attributes if the cluster is similar to other areas (Longley 2005).

Over sixty campsites were monitored in 2005 and 2006 composing a sample of about one third of all the campsites found in 2001. Monitoring campsites within these cluster samples should be representative of campsite proliferation and impact changes occurring throughout most of the Wilderness. Generalizations about campsite conditions in the northern third of the Wilderness may not be as easy to make. This is because of different recreation patterns. The northern third of the Wilderness tends to witness more recreationists riding and camping with stock and may display a different pattern of campsite condition changes. The reason a cluster sample was not taken from the northern part of the Wilderness is because this area was not included in the campsite inventory process prior to 2004 and not enough time has passed to make campsite conditions changes detectable.

Cluster sample size, within these study areas, was often limited because campsites found in 2001 could not be relocated in 2005 or 2006. In order to figure out if the density of campsites in these cluster samples increased, all of the campsites originally found in 2001 had to be relocated. Snow covered some portions of the study areas making it impossible to find previous campsites. In this case, the size of the study area was dictated by whether or not all previous campsites were relocated. Once all campsites were located in a particular area, then the search for newly formed campsites began. This would

ensure that an accurate picture of campsite density changes emerged. Once a campsite was found, campsite conditions were monitored using both Cole's (1983) classification index and the Frissell (1978) index.

Photographs of campsite conditions were taken from the same point at which photographs were taken previously. These photographs are most helpful in relocating the campsite and making sure monitoring takes place at the correct campsite. Photographs can benefit and enhance our knowledge about campsite conditions, but they are not useful in definitively determining condition changes to campsites (Cole 1989, 3). "Photographs taken at different times of the day, under different lighting conditions, with different films, cameras, and lenses, or from slightly different vantage point can give misleading impressions" (Cole 1989, 3). Few of the most important impacts to campsites can be captured by photographs (Cole 1989). Nevertheless, photographs can be used to communicate condition changes that have been detected using Frissell's (1978) index and Cole's (1983) condition class survey.

Density changes were determined by comparing the differences in the number of campsites within each cluster sample from 2001 to 2006, or 2005 in the case of the South Leigh Lakes study area. Finally, impact level changes were determined by comparing data from the Frissell (1978) campsite classification index and Cole's (1983) classification index gathered in 2001 and 2005 or 2006.

Ideally, baseline inventories of campsite impacts and conditions should be conducted at the time an area is officially brought into the National Wilderness Preservation System (Cole and Wright 2004). Unfortunately, a complete census of

campsite impacts was not complete until 2005 and it is difficult to tell if the number and condition of campsites have stayed the same since the time this area became federally designated wilderness in 1984. Finding out if campsite numbers and impacts have changed from 2001 to 2006 is a start to figuring out if campsite numbers and impacts have changed prior to 2001.

To take this investigation further, campsite condition data collected prior to 2001, were analyzed in the Moose Creek area. In July of 1990, two volunteers conducted a campsite inventory along Moose Creek, under the direction of Wilderness Manager, Linda Merigliano. These volunteers put a dot on a blown up photo copy of a 1:24,000 scale USGS quadrangle map to indicate the location of each campsite found. Unfortunately, they did not use the Frissell (1978) index to document the conditions of the campsite, but they took photographs and inventoried the conditions of the campsite using Cole's (1983) condition class survey.

These data can not be used to determine if the density of campsites, in the area, has increased since 1990 for three reasons. First, little information was found on the intensiveness of the search for campsites. These volunteers could have easily missed existing campsites because no protocol existed describing the characteristics of the areas to be searched. Secondly, the lack of accurate descriptions of the locations of the campsites makes it hard to relocate exactly where the previous inventories took place. Thirdly, photographs were not taken at many of the campsites. While photographs are not very useful for analyzing conditions at campsites, they are important in order to make sure subsequent monitoring takes place at the same campsite. Because data from Cole's

(1983) condition class survey and some photographs exist, these data provided enough information in order to relocate a portion of these campsites. While these data are fragmentary it still provides valuable insight about the conditions of campsites previous to 2001.

To answer the second and third research questions, interviews were conducted with all backcountry users that were willing to answer a few questions. People were often interviewed on the trail whether they were heading to their destination or back to the trailhead. Wilderness users were also interviewed at their campsites. In contrast to wilderness use research by the USDA Forest Service (2001) National Visitor Use Survey in which users were asked questions as they exited the wilderness, this process involved asking questions where ever people were seen. Therefore, the National Visitor Use Survey resulted in a much higher proportion of day users interviewed. This project resulted in a much higher proportion of interviews gathered from overnight users, because the interviews were conducted further back into the Wilderness where few day hikers are found. This process of interviewing may have resulted in a snapshot of the social conditions a backpacker or horseback rider may witness while taking an overnight trip into the Wilderness.

The number of recreationists interviewed, the location of each contact and the type of use (day or overnight) were recorded. Interviewees were asked two questions. First, they were asked if they resided in the Teton Valley (Teton County, Idaho or the portion of Teton County, Wyoming west of the Wilderness). Second, they were asked if they entered the Wilderness from Grand Teton Park. Often interviewees were willing to

discuss how they felt about the Wilderness, campsite conditions, camping permits and regional population growth.

RESULTS AND DISCUSSION

This chapter presents the results from the three research questions. It also presents a discussion on what may have contributed to these results. First, the change in campsite impacts from 2001 to 2006 is presented. Next, the results from field interviews are used to present how recent migrants and residents of the Teton Valley use the Jedediah Smith Wilderness. Finally, the field interviews are also used to present how recreationists entering from Grand Teton Park use the Wilderness.

Campsite Impacts from 2001 to 2006

Campsite impacts have decreased from 2001 to 2006. Campsite impacts are a combination of both the biophysical conditions at individual campsites and the total number of campsites (Cole 1993). While the number of campsites increased slightly, the bio-physical conditions at most campsites improved more significantly.

Based on the data from the Frissell (1978) index, the average campsite rating decreased from 2.33 in 2001 to 2.05 in 2006 (Table 1; See appendix B for the monitoring results of individual campsites). Similarly, the average score on Cole's (1983) condition class survey decreased from 35.51 to 30.35 (Table 1).

	2001	2005 & 2006
Number of Campsites Found	61	62
Average Frissell Score	2.33	2.05
Average Condition Class Score	35.51	30.35

Table 1. The number and average campsite condition score of campsites from 2001 to 2006.

In 2001, sixty one campsites were found. By 2006, sixty two campsites existed (Table 1). Because the number of campsites increased only minimally while the biophysical conditions at previously existing campsites improved more substantially it is safe to say that campsite impacts, on the whole, have decreased.

There are many possible reasons why campsite impacts have decreased. One is that less overnight camping has occurred in the Wilderness. While there is no data on the number of overnight Wilderness users through time, the number of overnight visits to Grand Teton Park has decreased since 2001. In lieu of the number of overnight visitors to the Wilderness through time, this data offers one of the best pictures of overnight use trends in the Tetons. In 2001, Grand Teton Park received 32,201 overnight visits (pers com. Spletter, Beth. May 27, 2006. Grand Teton National Park Backcountry Permit Office. via email). The number of overnight users declined at a rate of about 4 percent per year and in 2005 the Park received 26,826 overnight visits (pers com. Spletter, Beth. May 27, 2006. Grand Teton National Park Backcountry Permit Office. via email).

Another factor influencing campsite conditions is the behavior of campers. “Leave No Trace” camping technique campaigns may have influenced campers to leave fewer impacts at their campsites. “Leave No Trace” ethics discourage such things as the creation of new fire rings and hitching stock to trees for long periods of time. It is difficult to measure the effectiveness of these campaigns but there is little doubt if these suggestions are followed, campsite impacts will be greatly reduced. It is possible that the number of overnight users may have remained static or even increased but the impacts left by those users are less severe.

Campsite impacts did not decrease in each of the study areas. The next chapter presents campsite impact trends in relation to the geographic situation of each of the study areas. It combines the results from all three research questions and helps to clarify the causes behind the distribution of campsite impact changes.

Wilderness Use by Residents of the Teton Valley

This study is, in part, an attempt to figure out how recent migrants and residents living in the Teton Valley influence campsites by asking the question “what percentage of overnight campers reside in the Teton Valley?”. In response to that question, only about 3 percent of those interviewed were both overnight campers and residents of the Teton Valley (Table 2). This percentage reveals little about the patterns of use by Teton Valley residents without comparing it to use by residents from more distant origins. Based on the interviews conducted in 2006, residents of the Teton Valley camp in the Wilderness at a level nearly two thirds less than that of Wilderness users from more distant origins (Figure 16). Of the twenty two Teton Valley residents interviewed, only 23 percent were overnight users, while 66 percent of those not from the Teton Valley were overnight users (Figure 16). Recent migrants and residents living in the Teton Valley camp in the Jedediah Smith Wilderness at relatively low levels and thus have little impact on campsite conditions.

	Totals	Percent
Total number of Interviews	182	100%
Users from the Teton Valley	22	12%
Day Users from the Teton Valley	17	9%
Overnight Users from the Teton Valley	5	3%

Table 2. Day and overnight use by migrants and residents living in the Teton Valley.

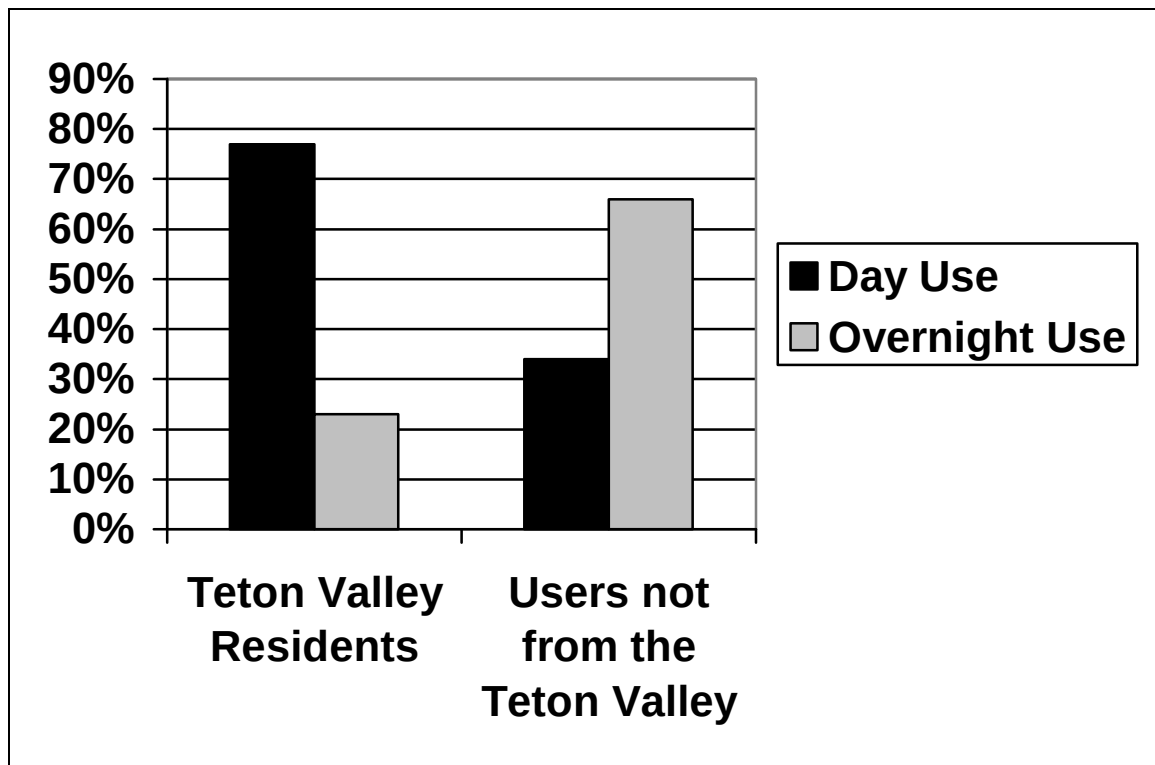


Figure 16. Use patterns of migrants and residents of the Teton Valley compared to users from more distant origins.

Because of the Teton Valley's close proximity to the Jedediah Smith Wilderness, these residents may chose to day hike more often than they chose to take overnight trips simply because they can walk out of the Wilderness at the end of the day and sleep in their own beds. Wilderness visitors that have to spend a greater deal of time getting to the Wilderness may not have that option.

The most significant impact to wilderness by growing nearby populations may be those influencing solitude as a result of day use. Over one third of recent migrants and residents surveyed in counties adjacent to wilderness use wilderness at least twelve times a year (Rudzitis and Johansen, 1991). Both long term residents and new migrants find wilderness to be an important reason for living in counties with wilderness nearby and desired more access to wilderness (Rudzitis 1996). One factor that has been overlooked when analyzing possible increases in the proportion of day use in wilderness is that many counties with or next to wilderness are growing rapidly. These new migrants and residents use wilderness often, and in the case of the Jedediah Smith Wilderness, largely for day outings.

Despite rapid regional growth and the possible increase in the number of day hikers, the National Visitor Use Monitoring Results (USDA Forest Service 2001) indicate that visitors are content with the amount of crowding perceived in the Jedediah Smith Wilderness. Visitors, on average, gave the Wilderness a score of five on a scale of one to ten concerning crowding. None of the respondents said the area they visited was overcrowded (a score of ten on the scale) and 15 percent said they saw very few people (a score of one on the scale).

The National Visitor Use Monitoring Program (USDA Forest Service 2001) also collected data on the distribution of visitor's origin by zip code. The zip codes contained by Teton County, Idaho accounted for 16.9 percent of those Wilderness users interviewed. Of the estimated 210,000 annual Wilderness visits, this makes up about 35,500 annual visits by Teton County, Idaho residents (Figure 17). Teton County, Idaho

has a population of about 6,000 residents and this level of estimated use amounts to an average of six visits to the Jedediah Smith Wilderness per Teton County resident.

