A Guide to Monitoring Encounters in Wilderness

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An Introduction to This Document

Documenting encounters among parties in wilderness is considered important to understanding how well a wilderness provides opportunities for solitude, one of the fundamental aspects of wilderness character to be protected under the Wilderness Act. Encounter monitoring has taken many forms when implemented in wilderness management programs. Within this guide to encounter monitoring, we attempt to represent the range of approaches available to the manager, from simple to complex. Readers should be aware that we will not cover every approach or consideration related to monitoring encounters. However, to provide a broad perspective, we spoke with managers engaged in encounter monitoring across a diversity of wilderness areas from big to small, from mountains to oceans, and from east to west. Researchers who have been involved in encounter monitoring were consulted, and the relevant literature was reviewed. We hope that in the following pages you will find the answers to your encounter monitoring questions, either for the improvement of an existing program or for the initiation of a new monitoring program.

The document begins with a discussion of what encounters are and why they should be monitored. It goes on to discuss basic issues in creating and implementing a monitoring program. This is followed by four case study examples that illustrate the diversity of approaches that can be used.

We should note that this document is specifically and only about monitoring encounters; it is not about monitoring all forms of visitor use, nor does it present other indicators that may be used for monitoring or measuring opportunities of solitude. We have focused solely on encounters here for those managers who find themselves with a requirement to monitor encounters or for those who would like to explore whether encounters is an appropriate indicator of desired wilderness conditions.

An Introduction to Encounter Monitoring

What Is Encounter Monitoring?

An encounter – in the broadest conceptualization – occurs when a person or group becomes aware of the presence of another person or group within the wilderness. This definition is purposefully vague in order to capture the range of possible options for what "counts" as an encounter. The encounter involves awareness – typically seeing or hearing – as well as cognitive or affective reactions. To be useful to management, there is a need to be able to define the measurable aspects of encounters.

Encounters have predominantly been categorized into two types: 1) encounters between groups while traveling, and 2) encounters with other groups while a party is at a campsite. These two encounter types, traveling and camping, can be operationalized and measured in a variety of fashions. However, all encounter monitoring takes place within a specified area during a prescribed period of time (Shelby & Heberlein, 1986).

Aggregate data for an area can be summarized as frequencies (e.g., the percent of days with different levels of encounters) or averages (e.g., the average number of encounters at a location on weekdays). These encounter rates can then be compared to a standard, if one has been specified in a wilderness (or other land management) plan. Or, if no standard exists, the data can become an inventory that can be used to assess change over time. (Note: this document does not address issues involved in setting standards; there are several other publications and tools on wilderness.net that address standards.)

For your encounter monitoring program to be successful, it is necessary to accomplish several different tasks:

- Define the purpose of your monitoring.
- Identify the type of encounters you will be monitoring.
- Explain and document how you will go about measuring and collecting encounter data in a systematic way.
- Decide how you will manage your encounters data.
- Understand how you will analyze your data.

We consider each of these topics in the sections below and provide guidance on how best to approach them for your specific wilderness and needs.

QUICK POINTS:

- Encounters have at least three components: location, unit of analysis (for example, group or individual), and time (the period within which contacts occur and also the length of the contact)

  (Source: Shelby & Heberlein 1986)

Where Did the Concept of Encounters Come from?

The conceptual side

Early research in wilderness focused on measuring the amount of use, or what is called "use density," in relation to crowding and carrying capacity (Cole, 2001; Stankey & McCool, 1984). Tracking use density has provided important insights into how recreational use levels and activity types have changed over time. However, researchers soon recognized that use density itself does not

directly affect visitors' experiences – one has to be aware of other visitors for there to be an impact. As an example, a place with 100 visitors who all disperse to different locations will offer a much greater opportunity for solitude than another place where 100 visitors are all confined within a small area.

Therefore, encounters between groups have been the subject of study for some time in wilderness and other settings. Logically, it seems that the more other groups or people one encounters, the more likely one is to feel crowded and the lower the opportunities for solitude. On the basis of this reasoning, many wilderness managers have adopted encounters as an indicator for "outstanding opportunities for solitude" and have established standards that should not be exceeded.

The empirical research on ***the relationship between encounters and experience quality has generated complex and sometimes mixed results***. Many studies have identified encounters as a salient part of wilderness users' experience and satisfaction.