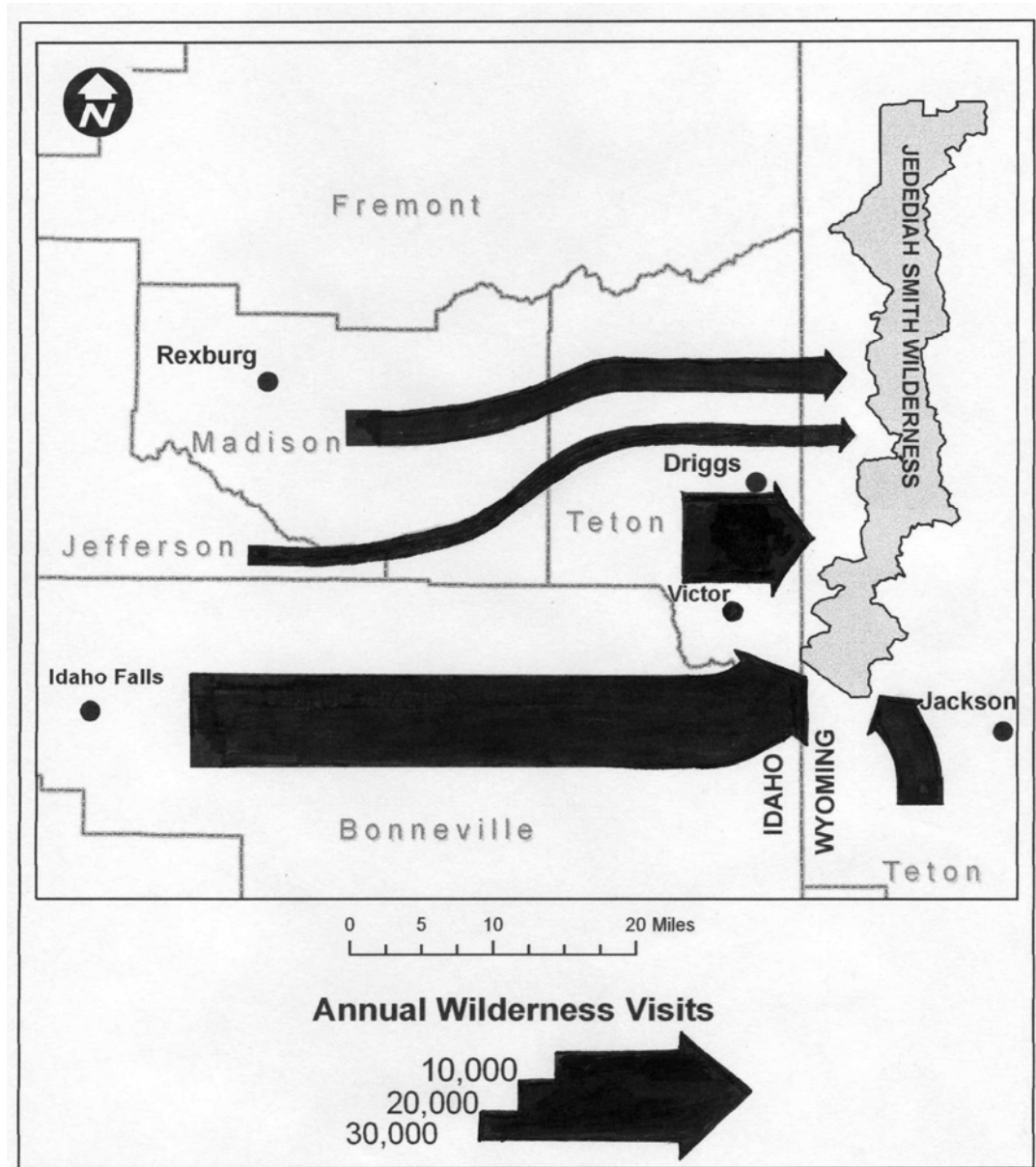


Figure 17. Nearby origins of visitors to the Jedediah Smith Wilderness by county.
Source: USDA Forest Service 2001 (Map by Author)

An equal amount of estimated visitors (35,500) originated from the zip codes

belonging in Bonneville County, Idaho with a population of 82,522 in 2000 (Figure 17, U.S. Census Bureau 2006). This amount of use and population produces an average of less than one half Wilderness visit per Bonneville County resident. Proximity to the Wilderness plays an important role on how frequently people visit the Wilderness. Based on the results from this study, those who live closer to wilderness are more likely to participate in day hiking as opposed to overnight backpacking. If Teton County, Idaho's population continues on the same trajectory and local residents continue to use the Wilderness primarily for day outings, we can expect to see a greater proportion of people day hiking in the Jedediah Smith Wilderness.

Wilderness Use by Recreationists Entering from Grand Teton Park

This study is, in part, an attempt to figure out how the shared border with Grand Teton Park influences campsite conditions by asking the question “what percentage of overnight campers enter the Wilderness from Grand Teton Park?”. In total, thirty-one out of 182, or 17 percent of the recreationists interviewed in 2006 had entered the Wilderness from Grand Teton Park (Table 3). This is a rather small percentage. The percentage of overnight users that had entered from the Park is more considerable. Twenty-eight percent of overnight users were found to have entered the Wilderness from the Park (Table 4).

	Totals	Percent
Interviews	182	100%
Users entering from Grand Teton Park	31	17%

Table 3. Percent of Wilderness users entering from Grand Teton Park

	Totals	Percent
Total overnight users	105	100%
Overnight users entering from Grand Teton Park	29	28%
Overnight users not entering from Grand Teton Park	76	72%

Table 4. Percent of overnight Wilderness users entering from Grand Teton Park

Based on the interviews conducted in 2006, recreationists entering the Wilderness from Grand Teton Park tend to camp overnight at much higher rates than other recreationists. Ninety-four percent of the interviewees that entered from the Park were overnight users and only 54 percent of those interviewed that had not entered the Wilderness from Grand Teton Park were overnight users (Figure 18).

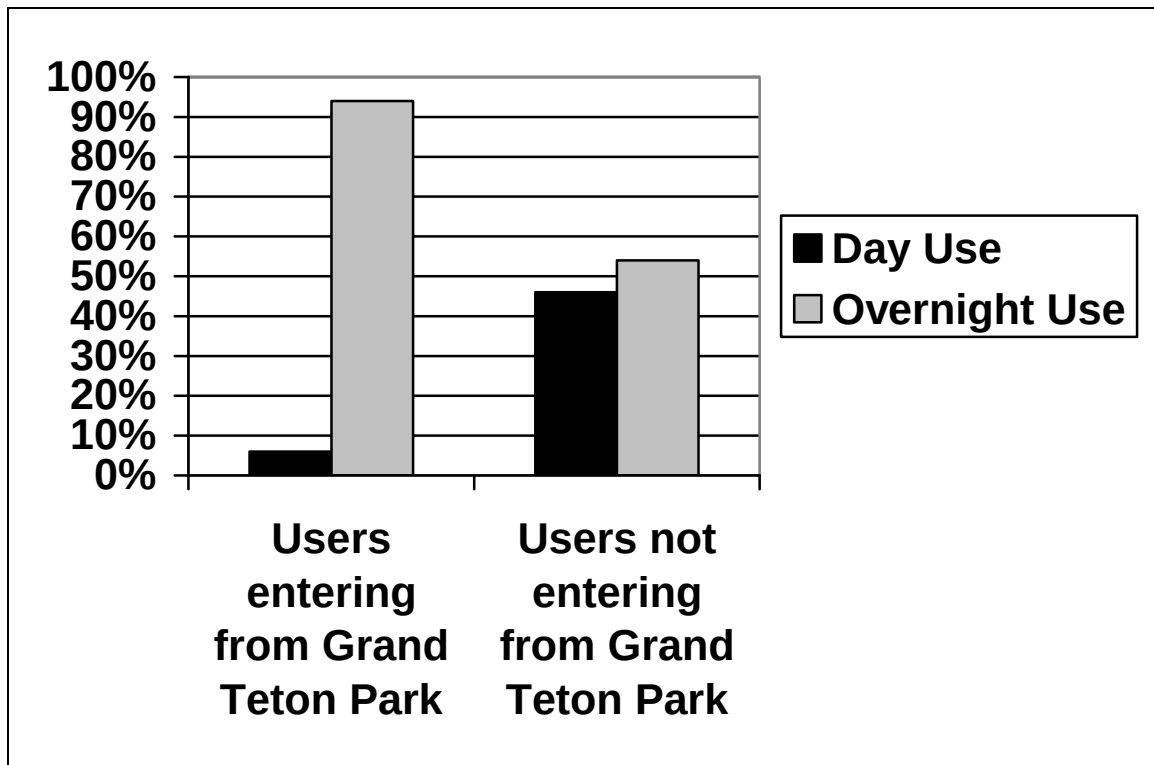


Figure 18. Use patterns between users that entered the Wilderness from Grand Teton Park and those that did not.

The vast majority of recreationists entering from Grand Teton Park are overnight

campers. While recreationists from Grand Teton Park make up a relatively small portion of Wilderness users, they may impact campsites to a much higher degree than the average visitor simply because they tend to camp overnight. All of these interviewees were encountered at or near Alaska Basin. What is it about Alaska Basin that makes it such an attraction for these Wilderness visitors? A need to look at the geographic situation of each of the study areas is required to answer that question and is presented in the next chapter.

RESULTS AND DISCUSSION BY STUDY AREA

It is important to point out that campsite impacts did not decrease at all of the study areas from 2001 to 2006. The number and impact levels of campsites decreased in Alaska Basin, while campsite impacts increased at the Moose Creek study area. These study areas have different geographic situations that influence how campsite conditions change over time. This chapter discusses the results from each of the three research questions in relation to the unique geographic situation of each study area. Presenting the data in such a way helps to show how each study area is used by recent migrants and residents. It also helps to show how connectivity with Grand Teton Park influences the geographic situation of each of these study areas. Most importantly, analyzing the data by study area helps to show how recreation trends and geographic situation influence campsite conditions.

The Green Lakes Study Area

Geographic Situation and Interview Results

Four alpine lakes, stocked with cutthroat trout, at an elevation of about 2,750 meters (9,022 feet) are the main attractions to the Green Lakes area (Figure 19). The most popular access is from the North Leigh Trailhead where hikers or horseback riders can head up to the lakes on the Green Mountain Trail and return to that same trailhead via the Tin Cup Trail. The loop is about twelve miles long and is often hiked in one day.

The entire lake basin and the trails leading to it are in the 1.1.8 prescription zone.

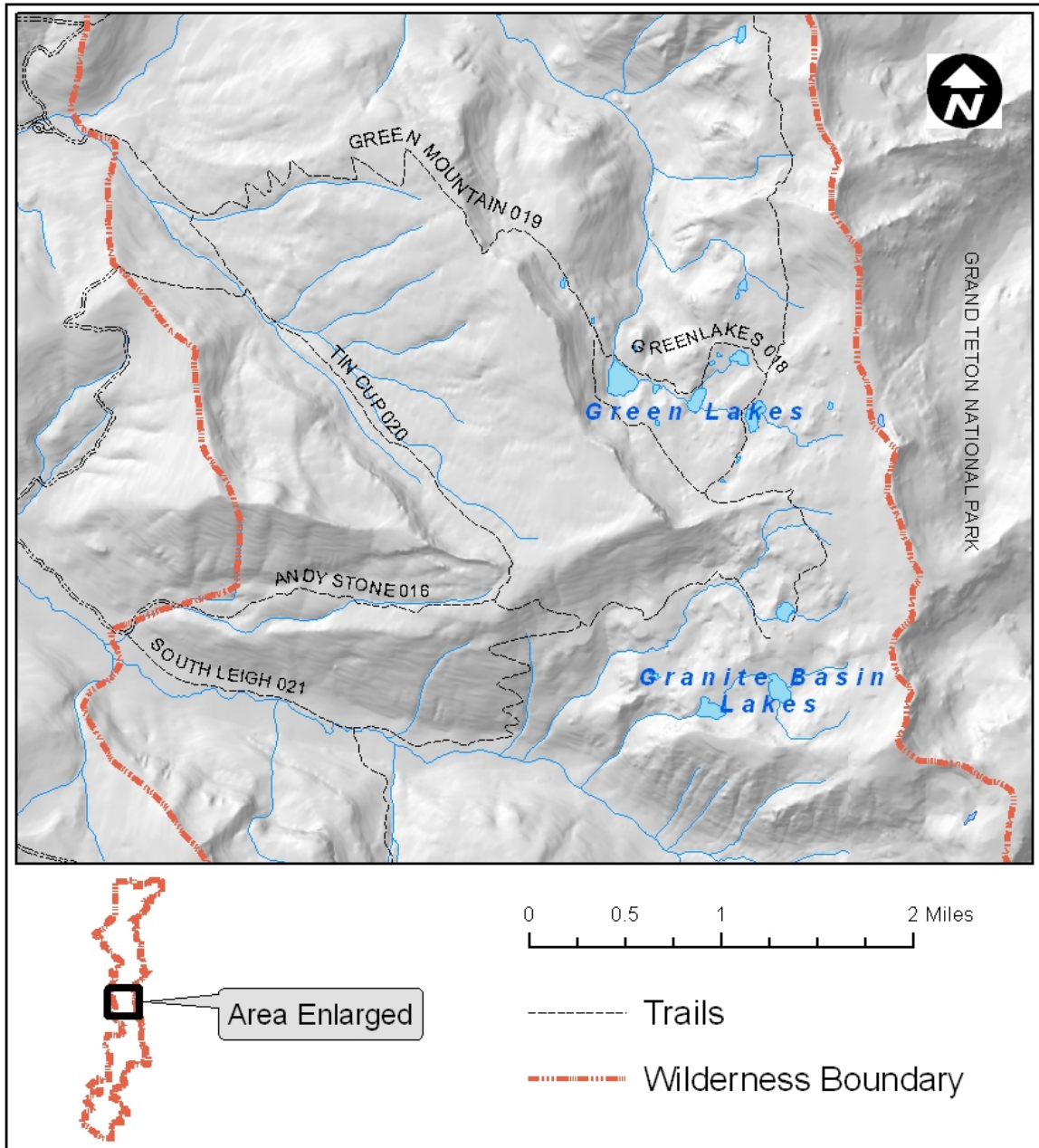


Figure 19. Green Lakes reference map. (Map by Author)

The Green Lakes area has a unique geographic situation. Unlike Alaska Basin and the Moose Creek area, no trails connect Green Lakes to Grand Teton Park.

Therefore, this area is isolated from the Park and only witnesses use that originates on the west side of the Wilderness. Not surprisingly, none of the interviewees met in this area had begun their hike in Grand Teton Park (Table 5. See Appendix C for the complete results from all interviews). These results are largely a consequence of this geographic situation. Twenty four percent of the interviewees were from the Teton Valley. From this small sample of users, it seems that the Green Lakes area is used rather heavily by local residents and because of it's lack of connectivity to Grand Teton Park rarely by those starting their hike or ride in the Park.

	Totals	Percent
Total Contacts	25	100%
Overnight Users	6	24%
Day Users	19	76%
Users from the Teton Valley	6	24%
Day Users from the Teton Valley	2	8%
Overnight Users from the Teton Valley	4	16%
Users Entered from Grand Teton Park	0	0%

Table 5. Results from interviews conducted in the Green Lakes area from July 13, 2006 to July 17, 2006.

Anecdotally, the Green Lakes area seems to serve as an overnight getaway for local residents. Four interviewees were backpackers who made a circuitous hike beginning and ending at the Green Mountain Trailhead. They hiked southeast and uphill on the Tin Cup Trail and spent the night at Granite Basin Lakes. The next day, they hiked north to Green Lakes and spent a second night. On the third day of their trip, they hiked west and back to the Green Mountain Trailhead. During the entire 2006 field season, this is one of only two groups contacted that consisted of overnight campers originating from the Teton Valley.

Campsite Density and Conditions at the Green Lakes Area from 2001 to 2006

Conditions on most existing campsites at Green Lake “A” improved, but the number of campsites increased. The WCIMP code for campsites found in the Green Lakes area is "GRL" and the largest lake was designated lake "A". Thus, the first campsite found near this lake was known as GRLA1 (see appendix A for the meanings for the campsite codes). In 2001, nine campsites were discovered near Green Lake “A” (Figure 20). Upon return to the area in 2006, the original nine campsites remained and three new campsites had formed.

By 2006, the condition of existing campsites had improved with a lower average score on both the Frissell (1978) and Cole’s (1983) condition class indices (Figure 20). While none of the original nine campsites had completely recovered, conditions at six of the campsites as measured by the Frissell (1978) index, improved. The same index showed further impacts at two campsites and no change in conditions at one campsite. The two campsites that showed further impacts (GRLA1 and GRLA2) on the Frissell (1978) index either showed more or the same amount of impact as rated by Cole’s (1983) condition class survey.

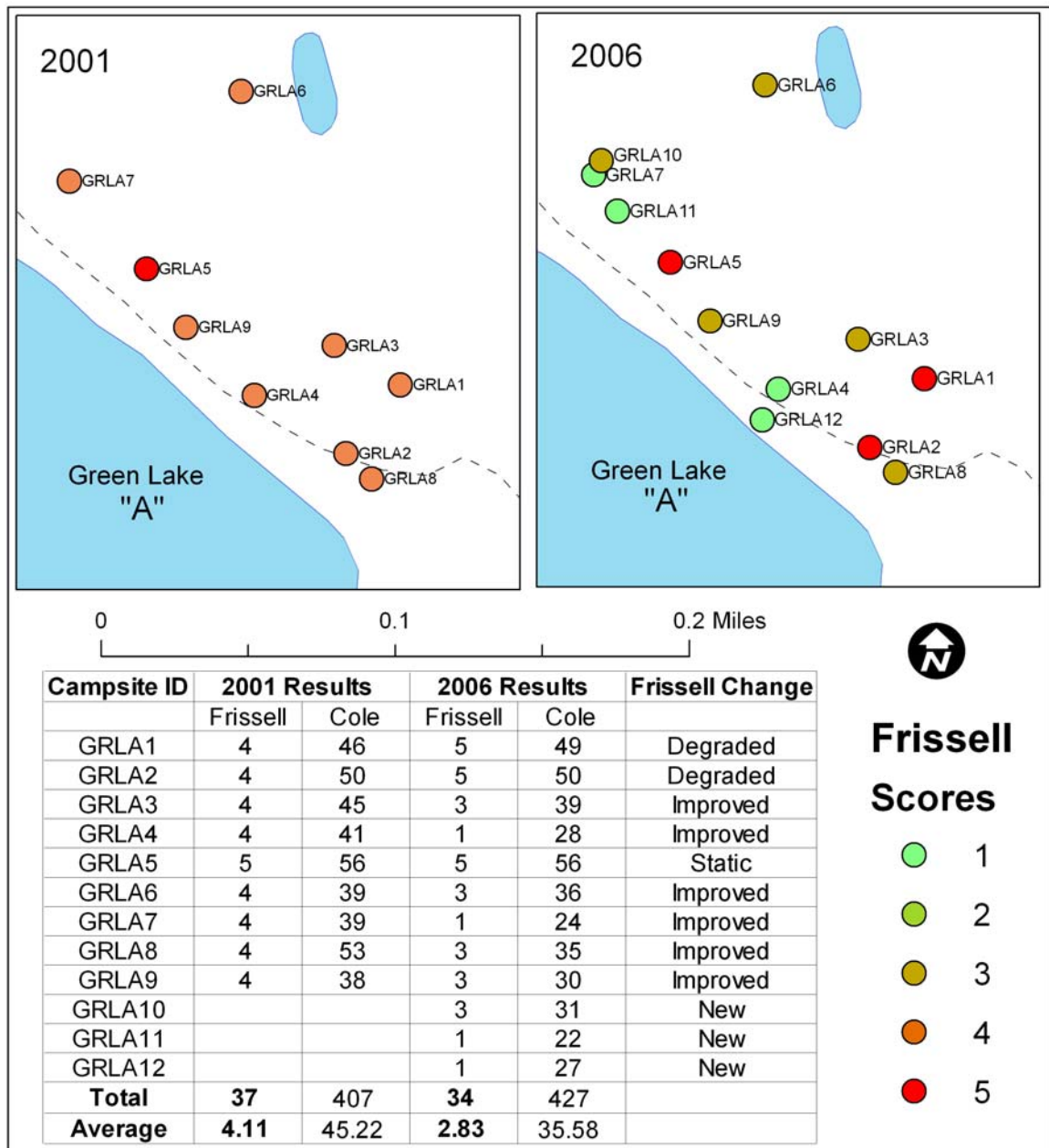


Figure 20. Changes in campsite distribution and conditions at Green Lake "A" from 2001 to 2006. (Map by Author)

The campsite with the identification label "GRLA4" showed significant improvement as rated by both indices. It decreased from a class four campsite on the Frissell (1978) index in 2001 to a class one campsite in 2006. It's score on Cole's (1983)

condition class index decreased from a rating of forty one in 2001 to a score of twenty eight in 2006. The area with bare mineral soil cover decreased significantly and the amount of the campsite with vegetative cover increased. The photographs of the campsite (Figures 21 and 22), seem to support these findings. The first photograph (Figure 21) was taken on 11 September, 2001 and the second photograph (Figure 22) was taken on 15 July, 2006. Due to the early date of the 2006 photograph, the vegetation appears to be greener and lushier. Despite the differences in seasonality of the two photographs, it is important to point out that the conditions at the campsite were compared to a patch of ground similar in species composition, aspect and slope during each monitoring session. The photographs play no role, what so ever, in determining whether conditions have improved or not. Nevertheless, the greater amount of vegetative cover appearing in the latter photograph seems to corroborate the findings that vegetation cover increased and the amount of bare mineral soil decreased.



Figure 21. Photo of campsite GRLA4 from the WCIMP inventory in September of 2001



Figure 22. Photo of campsite GRLA4 from the WCIMP monitoring in July of 2006.

Condition changes on existing campsites is only one aspect required for an evaluation of campsite impacts, as overall campsite impact also includes the number and condition of new campsites (Cole 1993). The three new campsites had relatively low ratings as measured by both indices. The combined total of the Frissell (1978) index scores decreased from thirty seven in 2001 to thirty four in 2006, despite the fact that three new campsites appeared (Figure 20). The combined total of the condition class index scores increased from 407 in 2001 to 427 in 2006 (Figure 20). The minimum score for a campsite on Cole's (1983) condition class index is twenty, so the addition of three new campsites contributes significantly to the total score for all campsites combined. Because new campsites were found while previously existing campsites showed improved conditions, it is difficult to determine whether overall campsite impacts increased or decreased. Exacerbating this dilemma is the fact that the total scores from the two indices show conflicting results.

The Moose Creek Study Area

Geographic Situation and Visitor Interview Results

The Moose Creek Trail begins at an elevation of 2,000 meters (6,408) feet, follows Moose Creek for eight miles and ends at Moose Lake at 2,850 meters (9,143 feet) (Figure 23). Most of this trail is in the 1.1.8 prescription zone. Moose Meadows, located about five miles east of the Moose Creek Trailhead, is a popular destination for users of this trail. The Moose Creek Trail connects with the Teton Crest Trail southeast

of Moose Lake and allows users to cross between the Wilderness and Grand Teton Park. Hikers or riders taking the Teton Crest Trail can follow it to its end in Alaska Basin. Because the Teton Crest Trail connects the Wilderness and the Park, the Moose Creek area has a moderate degree of connectivity with Grand Teton Park.

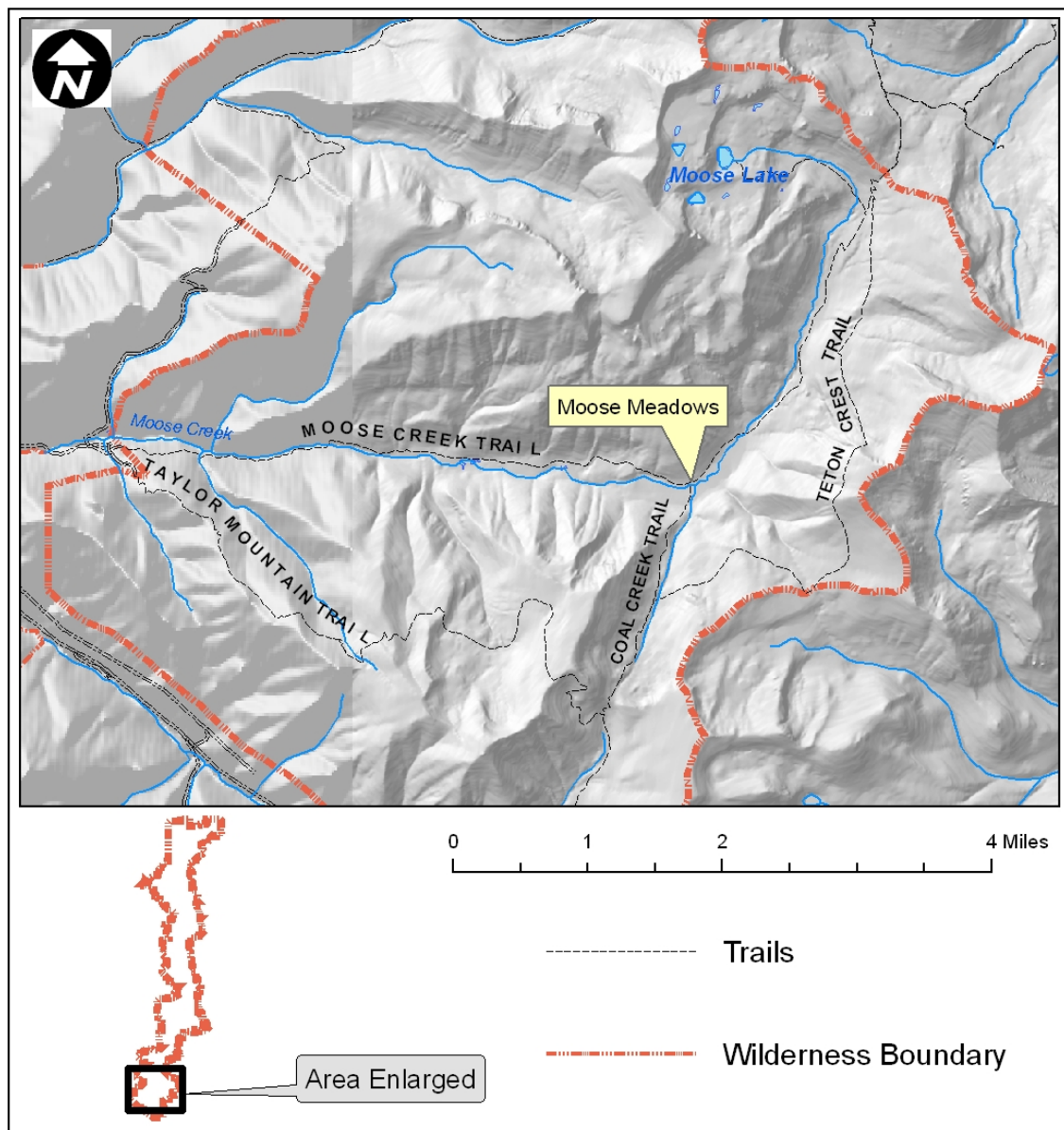


Figure 23. Moose Creek study area reference map. (Map by Author)

Four days were spent interviewing wilderness users and monitoring campsite conditions in the Moose Creek study area at the end of June and the beginning of July. A low number of users were found owing largely to the early time of the summer season. The existence of snow on the higher portions of many trails and the threat of cold weather may have deterred people from hiking during this time. Large amounts of snow cover found along the northeastern portion of the Moose Creek trail made finding campsites impossible and limited the size of this study area. Moose Lake was found to be partially frozen.

Of the seventeen wilderness users contacted, none had begun their trip in Grand Teton Park (Table 6). A group of two backpackers, interviewed about six miles from the trailhead on the Moose Creek Trail, planned to hike north on the Teton Crest Trail to Alaska Basin. Another group of two backpackers hiked the Moose Creek Trail and camped for one night at Moose Meadows. They returned to the Moose Creek Trailhead, without ever entering the Park. While it is hard to make any conclusions on the patterns of recreation use based on the low number of visitors contacted, the fact that backpackers can hike this trail to reach Grand Teton Park seems to draw people to it.

	Totals	Percent
Total Contacts	17	100%
Overnight Users	4	24%
Day Users	13	76%
Users from the Teton Valley	9	53%
Day Users from the Teton Valley	9	53%
Overnight Users from the Teton Valley	0	0%
Users that entered from Grand Teton Park	0	0%

Table 6. Results from interviews conducted in the Moose Creek area from June 29, 2006 to July 2, 2006

Overall the largest group of users on this trail consisted of day hikers, many of them from the Teton Valley. Fifty three percent of those interviewed in the Moose Creek study area were from the Teton Valley (Table 6) compared to only twenty four percent in the Green Lakes study area (Table 5). The Moose Creek trailhead is only about six miles from the town of Victor and not much further from Driggs. This trail's close proximity to these two growing communities makes it an attractive option for those seeking to get outside for the day.