- Stankey (1980) found that over 65% of visitors to the Desolation and Spanish Peaks Wildernesses would prefer to meet no other groups during the day.
- Brown and Haas (1980) found that, of forty items tested, "being away from crowds" had the highest overall rating on a scale measuring contribution to satisfaction.
- Among Shining Rock Wilderness visitors, "too many people in certain places" was rated as the second most severe among ten social problems that people might have noticed on their trips (Cole, Watson, & Roggenbuck, 1995).
- In a study of wilderness and backcountry visitors to Shenandoah National Park, Hockett and Hall (1999) found that nearly half of all respondents said that "many other visitors on the trails" detracted from their trip quality, and issues related to encounters were rated as among the factors having the most negative effect on trip quality.
- In a qualitative interview study of Shenandoah visitors, Hall (2001) reported that 68% of people who said they had experienced solitude attributed this to seeing few or no other visitors, while 62% of those who said they did not experience solitude said it was because of seeing many other visitors.
- Among Grand Canyon backpackers, 80% reported that crowding increased as the number of encounters increased, and 77% reported that feelings of solitude declined with an increase in encounters (Stewart & Cole, 2001).
- Overnight wilderness users at Denali National Park reported that encounters at camps and while hiking had a large influence on overall trip experience (Lawson & Manning, 2002), and 75% said they would prefer management that protects solitude over management that protect visitor freedom.
- Cole and Hall (2008) reported that Pacific Northwest wilderness visitors are highly motivated to be "away from crowds" and to experience a sense of solitude. People who visited very high use locations were less able to find solitude on their trips than visitors to moderate use locations.
- Overall, the majority of visitors support policies that would manage for solitude along either a few wilderness trails or on most wilderness trails (Cole & Hall, 2008; Hockett & Hall, 1999).

However, research has also shown that encounters may exhibit a weak relationship with overall experience quality, or sometimes no relationship at all (Stankey & McCool 1984; Cole 2001). For instance, in their study of visitors to 13 wildernesses, Cole and Hall (2008) reported that a majority of people said they noticed "large numbers of day users," "uncontrolled dogs," "inconsiderate behavior by others," and "large groups," but rated these as only slight problems. In examining the effect

of reported encounters (number of groups encountered) on people's sense of solitude, they found the expected negative relationship, but it was very weak. Similarly, Stewart and Cole (2001) found a negative but weak relationship between encounters and solitude: their analysis calculated that "solitude/privacy achieved would decrease about 50% on average if encounters increase from 1 to 28 per day or from 4 to 40 per day."

In general, research shows that encounters have a greater effect on perceived crowding than on other aspects of experience quality (Shelby & Heberlein 1986); however, even this effect is not always pronounced. A summary of research prior to 1990 showeed that encounters explained less than 10% of the variation in perceived crowding (Kuss, Graefe, & Vaske, 1990). The low correlation may be due in part to individual differences in orientation toward solitude (Manning, Valliere, Minteer, Wang, & Jacobi, 2000; Stankey & McCool, 1984) and the fact that many other factors (weather, scenery, etc.) affect the experience. Cole (2001) concludes that encounters may affect the *nature* of the experience more than the *quality* of the experience.

Nevertheless, if the "outstanding *opportunity* for solitude" is conceived as an important setting attribute, as has been suggested by researchers and managers, then encounters may remain the best indicator currently available, despite the weak relationships demonstrated in some empirical research (Cole, 2004). It should be understood that solitude is a complex cognitive state, and an indicator is a narrow, measurable attribute of a larger phenomenon that can be assessed to determine whether management goals are being met (Smyth, Watzin, & Manning, 2007; Watson et al., 2007).

The practical side

Encounters have been conceptualized in different ways. Most research has measured the number of other groups and/or people encountered per day (e.g., Hammitt, McDonald, & Noe, 1984; Manning & Ciali, 1980; Watson, Cronn, & Christensen, 1998) which assumes that all encounters are equal in their effects. However, others have focused on the percent of time during which people were in contact with others, which takes into account both the number and duration of encounters. For example, Shelby et al. (1987) posed questions in terms of the percentage of time boaters spent in sight of other boaters while on the river and the percentage of nights spent camped within sight or sound of another group. Others have focused on the duration of time between encounters, because some research has shown that long blocks of time alone provide solitude, even if a person has many encounters during other portions of a wilderness trip (Hall 2001). When designing your encounter monitoring program, you need to ***carefully consider which way of measuring encounters makes the most sense for your situation.***

Research studies have highlighted a number of dimensions that have an impact on how people evaluate encounters, including the number, type, and location of encounters (Manning et al. 2000). As discussed above, the number of encounters (or total time in sight of others) can detract from feelings of solitude. Evidence also suggests that encounters at campsites are evaluated much more negatively than encounters on trails (Hockett & Hall 1999). For example, Stankey (1980) found that over 75% of visitors preferred not to camp near anyone else. For this reason, it is ***recommended that encounter monitoring programs track both traveling and camp encounters***.

A number of characteristics of the group encountered have been explored in surveys, including the size of the group, mode of travel, and behavior of its members (e.g., Lime, 1977; Shelby, 1980; Stankey, 1980; West, 1982). In general, small groups have less of an impact than large groups; similar mode of travel is less impactful than different modes; and disruptive or distasteful behavior is more important to

users than the actual number of encounters (Manning et al. 2000). Given the importance of these factors to visitors, ***designers of monitoring systems should strive to incorporate them as variables measured***.

The information and insights obtained from research on encounters have been well summarized in a number of review articles and texts:

- Graefe et al. (1984) report on 15 studies of reported encounters and two studies of actual encounters.
- Stankey and McCool (1984) provide a historical overview of carrying capacity research in wilderness prior to 1984. They introduce the Limits of Acceptable Change as an alternative to carrying capacity.
- Shelby and Heberlein (1984) provide a framework for understanding and approaching carrying capacity determination.
- Manning (1985) gives an early review of crowding norm research in backcountry settings.
- Shelby and Heberlein (1986) discuss six different studies of river recreation and hunting. They explore the relationships between use, encounters, satisfaction, and crowding. They present a useful discussion of the descriptive vs. evaluative aspects of setting standards.
- Shelby, Vaske, and Heberlein (1989). compare fifteen years of crowding research from a variety of settings, including wilderness.
- Manning (1999) provides a comprehensive review of the literature for carrying capacity, crowding, the normative approach to indicators and standards, and more.
- Though not specific to wilderness, Manning et al. (2000) give a good overview of research on crowding, indicators and standards for experience quality, and related management issues.
- Stewart and Cole (2001) report detailed research on the relationship between encounters, crowding, and solitude/privacy among Grand Canyon backpackers.
- Cole (2001) provides a review of the historical research on visitor use density and its effect on experience quality. There is a nice discussion about the value-laden nature of management decisions related to visitor use management.
- Vaske & Donnelly (2002) summarize 13 different studies reviewed for the relationship between encounter norms and crowding
- Cole and Hall conducted a series of studies of high use destinations in Pacific Northwest wildernesses, much of which focused on understanding the impact of use on experience quality. Some of the studies looked specifically at encounters and solitude (Cole & Hall, 2005, 2006, 2008; Hall & Cole, 2007).

Why do Encounter Monitoring?

The Wilderness Act in Section 2(c) states that wilderness "has outstanding opportunities for solitude or a primitive and unconfined type of recreation." Further, Section 2(a) directs that wildernesses "shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness." Encounters can be one indicator that managers can measure over time to assess compliance with these policy mandates.

It is important to note that the Act specifies that wilderness will provide outstanding *opportunities* for solitude, as opposed to guaranteeing that visitors will have an actual experiences of solitude. We know that individual experiences of solitude are complex and affected by a variety of different factors, including one's own group size and dynamics (Hall 2001; Manning et al. 2000), one's comfort with and motivation to be alone(Hollenhorst, Frank, & Watson, 1994), or different ways that people cope with and rationalize going to crowded locations (Hall & Cole, 2007; Johnson

& Dawson, 2004). However, by managing setting attributes such as trail development level, protecting remote undeveloped areas, ensuring low use densities, and the like, managers can provide *opportunities* for visitors to seek out these areas and experience solitude if they choose.

QUICK POINTS:

- The Wilderness Act mandates management for *outstanding opportunities for solitude.*
- Encounters may be an indicator with defined standards within your management plan.
- Encounters may be an indicator as part of a standards-based management approach (i.e., LAC or VERP).
- For Forest Service units, encounter monitoring can be part of the Chief's 10-year Wilderness Stewardship Challenge (Elements 5 and 8).
- Encounters can be used as part of a wilderness character monitoring program to assess change over time.