Campsite Conditions and Density at the Moose Creek Study Area from 2001 to 2006

Owing to this study area's large size and its linear configuration, the data is presented in two portions. The first is the section of Moose Creek which flows from the east to the west. The second portion includes Moose Meadows and the section of trail northwest of Moose Meadows.

Four campsites were found in the first portion of this study area along a two and half mile stretch of the Moose Creek trail in 2001 (Figure 24.). By 2006, one of these campsites had completely recovered and three new campsites emerged. The campsite with the identification label "MSC5" does not appear on the map because it did not register on the Frissell (1978) index. It has not completely recovered because it still shows impacts as measured by Cole's (1983) index.

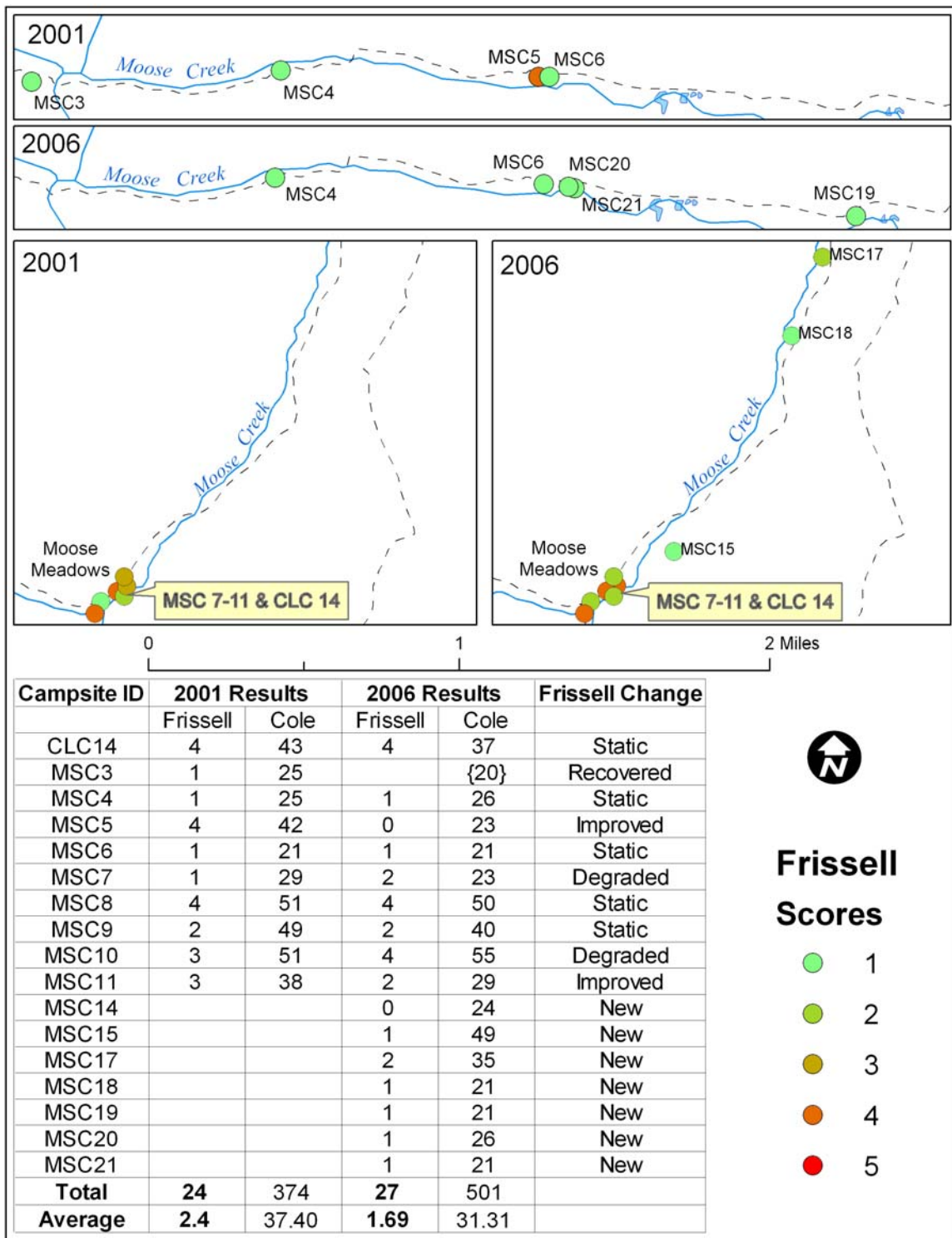


Figure 24. Changes in campsite distribution and conditions along Moose Creek from 2001 and 2006. (Map by Author)

Six campsites were found during 2001 at Moose Meadows and a one and one half mile long stretch of the Moose Creek Trail northwest of Moose Meadows (Figure 24). In 2006, all of these campsites remained and four new ones emerged. The campsite with the identification label "MSC 14" does not appear on the map because it did not meet any of the requirements of the Frissell (1978) index. It did however, register on Cole's (1983) index with a score of twenty four.

On average, the conditions of existing campsites improved as rated by both indices. The average rating of campsite conditions found in 2001 was 2.4 on the Frissell (1978) index. That average decreased to 1.69 in 2006. The average score for campsite conditions based on Cole's (1983) condition class score was 37.40 in 2001. By 2006, the average score had decreased to 31.31.

The conditions at the campsite with the identification label "MSC5" showed the most improvement (Figures 25 and 26). In 2001 it was a "Class 4" campsite on the Frissell (1978) index and in 2006 it no longer met the description of any the classes on the Frissell (1978) index. The campsite has not completely recovered, but it is quite close. The score it received on Cole's condition class index in 2006 decreased from forty two to twenty three. This score is only three points above the minimum score of twenty possible on the index. The campsite still exhibits damage from a fire scar and from the lack of vegetation when compared to nearby sites with the same characteristics. The campsite should not be considered fully recovered until it scores a twenty on Cole's classification index and a zero on Frissell's (1978) index.



Figure 25. Photo of the campsite with identification label "MSC5" taken in September of 2001.



Figure 26. Photo of the campsite with the identification label "MSC5" taken in July of 2006.

Despite the fact that conditions on previously existing campsites improved, the proliferation of new campsites resulted in more campsite impacts overall. The total number of campsites nearly doubled and the total score of campsite conditions based on the Frissell (1978) index increased from twenty four in 2001 to twenty seven in 2006 (Figure 24). Likewise, the total scores of campsite conditions as rated by Cole's (1983) condition class survey increased from 374 to 501 (Figure 24). Thus, the overall impact from camping in the Moose Creek area has increased due to the proliferation of campsites.

Campsite Conditions at the Moose Creek Study Area from 1990, 2001 and 2006

In a survey done by wilderness volunteers in 1990, a campsite at Moose Meadows was discovered. During the 2001 WCIMP, this campsite was rediscovered and labeled "MSC10". The condition rating for the parameter "tree damage" on the original 1990 condition class survey is missing. To effectively compare the scores from Cole's (1983) condition class index from data collected in 1990, 2001 and 2006, the results from this parameter were not considered in this analysis. Therefore, the scores from this campsite are relatively low when compared to campsites conditions in which all of Cole's parameters were measured.

The campsite with the identification label "MSC10" had a score of thirty two on Cole's condition class survey in July of 1990. The campsite had 50 to 75 percent less vegetation cover than a comparably similar nearby patch of ground. The site was also found to have 21 to 45 percent more bare mineral soil than a comparable site.

Eleven years later, the conditions at this same campsite had deteriorated. In 2001, the campsite scored a forty five (not considering the parameter of "tree damage") on Cole's condition class survey. According to the wilderness ranger's inventory results in 2001, more tree roots were exposed, more social trails had formed and the barren core area of the camp increased ten fold. In 2006, the campsite conditions had further deteriorated. More tree roots were found to be exposed and the site scored a forty nine on Cole's condition class survey (not considering the parameter of "tree damage").

The conditions at the campsite with the identification label "CLC14" have improved since 1990. It scored forty one points on Cole's condition class survey in 1990, increased slightly to forty three in 2001 and then decreased to thirty seven in 2006. The conditions at the campsite with the identification label "MSC8" have deteriorated. The data collected in 1990 is missing the values for the parameter of "bare mineral soil". Not including this parameter, the value from Cole's condition class index was thirty six in 1990. In 2001, that value increased to forty two and decreased slightly to forty one in 2006.

Because of the lack of data, it is impossible to tell if campsites have proliferated in the Moose Creek area since 1990. Nevertheless, based on the campsite condition data from these three campsites, it appears that campsite conditions have deteriorated in the Moose Creek area from 1990 to 2001 and improved slightly from 2001 to 2006 (Table 7).

Campsite ID	1990	2001	2006
MSC10	32	45	49
CLC14	41	43	37
MSC 8	36	42	41
Cole's Condition Class Index Total	109	130	127

Table 7. The totals from Cole's condition class index for three campsites in the Moose Creek study area from 1990, 2001 and 2006.

The Alaska Basin Study Area

Geographic Situation and Interview Results

Alaska Basin is one of the most popular destinations in the Jedediah Smith Wilderness owing largely to the views provided by its close proximity to the core Teton peaks such as the South Teton and Middle Teton (Figure 27). The vast majority of camping takes place at Sunset Lake and Basin Lakes. Access from the west is from the South Teton Trail and requires a five mile hike or ride to the area. Alaska Basin has a very high degree of connectivity with Grand Teton Park with three trails shared between the administrative boundary. The entire basin and the South Teton Trail are in the 1.1.8 prescription zone. Campfires, camping with stock and stock grazing are not permitted in Alaska Basin.

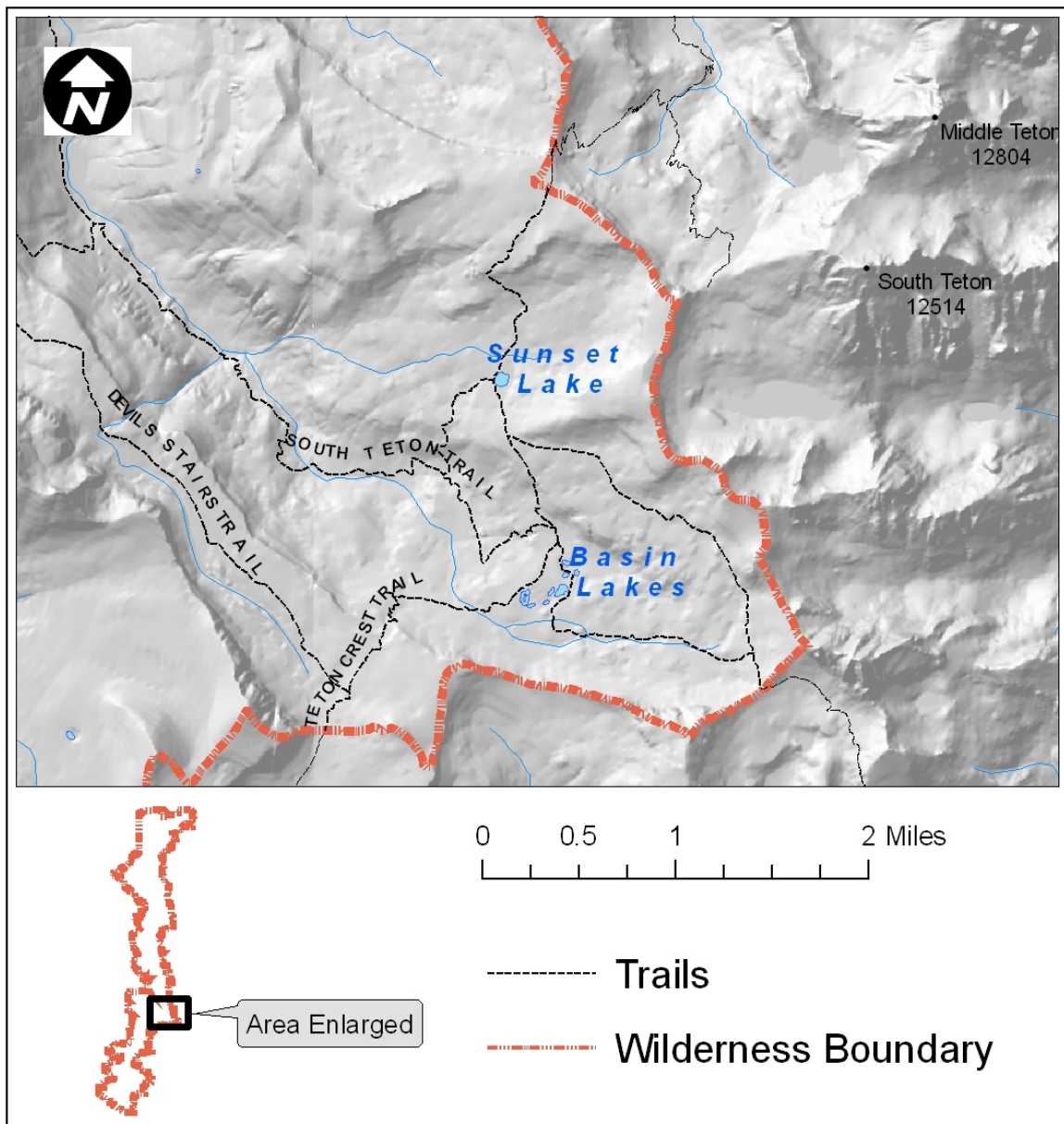


Figure 27. Alaska Basin reference map. (Map by Author)

There are seventeen camping zones in Grand Teton Park in which campers are required to get permits before being allowed to stay in the backcountry. Overnight users are not permitted to stay anywhere in Grand Teton Park with the exception of these zones and other smaller campsites. Three of these camping zones are close to Alaska Basin

(Figure 28).