The number of encounters among groups may be identified within a land management plan or a specific wilderness management plan as a social indicator, for which standards have been specified. This is often associated with a standards-based management approach such as the Limits of Acceptable Change (LAC) or Visitor Experience and Resource Protection (VERP). In these approaches, desired conditions are described and indicators are identified to measure the attainment of these conditions. Standards for indicators are set to trigger management actions. For example:

- the Frank Church River of No Return Wilderness management plan contains this language: "usually encounters with other groups will be less than 6 parties per day encountered on rivers and trails and less than 3 other parties visible at campsites" (U.S. Forest Service, 2003).
- The management plan for the Pasayten Wilderness directs that in pristine zones "there should be at least an 80% probability of not more than one encounter per day between groups during all use periods. Campsites should not be visible (within 500 feet) or audible from any other camp site." In transition zones the Pasayten plan increases the allowable number of encounters while traveling to a maximum of 7 groups and specifies 2 or fewer occupied campsites visible or audible from any campsite (U.S. Forest Service, 1998b).
- The management direction for the Lee Metcalf Wilderness outlines three opportunity classes within the wilderness. The "number of trail encounters with other parties" is identified as an indicator and the standard is presented as an 80% probability of encountering 0, fewer than 3, and fewer than 15 other parities in the respective zones. The "number of other parties camped within sight or continuous sound" also has standards set by zone of 0, fewer than 2, and fewer than 4.

Having standards like these necessitates some type of monitoring program to assess whether specified areas comply with direction set by the plan. What degree of monitoring is necessary for assessment depends on many factors that may be unique to an individual area. However, if it is probable that there are areas where crowding is an issue, standards are likely being exceeded, and management actions are likely to be taken, then adopting a more rigorous monitoring program would be appropriate to develop defensible data. (See the Obsidian Falls case study.) However, managers have pointed out that once an area has been thoroughly documented as being well above standard, it is not necessary to continually invest a high degree of monitoring effort to repeatedly establish what is by then known. For instance, in the Snow Lake area of Alpine Lakes Wilderness in Washington, hundreds of visitors

travel a short 3-mile trail to the lake and back on any given weekend day in the summer. It takes very little monitoring in a case like this to establish that a standard such as "no more than 12 groups encountered per day" is being exceeded.

On the other hand, in areas where conditions are well within standards, a thoughtful monitoring program can be designed to track changes in conditions over time, but would likely not require the time and resources of the previous situation. For instance, in a low-use wilderness, a manager might decide to monitor encounters only on the highest use trail, reasoning that if standards are not exceeded there, then they are unlikely to be exceeded anywhere else in the wilderness. Or, if there were a situation in which the wilderness plan specified that there should be no more than 10 encounters per day in any given zone, and the manager knows from observation or some other data that there are never more than 10 vehicles parked at the trailhead, it would be unnecessary to monitor encounters themselves. (Logic indicates that if fewer than 10 vehicles are present at any one time, the number of encounters between groups will certainly be less than 10.) However, it is still important to document such reasoning and evidence.

It is those areas that are continuously close to exceeding standards that may be the most challenging to monitor. There is no easy answer here; however, a well designed monitoring program will save time and effort in the long run, and lead to the most useful analysis. The Desolation example provides a useful case of a staged approach that uses triggers to implement more intensive monitoring.

Even if you don't have a management plan in place, you may decide to monitor encounters as part of a process of monitoring wilderness character. Recent national guidance for all of the wilderness management agencies has emphasized the mandate to protect wilderness character, a cornerstone of which is outstanding opportunities for solitude (Landres et al., 2008; Landres et al., 2005). Such a focus complies with law, helps fulfill agency policy, and can lead to improved wilderness stewardship.

Monitoring encounters can also help improve wilderness stewardship. Even if no specific indicator has been identified via a planning process, understanding the trends in encounters can help you identify where problems might occur and determine when additional monitoring or management action may be required.

One example of how encounter monitoring data helped improve stewardship comes from Mt. Jefferson Wilderness (Oregon). Over a period of two years, rangers recorded which campsites in a subalpine lakes basin were occupied each night. The data told managers that visitors were often camping within sight or sound of other campers. But equally important, the data showed that only a small percentage of the campsites was used each night. The monitoring data informed managers about how many campsites were actually necessary to accommodate current demand, as well as which campsites were the most popular. This information was used to develop a designated site camping policy that maximized opportunities for camping solitude, as well as enhancing resource protection through site closures and restoration.

Creating Your Encounter Monitoring Program

What is the Purpose of Your Encounter Monitoring Program?

QUICK POINTS:

- Monitoring can be done to assess whether conditions are within standards.
- Monitoring may serve as an inventory to track trends.
- Think through each part of your encounter monitoring program during the design phase:
  - What is the purpose and how will the data be used?
  - How will data be collected?
  - How will you manage your data?
  - What type of analysis will you do?
  - How will you report your findings?

Whether you are improving or evaluating your current encounter monitoring program or designing an entirely new system, it is important to consider each element of the program before data collection begins. This will help ensure you have not wasted your effort or forgotten some essential element. Seasons of data can be lost when, during analysis, it becomes apparent that the data were not collected in a way that allows the individual observations to be aggregated or permits comparison to a standard. For example, if standards are different for different opportunity class zones, but data are not collected separately in each type of zone, the data could not be used to assess compliance with standards. (See the Desolation and Clifty case studies for a good example of zoning's effect on data collection.) It could also become apparent that sufficient data were not collected in an area to permit the quality of analysis congruent with the need to make a tough management decision.

These and other problems can be avoided by starting with careful consideration about your purpose for monitoring encounters. Purposes range from simply collecting encounter rates for a wilderness in order to establish a base line and track trends over time to using encounters data as part of a decision making process with the potential for controversial management actions. The intended purpose should guide the other elements of your encounter monitoring program: data collection, data management, and data analysis.

Common Purposes for Encounters Monitoring

- The number of encounters is an indicator in a land management or Wilderness management plan, with associated standards for maximum acceptable encounter rates.
- Encounters will be used to inform a management decision. This decision could range from routine and benign (e.g., increased ranger patrols) to complex or controversial (e.g., camping restrictions or use limits).
- Encounter data are used as an indicator to track opportunities for solitude as part of a wilderness character monitoring effort.
- For the Forest Service, in addressing elements 5 and 8 of the Chief's 10 Year Wilderness Stewardship Challenge, encounters may be chosen as an indicator.

To help wilderness managers think through the purpose guiding the monitoring program, we present the sliding scale of analysis tool (Figure 1) developed by The Federal Interagency Task Force on Visitor Capacity on Public Lands (see Haas, 2002, pp. 29-31). There are three levels of analysis proposed by the sliding scale, which

increase in complexity and consequence from Level 1 (the fewest likely changes and least impactful consequences) to Level 3 (the most changes to management with significant consequences). The level of rigor – things like type of sampling and amount of data – increases accordingly. As can be seen in the diagram, the elements contained in the large arrow on the left increase in relation to one another as the corresponding level of analysis increases. The smaller black arrows denote the levels of analysis proposed and the suggested managerial purpose of each. The levels of analysis are also plotted against time and communicate that more time is involved as analysis increases.

Deciding where your wilderness area and its issues fit within this model can help in determining the rigor necessary in an encounters monitoring program. It also becomes apparent that not all encounters monitoring programs should be the same. A remote wilderness with few encounters that does not have a standard and is monitoring encounters for purposes of tracking wilderness character (Level 1) does not require the same level of analysis as a wilderness area with a standard for encounters which is consistently exceeded and whose only resolution is to implement management actions which are anticipated to be controversial (Level 3).

Clearly defining the purpose for which your program is monitoring encounters will enable the development of field protocols that can generate the right type and amount of data to allow you to address the purpose adequately.