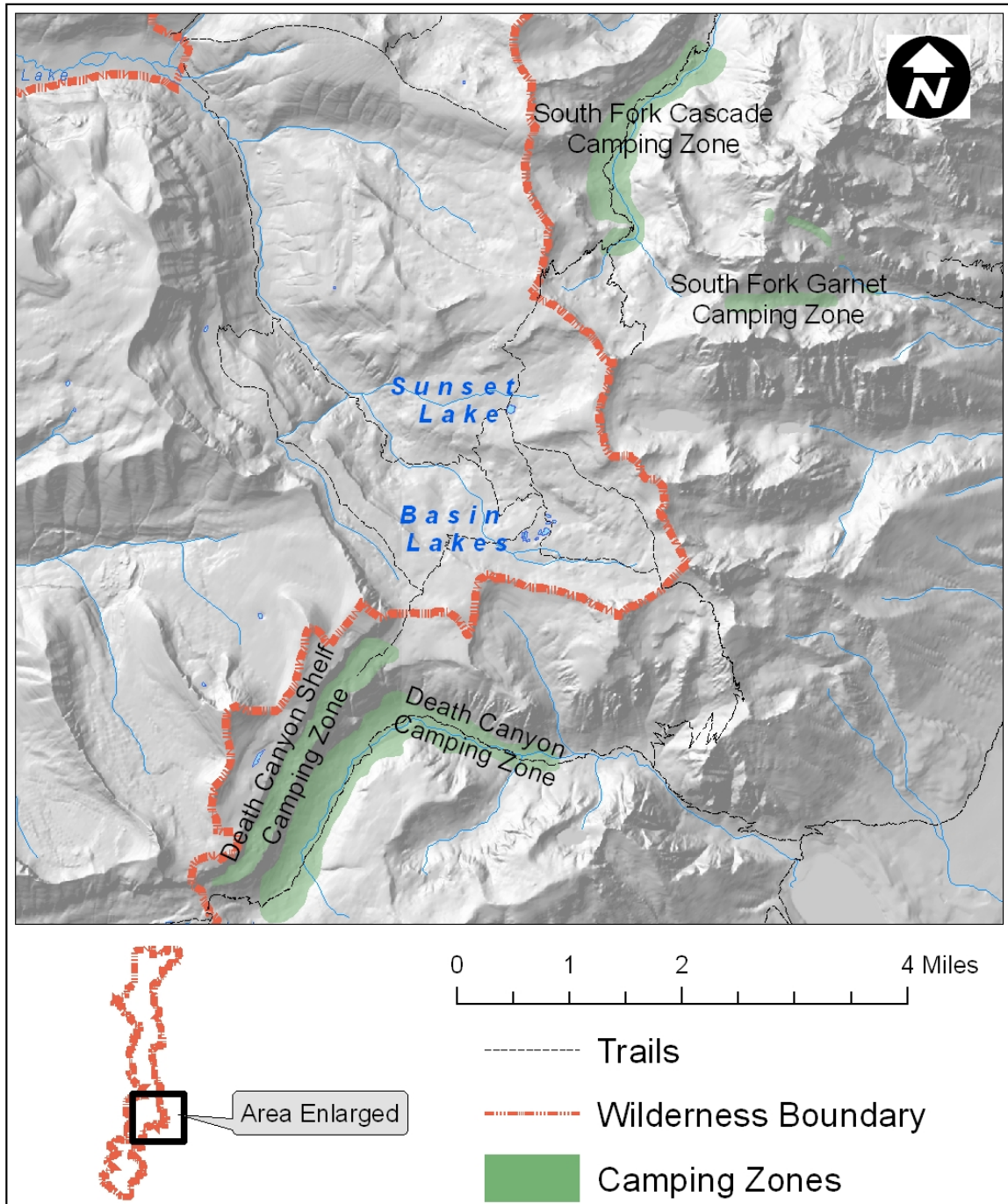


Figure 28. Grand Teton National Park camping zones near Alaska Basin. Sources: U.S. Department of the Interior, National Park Service (2006) and Spletter (pers com, 2006). (Map by Author)

On a nightly basis, thirty one people or eleven parties are allowed in the South Fork Cascade camping zone whichever total is reached first (Spletter, pers com 2006). The Death Canyon Shelf camping zone accommodates seven parties or twenty campers and the Death Canyon camping zone allows eleven parties or thirty one campers per night (Spletter, pers com 2006). The Death Canyon camping zone is close to Alaska Basin, but it is well over 312 meters (1,000 feet) lower in elevation. Consequently, this camping zone does not provide an alternative to camping in Alaska Basin. Between the South Fork Cascade and the Death Canyon Shelf camping zones, only sixteen groups or forty six people are allowed to stay near Alaska Basin on the National Park side of the border on a nightly basis.

A total of seven days was spent getting to and in Alaska Basin where campsites were monitored and Wilderness users interviewed. In total, 140 interviews were conducted (Table 8). A very low number of these contacts were local residents as only seven, or 5 percent, of the interviewees were from the Teton Valley (Table 8). Four of these seven interviewees from the Teton Valley were both day hikers and part time residents as owners of second homes.

	Totals	Percent
Contacts	140	100%
Overnight Users	100	71%
Day Users	40	29%
Users from the Teton Valley	7	5%
Day Users from the Teton Valley	6	4%
Overnight Users from the Teton Valley	1	0.7%
Users that entered from Grand Teton Park	31	22%
Day Users that entered from Grand Teton Park	2	1%
Overnight Users that entered from Grand Teton Park	29	21%

Table 8. Results from interviews conducted on the trails leading to and in Alaska Basin on July 27, July 28 and August 9 through August 13.

Most people contacted in Alaska Basin were overnight users (100 interviewees or 71 percent; Table 8). Almost one third of the overnight users had entered the Wilderness from Grand Teton Park. Because permits are required to camp in Grand Teton Park and only a maximum of forty six people or sixteen groups are allowed to stay on the Park side of the boundary near Alaska Basin, many potential Park campers may be displaced into the Jedediah Smith Wilderness. Megan Bogle, former Wilderness Manager of the Jedediah Smith Wilderness, believes that significant displacement occurs because of the popularity of the Park and the low number of campsites available for Park users (pers com. January 10, 2007, Teton Basin Ranger District. In person). Compared to the Green Lakes and Moose Lakes area, where no interviewees had entered the Wilderness from Grand Teton Park, a total of thirty one or 22 percent of the people interviewed in Alaska Basin had come from Grand Teton Park (Table 8). The geographic situation of Alaska Basin makes it an important recreational resource for overnight hikers starting their trip in the Park.

Anecdotally, one interviewee expressed that Grand Teton Park's camping permit system influenced how they chose to hike and camp in the Tetons. This person was one of the leaders of a group of ten backpackers from the Teton Science School. This group began their hike at the Moose Creek Trailhead in the southern portion of the Wilderness. They made their way north to Alaska Basin on the Teton Crest Trail crossing between Grand Teton Park and the Wilderness. The group spent all of their nights on the Wilderness side of the border despite having spent a good deal of their time hiking in Grand Teton Park. According to this instructor, they had chosen this hike because of the

difficulty of getting camping permits in Grand Teton Park and camping in the Wilderness did not require obtaining permits.

Campsite Density and Conditions at the Alaska Basin Study Area

Two separate cluster samples were analyzed for changes in campsite condition and distribution in Alaska Basin. The first cluster sample consisted of an area near Sunset Lake and the second near Basin Lakes (see Figure 30). The results from these two cluster samples are presented separately, but both represent the recreational patterns found in Alaska Basin.

Campsite Density and Conditions at the Sunset Lake Cluster Sample. The density of campsites at the Sunset Lake sample area within Alaska Basin decreased (Figure 29). This cluster sample consisted of campsites near the northern most lake in Alaska Basin. Eleven campsites were originally discovered in 2001. In 2006, two of these campsites showed no impacts as rated by both surveys and had completely recovered. Unlike the Green Lakes and Moose Creek areas, no new campsites were found to have developed from 2001 to 2006.

Not only did the density of campsites decrease, but the majority of the campsites showed improved or completely recovered conditions as rated by the Frissell (1978) index. The two campsites that showed degraded conditions on the Frissell (1978) index showed improved conditions as rated by Cole's (1983) index. Every campsite in this cluster sample showed improved conditions according to the Cole (1983) index.

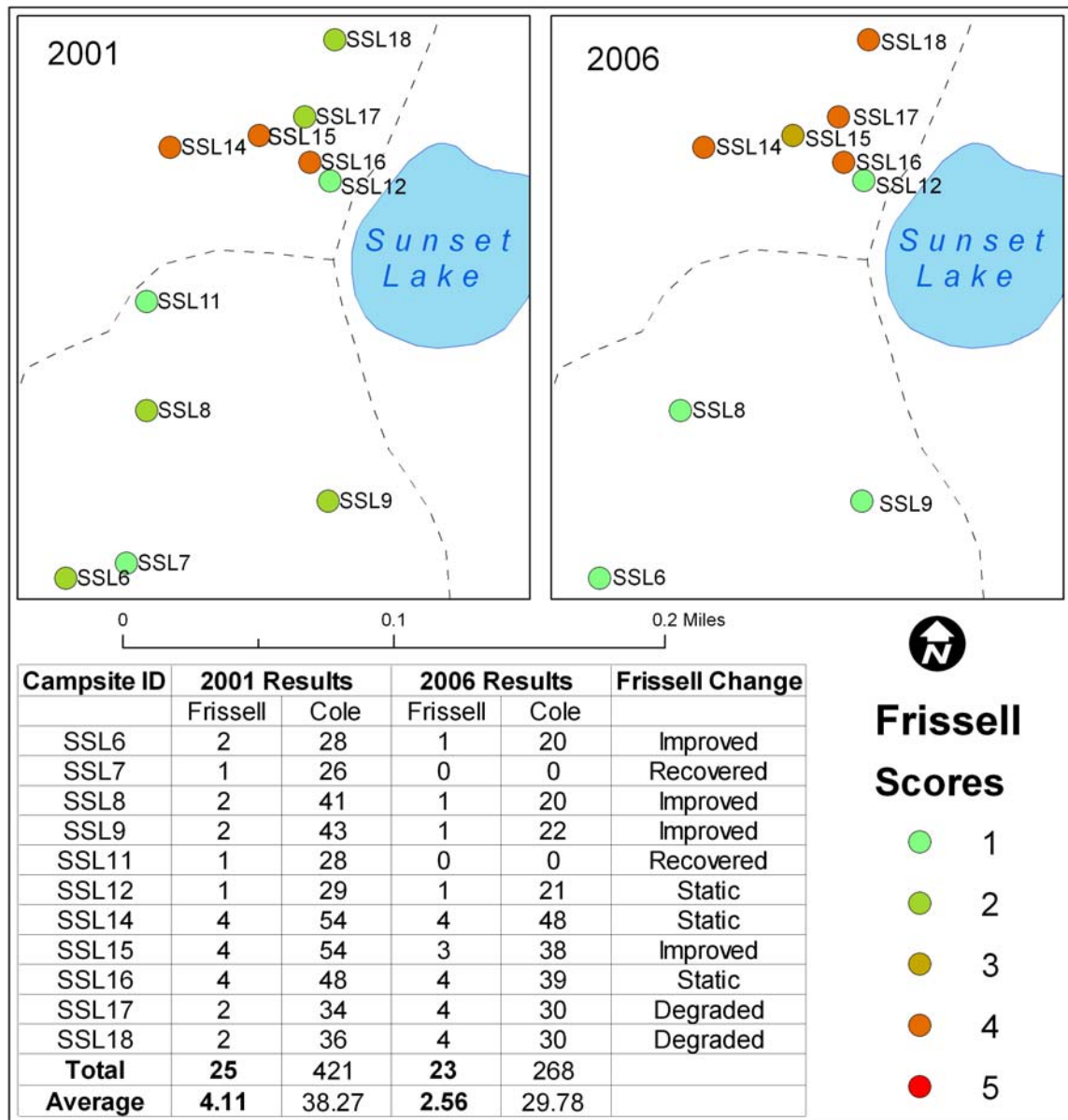


Figure 29. Changes in campsite distribution and conditions at Sunset Lake between 2001 and 2006. (Map by Author)

Contrary to the findings of campsite conditions at the Moose Creek area where camping impacts increased due to campsite proliferation, the overall camping impacts to this portion of Alaska Basin have decreased. This reduction in the overall impact from

camping is a result of both improved conditions on existing campsites and the lack of proliferation of new campsites.

Campsite Density and Conditions at the Basin Lakes Cluster Sample. The density of campsites in the Basin Lakes sample area of Alaska Basin decreased (Figure 30). This cluster sample consisted of the area around two lakes in the southwestern portion of Alaska Basin. Eighteen campsites, with relatively low levels of impact, were found near these two lakes in 2001. In 2006, five of these campsites had completely recovered and no new campsites were found, leaving thirteen campsites in total.

On the whole, the conditions of campsites improved with both a lower total rating and a lower average score on the Frissell (1978) index and Cole's (1983) condition classification index (Figure 30). The total of the Frissell (1978) campsite condition ratings decreased from thirty four in 2001 to twenty three in 2006. Similarly, the total score of campsite conditions on Cole's (1983) condition class survey decreased from 600 in 2001 to 341 in 2006. Almost all of the campsites found in 2001 showed improved conditions, in 2006, based on Cole's (1983) condition class index. Only eight of the eighteen campsites showed lesser degrees of campsite impact based on the Frissell (1978) index. One campsite (BSLC1) showed further impacts based on the Frissell (1978) index and nine campsites showed no changes at all. Because only one half of the campsite displayed conditions changes based on the Frissell (1978) index and all eighteen campsites showed improved conditions as rated by Cole's (1983) condition class index, it is safe to say that Cole's (1983) method of monitoring campsite is more sensitive.