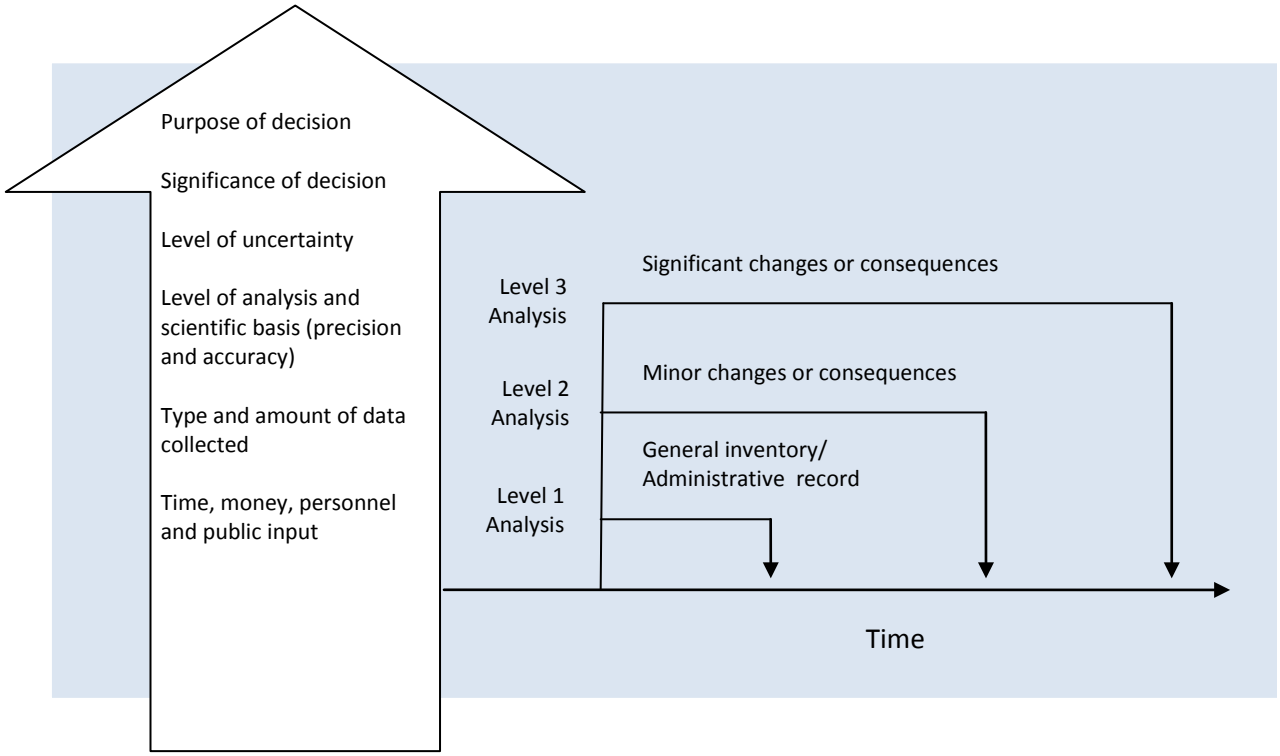

Figure 1. Sliding Scale of Analysis Tool (Haas, 2002, pp. 29-31)

Thinking about Encounters and How to Measure Them

Monitoring for any aspect of wilderness character requires developing specific indicators, which can be measured in a reliable way by different field staff. You need to be confident that any trends or tendencies that you identify are real, and not just an artifact of different people collecting data in different ways. Moreover, if you do have a standard specified in a plan, you need to be sure that you collect the data in a way that can accurately be applied to that standard. For instance, if a standard specifies that a visitor should be in sight of other visitors no more than 80% of the time, data would have to record the duration of encounters in addition to the number of encounters. However, if a standard specifies that visitors should have no more than 10 encounters with other groups on 80% of days, no additional information is needed about each encounter beyond the number of encounters.

QUICK POINTS:

- There are many variations for measuring encounters.
- The measure(s) should be tailored to be right for your program; there is no one size fits all solution.
- However, there is much to learn from others efforts in how you compose your measure of encounters.
- Different measures measure different things, so know what you are measuring.

Because of these considerations, many different definitions of encounters have been developed for monitoring. The most common are:

- Number of groups encountered per day (regardless of location)
- Number of individuals encountered per day (regardless of location)
- Number of groups encountered specifically on trails or rivers per day
- Number of occupied camps in sight or sound of a camping party

Other encounter measures which have been utilized to a lesser extent, but may be appropriate are:

- Percent of time in sight of others (or duration of time not in sight of others)
- Number of encounters between different types of visitors (e.g., hiker and horse groups; climbers and day hikers)
- Number of encounters with groups displaying problematic behaviors

There are also other measures which in a broad sense can be considered encounters, but do not measure the opportunity for solitude on a temporal and spatial scale that reflects the totality of a visitor experience traveling in a wilderness. For example people-at-one-time (PAOT) is a measure of the number of people present at one time at an attraction site, a lake shore or a waterfall for example. Persons-per-viewscape (PPV) measures the number of people that can be seen by the observer, for example along a 100 yard-stretch of trail (see Manning, 2007). These measures may be applicable for measuring crowding or even opportunities for solitude at an attraction site or busy location; however, they likely do not necessarily measure a larger opportunity for solitude experienced as visitors travel through the wilderness. For some high use wilderness destinations, PAOT or PPV might be a highly relevant indicator, and monitoring protocols could easily be developed.