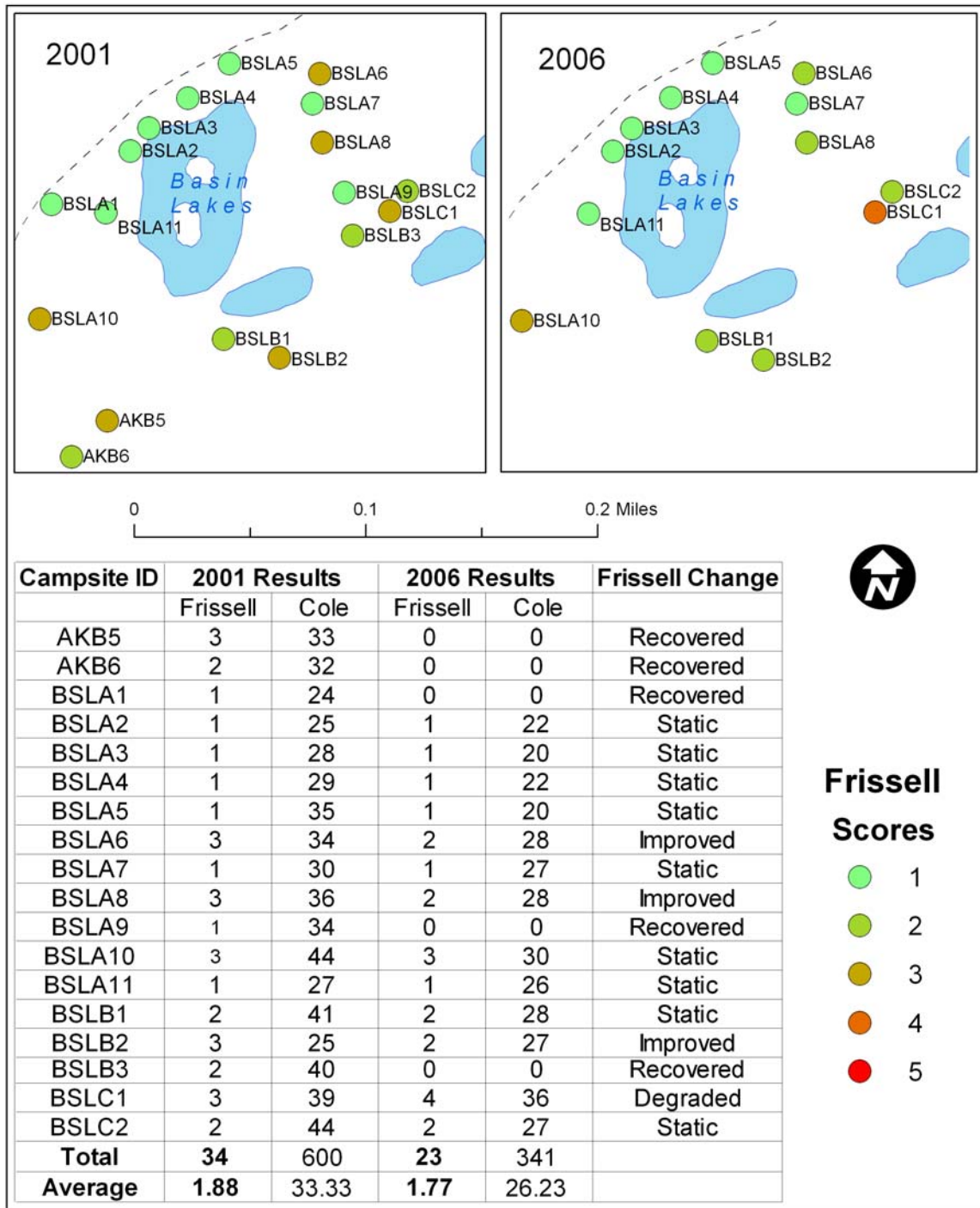


Figure 30. Changes in campsite distribution and conditions at Basin Lakes between 2001 and 2006. (Map by Author)

In summary, campsite impacts within both cluster samples at Alaska Basin improved. At Sunset Lake and Basin Lake, no new campsites were found and the conditions at previously existing campsites improved.

Compared to conditions at campsites in the other study areas, the campsite conditions near the Basin Lakes are very low. The average 2006 rating for campsites near Basin Lakes on Cole's condition class survey was 26.23. This average is lower than that found at Green Lakes (35.58), Moose Creek (30.94) and Sunset Lake (29.78). One reason that campsite impacts tend to be low in the Basin Lakes area is because camping with stock and campfires are both prohibited. Camping with stock tends to result in larger campsites with higher degrees of impact (Cole 1983). Fire rings and scars certainly cause a higher level of ecological damage to campsites. At Sunset Lake, stock use and campfires are prohibited as well, but the average rating of campsite condition there is higher. Two possible reasons may help explain why campsite impacts are lesser at Basin Lakes. Firstly, the Basin Lakes area offers more places to camp due to less dramatic topography resulting in a lower frequency of use of campsites. Most of the flat spots suitable for pitching a tent, near Basin Lakes, have no or little canopy cover. Often, the grass is merely matted down after a group of campers leave a site. A short time later, it is often difficult to tell whether that spot was used for camping or not. This lack of canopy cover may contribute to the resiliency of the vegetation and partly explain why campsite impacts at Basin Lakes are relatively low.

The South Leigh Lakes Study Area

A number of small lakes at an elevation of 2900 meters (9,514 feet) and the opportunity to camp in relative solitude draw people to the South Leigh Lakes area (Figure 31). Most of the area is within the 1.1.6 prescriptions where no maintained trails and the best opportunity for solitude are to be found. This area is one of the few places in the Wilderness where lakes exist and trails do not. The lakes are not terribly difficult to reach because of gentle topography and the existence of user created trails.

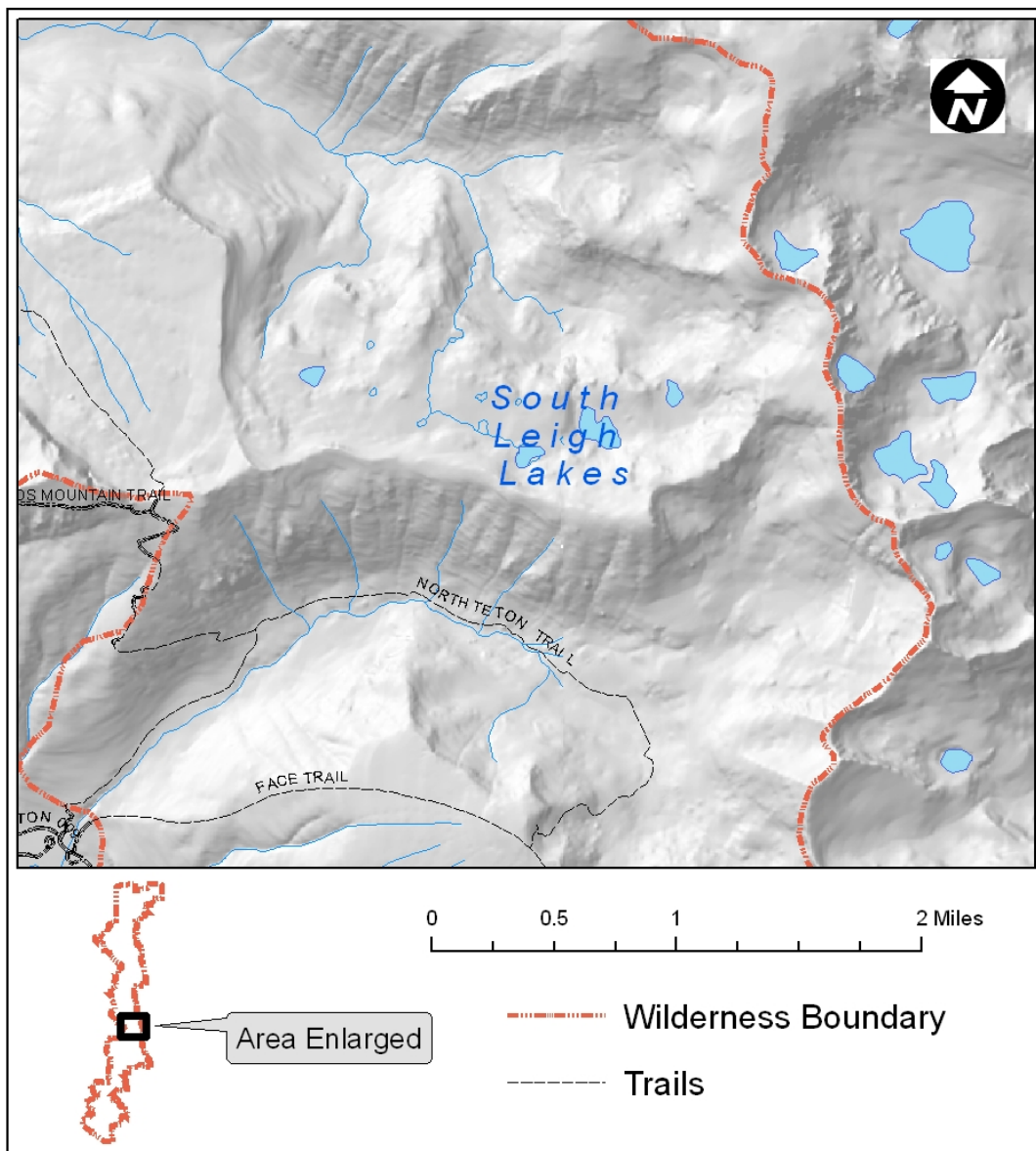


Figure 31. South Leigh Lakes reference map. (Map by Author)

Campsite Density and Conditions at South Leigh Lakes

The number of campsites decreased at South Leigh Lakes from 2001 to 2005. In 2001, thirteen campsites were found. By 2005, two campsites had completely recovered and one new campsite appeared, resulting in a total of twelve campsites (Figure 32).

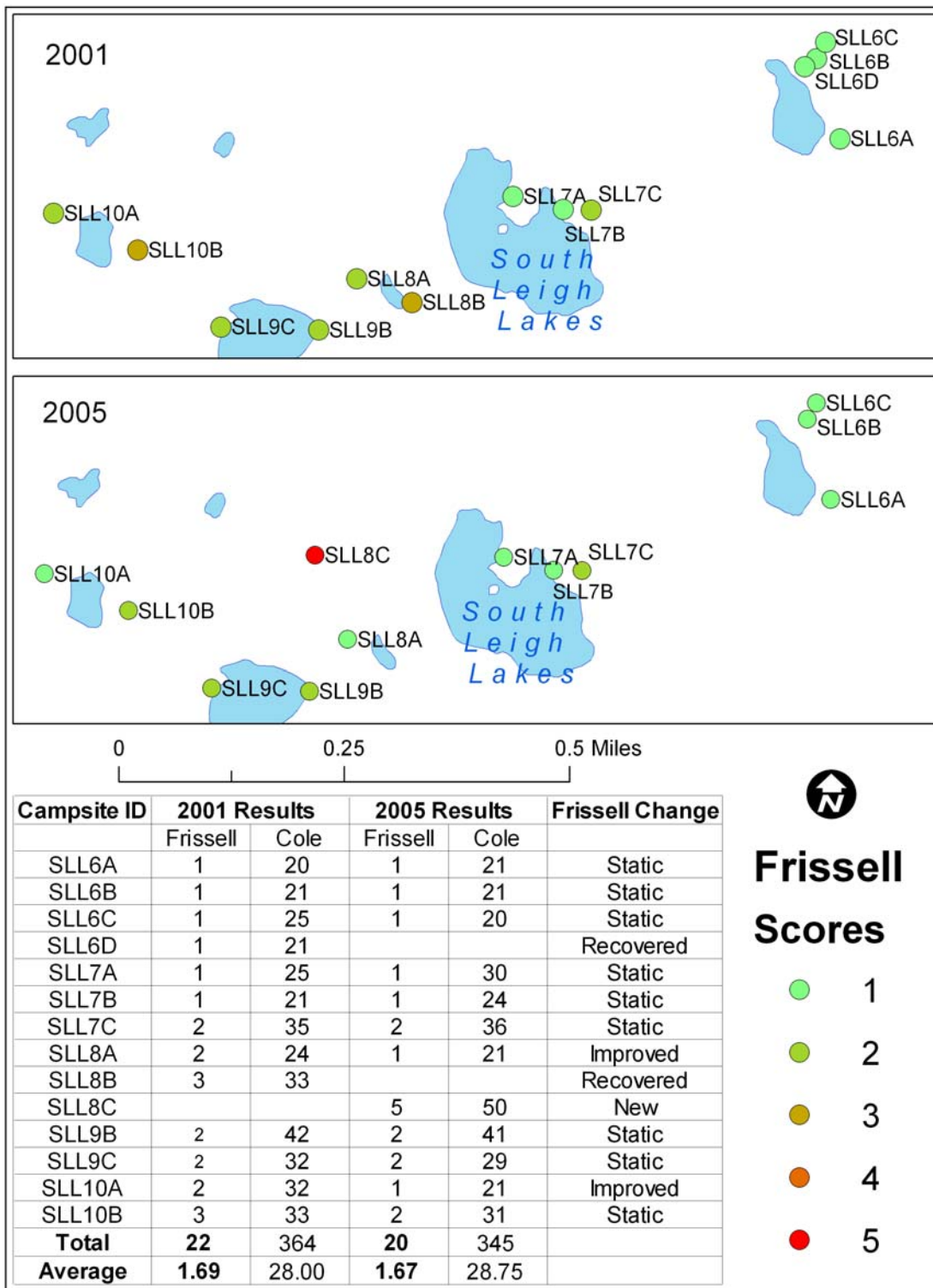


Figure 32. Changes in campsite distribution and conditions in the South Leigh Lakes area from 2001 to 2005. (Map by Author)

The conditions at most campsites at South Leigh Lakes improved. Conditions at nine of the original campsites found in 2001 were found to have lower scores on Cole's (1983) condition class survey (Figure 32). Conditions at those same nine campsites also had lower or the same rating on the Frissell (1978) index. Two campsites were found to have completely recovered.

Despite the improvement of conditions at the original campsites, cumulative campsite conditions deteriorated. The average score for campsite conditions on the Frissell (1978) index increased from 1.69 in 2001 to 2.00 in 2005 (Figure 32). Similarly, the conditions of campsites as rated by Cole's condition class index increased from 28.00 in 2001 to 28.75 in 2005 (Figure 32). The discovery of a new and heavily impacted campsite (SLL8C) resulted in a higher average score of campsite impacts as rated by both indices.

It is difficult to definitively determine whether campsite impacts at the South Leigh Lakes area have improved or deteriorated. On the one hand, the density of campsites in this study area decreased from thirteen to twelve and the total values from both campsite impact monitoring methods decreased. On the other hand, the average score on both campsite monitoring indices increased.

CONCLUSION AND MANAGEMENT IMPLICATIONS

The purpose in undertaking this research was to discover the geography and trends that influence campsite impacts. This was addressed by asking three research questions. First, the question of whether campsite impacts have increased from 2001 to 2006 was explored. Second, Wilderness use by local residents and recent migrants was examined in order to determine how they influence campsite conditions. Lastly, the patterns of overnight recreation use between Grand Teton Park and the Wilderness were analyzed.