By far the most common measurement of encounters within wilderness management programs is of “actual” encounters using trained observers as a surrogate for a visitor (most often this is an agency employee).

Observers record their own encounters as they travel in a manner similar to how a visitor would travel, though field duties may limit the ability of the observer to simulate the visitor travel patterns. These are considered actual encounters because they are witnessed by the recorder; however, this has been classified as an indirect technique because the measure captures encounters of the trained observer who is not an actual member of the visiting public (Watson et al., 1998). The advantage of this method is the validity of the measurement of actual encounters and the control of travel routes. Some disadvantages of this technique are the need to theorize the travel of a typical visitor and staff costs for observations. Staff costs can be reduced by scheduling normal work duties to coincide with encounter observations or by using trained volunteers.

It should be noted that there may be a difference between wilderness ranger reports of actual encounters and reports of actual encounters by field staff tasked solely with recording encounter observations. Wilderness ranger job duties may increase the number of group contacts and alter travel routes from that of the "typical visitor." However, these differences remain untested; wilderness ranger encounter rates have not been directly compared within the empirical research to those of other trained observers.

A direct measure of actual encounters is achieved by following a visitor party and noting the number of encounters they have during the day (Shelby & Heberlein, 1986; Watson et al., 1998). The advantage of this method is the high level of validity of the data; the observer can accurately document the encounters a visitor group has during a wilderness visit. There are three substantial disadvantages of this direct actual encounter measure. First, the inability to control visitor travel, both duration of stay and presence within the area of study, can lead to lost data points and reduce the overall sample size (for instance, if the shadowed visitors go outside the study area). Second, there are potential negative impacts on the experience of the group, if they are aware of the presence of the observer. Third, it can be cost prohibitive to devote enough staff days for adequate sampling. Though the direct actual encounter technique has been used as part of research studies, there are no reports of this technique being employed within the normal operations of a wilderness encounter monitoring program.

"Perceived" encounters reported by visitors have been another widely used measure primarily within research on subjects such as crowding, carrying capacity, experience quality, satisfaction, and solitude/privacy (Shelby & Heberlein, 1986; Stankey, 1980; Stewart & Cole, 2001; Watson et al., 1998). Post-visit surveys and visitor diaries have both been used to measure perceived encounters (Cole & Hall, 2008; Shelby & Heberlein, 1986; Stewart & Cole, 2001; Watson et al., 1998). Our interviews with managers also showed that perceived encounters have been used in some instances to collect encounter data when contacting visitors. For example, rangers may ask visitors to recall how many encounters they had during the course of their hike.

Data from visitors are referred to as "perceived encounters" because they capture the encounters a visitor recalls or notices, rather than the observations of a trained observer whose purpose is to carefully record encounters. Shelby and Heberlein (1986) reported that visitors are accurate in recalling encounters if they number less than four to six, at which point they begin to underestimate actual encounters. Thus, visitor reports of encounters (perceived encounters) and observer recorded encounters (actual encounters) are not the same measure, and caution should be used in grouping the data together for analysis. However, the applicability of perceived encounters to assessing opportunities for solitude should not be discounted. It could be argued that the encounter rates noticed by visitors are more salient to the experience of solitude in an area

than those counted by observers. However, the administrative process necessary in order to survey visitors would make regular use of this measure burdensome. (There are requirements for approving surveys through the Office of Management and Budget.)