Campsite impacts were analyzed for changes from 2001 to 2006 by monitoring the condition of campsites at four study areas. The results from 182 interviews were used to determine the geographic patterns of recreational use and the type of use (overnight or day) by local residents and recent migrants. Similarly, the results from these interviews were analyzed to determine how these different study areas are used by recreationists entering the Wilderness from Grand Teton Park.

This chapter provides a summary of the results from these three research questions. It is organized to address the possible implications of each study question on the management of the Jedediah Smith Wilderness area. Finally, the chapter concludes with implications for wilderness areas with similar geographic situations.

Campsite Impacts from 2001 to 2006

Based on the data collected from the Frissell (1978) index and Cole's (1983)

Condition Class survey, campsite impacts decreased from 2001 to 2006. Campsite impacts are a combination of both the biophysical conditions at individual campsites and the total number of campsites (Cole 1993). The number of campsites increased minimally, while the campsite conditions improved more significantly. The number of campsites, found within the four study areas, increased from sixty one in 2001 to sixty two in 2006, but the bio-physical conditions at most campsites improved.

Looking at campsite condition changes from all of the study areas combined only presents part of the picture. Different study areas displayed very different results. The Green Lakes area has no trails connecting it with Grand Teton Park and is used relatively heavily by local residents. In this area's cluster sample, the number of campsite increased, while the conditions on most sites improved. Overall, campsite impacts remained roughly the same in 2006 as they were in 2001.

The Moose Creek cluster sample displayed a different pattern. Largely because of significant campsite proliferation, campsite impacts increased. Of the four study areas, Moose Creek has a moderate level of connectivity with the Park. It also seems to be used rather heavily by residents of the Teton Valley, although not for overnight use.

Alaska Basin has a high degree of connectivity with Grand Teton Park. User interviews seem to confirm that this connectivity results in it being used heavily by those starting their hike in Grand Teton Park. It is used to a lesser degree by recent migrants and residents living in the Teton Valley. This is the only study area that witnessed both a reduction in the number of campsites and in the severity of the bio-physical impacts at individual sites. Overall, campsite impacts decreased in Alaska Basin.

The South Leigh Lakes study area has no maintained trails and has little connectivity with Grand Teton Park. This was the only study area in which campsite impacts were analyzed for changes from 2001 to 2005. The number of campsites decreased, but the average condition at the remaining campsites deteriorated. Overall, campsite impacts remained roughly the same from 2001 to 2005. Interviews were not conducted in the South Leigh Lakes study area.

The most significant aspect of campsite impact changes from 2001 to 2006 is that campsite distribution changed in all of the study areas. Campsite proliferation or recovery was greater in some study areas than others, but there is no simple explanation for the different findings.

Campsite density is influenced by four variables: amount of use, site selection behavior, campsite availability and management intervention (Cole 1993). Alaska Basin has the highest density of campsites of any area in the Wilderness with over fifty campsites inventoried in 2001. With a history of high amounts of use by overnight campers, most of the potential sites at Alaska Basin may have already been turned into campsites. Cole (1983) used this same reasoning to explain why campsites did not proliferate at one of the most heavily used lakes in the Selway –Bitterroot Wilderness of Montana. Because the availability of existing sites is so great, there may be little need by campers to pioneer new sites. With reduced overnight use in Grand Teton Park since 2001, Alaska Basin may be witnessing fewer overnight campers and thus fewer campsite impacts.

Density of campsites should increase when more use occurs, campers tend to

pioneer new sites, more potential sites are available, and when managers do not encourage the use of existing sites (Cole 1993). The Moose Creek study area showed the greatest increase in campsite impacts, mostly from the establishment of new campsites. Contrary to Cole's (1983) findings, campsites proliferated at the greatest rate along trail corridors as opposed to destinations, such as lakes. The Moose Creek study area was found to be more heavily used by local residents than any of the other study areas, but this does not mean that local residents were the cause of these new campsite impacts. None of the interviewees were found to be residents of the Teton Valley and overnight campers. Nevertheless, campsites did proliferate at the Moose Creek study area and maybe a function of increased amounts of use.

Management Implications of Campsite Density Changes

The LAC indicator for campsites listed in the Targhee Revised Forest Plan (USDA Forest Service, 1997; V-36 & III-27) is "the condition of individual campsites" (Figure 33). The language used to describe the standards for campsite conditions was taken from the first three classes of the Frissell (1978) index (see Figure 10). Essentially, the Forest Plan requires campsites in the 1.1.6 prescription zone to remain at the Frissell class one level, campsites in the 1.1.7 prescription zone are to remain at the class two level or lower and campsites in the 1.1.8 prescription zone to remain at the class three level or lower.

Indicator #2	Standards		
	1.1.6 Prescription Zone	1.1.7 Prescription Zone	1.1.8 Prescription Zone
Condition of individual campsites	vegetation flattened, not permanently injured	vegetation worn away at center of activity	vegetation lost around center of activity

Figure 33. Campsites standards found in the 1997 Targhee Revised Forest Plan (USDA Forest Service, 1997; V-36).

There is no spatial aspect to this indicator. For instance, this indicator allows for an unlimited number of campsites in the 1.1.7 prescription zone as long as they remain as class two or lesser campsite as rated by the Frissell (1978) index. A campsite indicator that has a spatial aspect is the “number of human impacted sites above a particular condition class index per 640 acre area” used in The Bob Marshall, Great Bear and Scapegoat Wilderness LAC plan (Figure 34).

	Opportunity Class I	Opportunity Class II	Opportunity Class III	Opportunity Class IV
5. Number of human impacted sites above a particular condition class index per 640 acres	No moderately or highly impacted sites per 640 acre area	No more than (1) moderately impacted site and (0) highly impacted sites per 640 acre area	No more than (2) moderately impacted site and (0) highly impacted sites per 640 acre area	No more than (3) moderately impacted site and (0) highly impacted sites per 640 acre area

Figure 34. Campsite indicator and standards found in the Bob Marshall, Great Bear and Scapegoat Wilderness LAC plan (USDA Forest Service 1987, 31).

Because campsite impacts are a combination of the biophysical conditions at individual campsites and the total number of campsites (Cole 1993), the Bob Marshall

indicator (Figure 34) may more accurately measure campsite impacts. It takes due consideration of the condition of individual campsites, like the Targhee campsite indicator, but it also factors in the total number of campsites allowed per square mile. The Targhee campsite indicator lacks a spatial aspect and is therefore a poor indicator of overall campsite impacts.

When campsites are found to have exceeded the standards for campsite condition, the Targhee Forest Plan (USDA Forest Service, 1997; V-36) lists four possible management actions that are to be carried out. One of the actions is to rehabilitate and/or close the site. Another is to relocate the site to a more durable location and to restore the former site to as near a natural condition as possible.

These management actions go against what the leading wilderness researcher; David Cole has recommended in high use areas. Once a highly impacted campsite exists, subsequent camping at the site (even at high frequencies) tends to result in minor differences in impact (Cole 1993; 2004). In popular camping areas, campsite rehabilitation should focus on eliminating all class one and two sites, (Cole 1993) not with the higher class sites like the 1997 Targhee Forest Plan's management actions require.

Research by Cole (1993) and Cole, Peterson and Lucas (1987) have influenced "Leave no Trace" campaigns, including videos, web-pages and pamphlets, to encourage campers to stay at heavily impacted campsites in popular camping areas. The reasoning behind this rule of thumb is to concentrate camping impacts to a few heavily used and impacted sites. These sites will likely become class three or higher sites on the Frissell

(1978) index, but concentrating use on these sites helps to prevent large numbers of campsites from forming (Cole 1983). In less popular areas, where no heavily impacted sites exist, campers should use a spot that has never been camped on before. It is unlikely that anyone will camp at that site in the near future and the site will recover quite quickly. In theory, this practice will result in the absence of campsites altogether. The “Leave No Trace” camping ethic requires campers to refrain from building fire rings or otherwise altering the sites in pristine areas.

Furthering the reasons why low-impacted campsites should be rehabilitated is the ease at which it is done. Frissell (1978) class four and five campsites, by definition, have high amounts of bare mineral soil, exposed tree roots, dead trees and obvious soil erosion. There is little that can be done to bring back organic soil horizons or revive dead trees. Conversely, a Frissell (1978) class one or two campsite still retains organic soil. At these sites, destroying the fire ring and bringing organic soil to the top of the former fire scar can deter people from camping there and promote vegetation recovery.

In order to remain consistent with “Leave No Trace” teachings and the findings of David Cole, a new standard in the 1.1.8 prescription zone may be needed. Both the Bob Marshall LAC plan (U.S. Department of Agriculture 1987) and the Targhee campsite standard do not allow for highly impacted campsites in the more heavily used zones in wilderness. Instead, these standards should limit the number of campsites, not the level of impact found at these sites. Highly impacted campsites should remain because they are unlikely to receive many new impacts with further use and it is difficult to persuade recreationists not to use these sites. These campsites can be viewed as sacrifice sites in

which a few heavily impacted campsites exist instead of dozens of moderately impacted campsites.

Geographic Situation and Wilderness Use Trends

The geographic situation to the west of the Wilderness is that of rapid amenity based population growth. Despite this growth, these residents and recent migrants camp in the Wilderness at very low levels and thus have little impact on campsites. The geographic situation on the east side is that of a popular National Park with declining overnight use. Despite this decline, users entering from the Park tend to be overnight campers and continue to impact campsites.

Proximity to the Wilderness plays an important role on how frequently people visit the Wilderness. Compared to those from more distant locations, residents of the Teton County visit the Jedediah Smith Wilderness often. Based on the results from this study, those who live closer to wilderness are more likely to participate in day hiking as opposed to overnight backpacking and have little impact on campsite conditions. If the Teton Valley's population continues on the same trajectory and local residents continue to use the Wilderness primarily for day outings, we can expect to see a greater proportion of people day hiking in the Jedediah Smith Wilderness in the future. Western places adjacent to wilderness have grown more quickly in recent decades and may continue to grow at a fast rate in the future. If the same pattern exists near other wildernesses, increasing amounts of recreational day use may have a strong influence on the opportunity for solitude in many Western wildernesses.

Depending on the degree of connectivity with Grand Teton Park, some places in the Wilderness witness high levels of use from Grand Teton Park. Alaska Basin is such a place and has the highest density of campsites in the entire Wilderness. Recreationists that enter from Grand Teton Park make up a small portion of the total users of the Wilderness. Nevertheless, these recreationists may have impacts on campsites beyond their numbers as 94 percent of them were found to be overnight campers. Overnight stays in Grand Teton Park have declined in recent years and less displacement to the Wilderness may be occurring in places like Alaska Basin. Despite this decline, recreationists entering the Wilderness from Grand Teton Park have a significant influence on campsite conditions.

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APPENDICES

APPENDIX A

CAMPSITE CODE MEANINGS

Campsite Code	Area Name
AKB	Alaska Basin
ASC	Andy Stone Creek
BCH	Bitch Creek Trail
BCT	Bear Canyon Trail
BDG	Badger Creek Trail
BSL	Basin Lakes
CLC	Coal Creek
CON	Conant Basin
CPL	Camp Lake
CRA	Carrot Ridge Area
DBC	Darby Canyon
DVS	Devil's Stairs
FCT	Table Face Trail
FDM	Fred's Mountain
FXC	Fox Creek
GBL	Granite Basin Lakes
GDH	Green Lake/Dead Horse Pass
GMC	Game Creek
GMT	Green Mountain Trail
GRL	Green Lakes Area
GRZ	Grizzly Creek
HCB	Hidden Corral Basin
HDL	Hidden Lake
HOM	Hominy
INM	Indian Meadows
JSP	Jackass Pass and Survey Peak
MBO	Middle Boone
MSC	Moose Creek
MSL	Moose Lake
NFG	North Fork Game Creek
NTL	North Teton Lakes
NTT	North Teton
PLC	Plummer Canyon
POT	Poacher Trail
PPC	Phillip's Pass/Crest
RML	Rammel Mountain Area
SBO	South Boone
SLC	South Leigh Creek
SLL	South Leigh Lakes
SPP	Spearhead Peak Area
SSL	Sunset Lake
STT	South Teton
TCT	Tin Cup Trail
TLM	Taylor Mountain
UBB	Upper Bitch Creek Basin

APPENDIX B

CAMPSITE CONDITION SURVEY VALUES

			2001 Results		
		Campsite ID	Date	Frissell Index	Condition Class Index
	1	GRLA1	9/11/2001	Class 4	46
	2	GRLA2	9/11/2001	Class 4	50
	3	GRLA3	10/11/2001	Class 4	45
	4	GRLA4	9/11/2001	Class 4	41
	5	GRLA5	9/11/2001	Class 5	56
	6	GRLA6	9/11/2001	Class 4	39
	7	GRLA7	9/11/2001	Class 4	39
	8	GRLA8	9/11/2001	Class 4	53
	9	GRLA9	9/11/2001	Class 4	38
	10	CLC14	8/7/2001	Class 4	43
	11	MSC3	8/1/2001	Class 1	25
	12	MSC4	8/1/2001	Class 1	25
	13	MSC5	8/1/2001	Class 4	42
	14	MSC6	8/1/2001	Class 1	21
	15	MSC7	8/9/2001	Class 1	29
	16	MSC8	8/8/2001	Class 4	51
	17	MSC9	8/9/2001	Class 2	49
	18	MSC10	8/9/2001	Class 3	51
	19	MSC11	8/9/2001	Class 3	38
	20	SSL6	9/20/2001	Class 2	28
	21	SSL7	9/20/2001	Class 1	26
	22	SSL8	9/20/2001	Class 2	41
	23	SSL9	9/20/2001	Class 2	43
	24	SSL11	9/20/2001	Class 1	28
	25	SSL12	9/20/2001	Class 1	29
	26	SSL14	9/20/2001	Class 4	54
	27	SSL15	9/20/2001	Class 4	54
	28	SSL16	9/20/2001	Class 4	48
	29	SSL17	9/20/2001	Class 2	34
	30	SSL18	9/20/2001	Class 2	36
	31	AKB5	9/19/2001	Class 3	33
	32	AKB6	9/19/2001	Class 2	32
	33	BSLA1	9/19/2001	Class 1	24
	34	BSLA2	9/19/2001	Class 1	25
	35	BSLA3	9/19/2001	Class 1	28
	36	BSLA4	9/19/2001	Class 1	29
	37	BSLA5	9/19/2001	Class 1	35
	38	BSLA6	9/19/2001	Class 3	34

	39	BSLA7	9/19/2001	Class 1	30
	40	BSLA8	9/19/2001	Class 3	36
	41	BSLA9	9/19/2001	Class 1	34
	42	BSLA10	9/19/2001	Class 3	44
	43	BSLA11	9/19/2001	Class 1	27
	44	BSLB1	9/19/2001	Class 2	41
	45	BSLB2	9/19/2001	Class 3	25
	46	BSLB3	9/19/2001	Class 2	40
	47	BSLC1	9/19/2001	Class 3	39
	48	BSLC2	9/19/2001	Class 2	44
	49	SLL6A	6/24/2001	Class 1	20
	50	SLL6B	9/24/2001	Class 1	21
	51	SLL6C	9/24/2001	Class 1	25
	52	SLL6D	9/24/2001	Class 1	21
	53	SLL7A	9/25/2001	Class 1	25
	54	SLL7B	9/25/2001	Class 1	21
	55	SLL7C	9/25/2001	Class 2	35
	56	SLL8A	9/25/2001	Class 2	24
	57	SLL8B	9/25/2001	Class 3	33
	58	SLL9B	9/25/2001	Class 2	42
	59	SLL9C	9/25/2001	Class 2	32
	60	SLL10A	9/25/2001	Class 2	32
	61	SLL10B	9/25/2001	Class 3	33
Total	61			142	2166
Average				2.33	35.51
			2005 & 2006 Results		
		Campsite ID	Date	Frissell Index	Condition Class Index
	1	GRLA1	7/15/2006	Class 5	49
	2	GRLA2	7/15/2006	Class 5	50
	3	GRLA3	7/15/2006	Class 3	39
	4	GRLA4	7/15/2006	Class 1	28
	5	GRLA5	7/15/2006	Class 5	56
	6	GRLA6	7/15/2006	Class 3	36
	7	GRLA7	7/15/2006	Class 1	24
	8	GRLA8	7/15/2006	Class 3	35
	9	GRLA9	7/15/2006	Class 3	30
	10	GRLA10	7/15/2006	Class 3	31
	11	GRLA11	7/15/2006	Class 1	22
	12	GRLA12	7/15/2006	Class 1	27
	13	CLC14	7/1/2006	Class 4	37
	14	MSC4	7/2/2006	Class 1	26

	15	MSC5	7/1/2006	Class 0	23
	16	MSC6	7/1/2006	Class 1	21
	17	MSC7	7/1/2006	Class 2	23
	18	MSC8	7/1/2006	Class 4	50
	19	MSC9	7/1/2006	Class 2	40
	20	MSC10	7/1/2006	Class 4	55
	21	MSC11	7/1/2006	Class 2	29
	22	MSC14	6/30/2006	Class 0	24
	23	MSC15	6/30/2006	Class 1	49
	24	MSC 17	6/30/2006	Class 2	35
	25	MSC18	6/30/2006	Class 1	21
	26	MSC19	7/1/2006	Class 1	21
	27	MSC20	7/1/2006	Class 1	26
	28	MSC21	7/1/2006	Class 1	21
	29	SSL6	8/11/2006	Class 1	20
	30	SSL8	8/11/2006	Class 1	20
	31	SSL9	8/11/2006	Class 1	22
	32	SSL12	8/11/2006	Class 1	21
	33	SSL14	8/11/2006	Class 4	48
	34	SSL15	8/11/2006	Class 3	38
	35	SSL16	8/11/2006	Class 4	39
	36	SSL17	8/11/2006	Class 4	30
	37	SSL18	8/11/2006	Class 4	30
	38	BSLA2	8/10/2006	Class 1	22
	39	BSLA3	8/10/2006	Class 1	20
	40	BSLA4	8/10/2006	Class 1	22
	41	BSLA5	8/10/2006	Class 1	20
	42	BSLA6	8/10/2006	Class 2	28
	43	BSLA7	8/10/2006	Class 1	27
	44	BSLA8	8/10/2006	Class 2	28
	45	BSLA10	8/10/2006	Class 3	30
	46	BSLA11	8/10/2006	Class 1	26
	47	BSLB1	8/10/2006	Class 2	28
	48	BSLB2	8/10/2006	Class 2	27
	49	BSLC1	8/10/2006	Class 4	36
	50	BSLC2	8/13/2006	Class 2	27
	51	SLL6A	8/23/2005	Class 1	21
	52	SLL6B	8/23/2005	Class 1	21
	53	SLL6C	8/23/2005	Class 1	20
	54	SLL7A	8/23/2005	Class 1	30
	55	SLL7B	8/22/2005	Class 1	24
	56	SLL7C	8/22/2005	Class 2	36

	57	SLL8A	8/23/2005	Class 1	21
	58	SLL8C	7/28/2005	Class 5	50
	59	SLL9B	8/23/2005	Class 2	41
	60	SLL9C	8/23/2005	Class 2	29
	61	SLL10A	8/23/2005	Class 1	21
	62	SLL10B	8/23/2005	Class 2	31
Total	62			127	1882
Average				2.05	30.35

APPENDIX C

INTERVIEW RESULTS

	AREA	DATE	TYPE	VALLEY	PARK	NOTES
1	MOOSE	6/29/2006	OVERNIGHT	NO	NO	
2	MOOSE	6/29/2006	OVERNIGHT	NO	NO	
3	MOOSE	6/30/2006	OVERNIGHT	NO	NO	
4	MOOSE	6/30/2006	OVERNIGHT	NO	NO	
	MOOSE	7/1/2006				NO CONTACTS MADE
5	MOOSE	7/2/2006	DAY	YES	NO	
6	MOOSE	7/2/2006	DAY	YES	NO	
7	MOOSE	7/2/2006	DAY	YES	NO	
8	MOOSE	7/2/2006	DAY	YES	NO	
9	MOOSE	7/2/2006	DAY	YES	NO	
10	MOOSE	7/2/2006	DAY	YES	NO	
11	MOOSE	7/2/2006	DAY	NO	NO	
12	MOOSE	7/2/2006	DAY	NO	NO	
13	MOOSE	7/2/2006	DAY	YES	NO	
14	MOOSE	7/2/2006	DAY	YES	NO	
15	MOOSE	7/2/2006	DAY	NO	NO	
16	MOOSE	7/2/2006	DAY	NO	NO	
17	MOOSE	7/2/2006	DAY	YES	NO	
	GRN MTN	7/13/2006				NO CONTACTS MADE
	GRN LAKE	7/14/2006				NO CONTACTS MADE
18	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
19	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
20	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
21	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
22	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
23	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
24	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
25	GRN LAKE	7/15/2006	DAY	NO	NO	CLIENT
26	GRN LAKE	7/15/2006	DAY	YES	NO	GUIDE
27	GRN LAKE	7/15/2006	DAY	YES	NO	GUIDE
28	GRN LAKE	7/15/2006	OVERNIGHT	NO	NO	
29	GRN LAKE	7/15/2006	OVERNIGHT	NO	NO	
30	GRN LAKE	7/15/2006	DAY	NO	NO	
31	GRN LAKE	7/15/2006	DAY	NO	NO	
32	GRN LAKE	7/15/2006	DAY	NO	NO	
33	S LEIGH CREEK	7/16/2006	DAY	NO DATA	NO	
34	S LEIGH CREEK	7/16/2006	DAY	NO	NO	
35	S LEIGH CREEK	7/16/2006	DAY	NO	NO	
36	S LEIGH CREEK	7/16/2006	DAY	NO	NO	
37	S LEIGH CREEK	7/16/2006	DAY	NO	NO	
38	S LEIGH CREEK	7/16/2006	DAY	NO	NO	
39	S LEIGH CREEK	7/16/2006	OVERNIGHT	YES	NO	
40	S LEIGH CREEK	7/16/2006	OVERNIGHT	YES	NO	
41	S LEIGH CREEK	7/16/2006	OVERNIGHT	YES	NO	
42	S LEIGH CREEK	7/16/2006	OVERNIGHT	YES	NO	

INTERVIEW RESULTS CONTINUED

	AREA	DATE	TYPE	VALLEY	PARK	NOTES
	S LEIGH CREEK	7/17/2006				NO CONTACTS MADE
43	SOUTH TETON	7/27/2006	DAY	YES	NO	2ND HOME RESIDENT
44	SOUTH TETON	7/27/2006	DAY	YES	NO	2ND HOME RESIDENT
45	SOUTH TETON	7/27/2006	DAY	YES	NO	2ND HOME RESIDENT
46	SOUTH TETON	7/27/2006	DAY	YES	NO	2ND HOME RESIDENT
47	SOUTH TETON	7/27/2006	DAY	NO	NO	
48	SOUTH TETON	7/27/2006	DAY	NO	NO	
49	SOUTH TETON	7/27/2006	DAY	YES	NO	
50	SOUTH TETON	7/27/2006	DAY	YES	NO	
51	SOUTH TETON	7/27/2006	DAY	NO	NO	
52	SOUTH TETON	7/27/2006	DAY	NO	NO	
53	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
54	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
55	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
56	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
57	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
58	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
59	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
60	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
61	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
62	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
63	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
64	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
65	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
66	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
67	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
68	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
69	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
70	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
71	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
72	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
73	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
74	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
75	SOUTH TETON	7/27/2006	DAY	NO	NO	
76	SOUTH TETON	7/27/2006	DAY	NO	NO	
77	SOUTH TETON	7/27/2006	DAY	NO	NO	
78	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
79	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
80	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
81	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
82	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
83	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
84	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
85	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
86	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	

INTERVIEW RESULTS CONTINUED

87	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
88	SOUTH TETON	7/27/2006	DAY	NO	NO	
89	SOUTH TETON	7/27/2006	DAY	NO	NO	
90	SOUTH TETON	7/27/2006	DAY	NO	NO	
91	SOUTH TETON	7/27/2006	DAY	NO	NO	
92	SOUTH TETON	7/27/2006	DAY	NO	NO	
93	SOUTH TETON	7/27/2006	DAY	NO	NO	
94	SOUTH TETON	7/27/2006	DAY	NO	NO	
95	SOUTH TETON	7/27/2006	DAY	NO	NO	
96	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
97	SOUTH TETON	7/27/2006	OVERNIGHT	NO	NO	
98	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
99	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
100	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
101	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
102	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
103	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
104	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
105	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
106	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
107	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
108	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
109	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
110	SOUTH TETON	7/28/2006	DAY	NO	NO	
111	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
112	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
113	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
114	SOUTH TETON	7/28/2006	OVERNIGHT	NO	NO	
115	SOUTH TETON	8/9/2006	DAY	NO	YES	
116	SOUTH TETON	8/9/2006	DAY	NO	YES	
117	SOUTH TETON	8/9/2006	DAY	NO	NO	
118	SOUTH TETON	8/9/2006	DAY	NO	NO	
119	SOUTH TETON	8/9/2006	OVERNIGHT	NO	NO	
120	SOUTH TETON	8/9/2006	OVERNIGHT	NO	NO	
121	SOUTH TETON	8/9/2006	OVERNIGHT	NO	NO	
122	SOUTH TETON	8/9/2006	OVERNIGHT	NO	NO	
123	SOUTH TETON	8/9/2006	OVERNIGHT	NO	NO	
124	SOUTH TETON	8/9/2006	OVERNIGHT	NO	NO	
125	AK BASIN	8/10/2006	OVERNIGHT	NO	YES	
126	AK BASIN	8/10/2006	OVERNIGHT	NO	YES	
127	AK BASIN	8/10/2006	OVERNIGHT	NO	YES	
128	AK BASIN	8/10/2006	OVERNIGHT	NO	YES	
129	AK BASIN	8/10/2006	OVERNIGHT	NO	YES	
130	AK BASIN	8/10/2006	OVERNIGHT	NO	YES	
131	AK BASIN	8/10/2006	OVERNIGHT	YES	NO	
132	AK BASIN	8/10/2006	OVERNIGHT	NO	NO	
133	AK BASIN	8/10/2006	OVERNIGHT	NO	NO	

INTERVIEW RESULTS CONTINUED

134	AK BASIN	8/10/2006	OVERNIGHT	NO	NO	
135	AK BASIN	8/10/2006	OVERNIGHT	NO	NO	
136	AK BASIN	8/10/2006	OVERNIGHT	NO	NO	
137	AK BASIN	8/11/2006	OVERNIGHT	NO	YES	
138	AK BASIN	8/11/2006	OVERNIGHT	NO	YES	
139	AK BASIN	8/11/2006	OVERNIGHT	NO	NO	
140	AK BASIN	8/11/2006	OVERNIGHT	NO	NO	
141	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
142	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
143	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
144	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
145	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
146	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
147	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
148	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
149	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
150	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
151	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	YES	
152	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	NO	
153	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	NO	
154	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	NO	
155	SUNSET LAKE	8/11/2006	OVERNIGHT	NO	NO	
156	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
157	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
158	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
159	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
160	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
161	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
162	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
163	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
164	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
165	DEATH SHELF	8/12/2006	OVERNIGHT	NO	YES	
166	SOUTH TETON	8/13/2006	DAY	NO	NO	
167	SOUTH TETON	8/13/2006	DAY	NO	NO	
168	SOUTH TETON	8/13/2006	DAY	NO	NO	
169	SOUTH TETON	8/13/2006	DAY	NO	NO	
170	SOUTH TETON	8/13/2006	DAY	NO	NO	
171	SOUTH TETON	8/13/2006	DAY	NO	NO	
172	SOUTH TETON	8/13/2006	DAY	NO	NO	
173	SOUTH TETON	8/13/2006	OVERNIGHT	NO	NO	
174	SOUTH TETON	8/13/2006	OVERNIGHT	NO	NO	
175	SOUTH TETON	8/13/2006	OVERNIGHT	NO	NO	
176	SOUTH TETON	8/13/2006	DAY	NO	NO	
177	SOUTH TETON	8/13/2006	DAY	NO	NO	
178	SOUTH TETON	8/13/2006	DAY	NO	NO	
179	SOUTH TETON	8/13/2006	DAY	NO	NO	
180	SOUTH TETON	8/13/2006	DAY	NO	NO	
181	SOUTH TETON	8/13/2006	DAY	NO	NO	
182	SOUTH TETON	8/13/2006	DAY	NO	NO	