Many encounter measures utilize the "group" as a unit of measurement, though most protocols also document the number of individuals in the group. Although it seems intuitive what a group is, in practice many details pop up to complicate the reliability of measuring a group. The definition of a group within the realm of encounter monitoring has been described as a party consisting of one or more people (Hall & Shelby, 1994; Shelby & Hall, 1992; U.S. Forest Service, 2007; Watson et al., 1998). However, just how this group must function or relate to other visitors to count as one encounter is often not expressly addressed. For example, if a party that arrived together becomes divided during the day into three subgroups, separated by one-half mile, each of which is encountered by the observer, how are they to be counted? Does this constitute one encounter, or three separate encounters? Or, if two different groups happen to be hiking within speaking distance of each other, should they be counted as one group or two groups by the observer? How specifically such issues are resolved may be less important than clearly articulating all relevant decision rules, so that data from different observers are compatible. For example, *The Bob Marshall Wilderness Complex LAC Monitoring Guidebook* (U.S. Forest Service, 2007, pp. 17-18) gives direction to employees for how to record encounters when faced with the previous two situations posed here:

> "A party is a group of people readily recognized as traveling together. There should be no more than 1/8 mile and/or 15 minutes between the first and last members of the party. If in doubt as to whether parties are associated and traveling together, tally as separate encounters."

Because the goal of encounter monitoring is to provide a sense of the opportunities for solitude available to visitors, observers should record encounters from the perspective of a visitor. It is not pertinent whether a small group encountered is actually part of a larger group, though this may be of interest for other managerial reasons. Researchers and managers have at times chosen to monitor the number of individuals encountered, rather than the number of groups, due to difficulties distinguishing individuals' affiliations to others, especially in busy areas (Shelby & Heberlein, 1986). However, where possible, documenting each group encountered as well as the number of people in the group will provide the most flexibility for subsequent analysis.

The proximity a group must have to the observer in order to be counted as an encounter also differs amongst encounter monitoring protocols. Some programs count as an encounter any group that is seen no matter the distance from the observer, while others count only groups that are passed along a trail corridor. Watson et al. (1998), in a study on encounter monitoring measures, distinguished between cases when the observer passed within speaking distance, about 25 feet, and groups outside of speaking distance as separate categories of encounters. Other studies have addressed this issue by recording encounters on trail and off trail, the latter capturing the groups seen in the distance, which allows for analysis that lumps the data or treats each type independently (Shelby & Hall, 1992).

How to handle repeatedly encountering the same group during the day has been addressed by protocols within wilderness management plans. The question is whether encountering the same group multiple times should count a single encounter, or whether each time a group is seen should be documented as another encounter. One method is to record the encounter the first time a group is met as well

as each additional time, with a notation that the group had been seen before (Hall & Shelby, 1994; Shelby & Hall, 1992). This technique allows for analysis to examine both unique encounters and total encounters. Other management protocols, such as at Yosemite NP, only count groups the first time they are seen (Yosemite National Park, 2007). This may allow for simpler field data collection, but may limit the utility of the data. Total encounters may represent a truer picture of the opportunity of solitude being provided.

Different forms of a "leapfrogging rule" have been developed that address the time or distance that must elapse before an encounter with a group is counted again. Two protocols specified that 5 to 10 minutes must pass before counting a group again, unless continuously "leapfrogging" with the group. On the other hand, another management plan specifies 20 minutes or one mile must elapse before counting the same group between sightings (Hall & Shelby, 1994; Shelby & Hall, 1992; U.S. Forest Service, 2007).

The number of occupied campsites within sight and sound of a camped party is another common encounter measure. It simply documents how many other groups are camped within sight or continuous sound of a group's camp. Interviews revealed that, for some reason, this measure may become confused with other measures unrelated to encounters. It is not the same as campsite occupancy; that is, it is not the number of nights a campsite is occupied by a group (although the data can be used for determine occupancy rates). It is also not campsite condition monitoring, which measures the impacts to a campsite. Both of these are valuable elements for management to monitoring, but they are different indicators entirely. To measure "camping encounters" other occupied campsites are counted from the viewpoint of a campsite currently occupied by a visitor. It should be remembered that encounters while camped have been reported in the empirical literature to be more significant to visitors than encounters while travelling.

One issue relevant to occupied campsite encounters is the time of day in which data are recorded. In many locations, campers tend to arrive late in the day, and the best determination of campsite encounters would be made in early evening or early morning. Such considerations should be built into a monitoring program.

There is often interest in finding indirect measures that relate to encounters, because it can be time consuming and expensive to collect encounter data. To further this aim, correlations between visitor use numbers and encounter rates have been examined in the empirical research literature. Watson et al. (1998) examined the relationship between four indirect predictors of wilderness encounter estimates (mechanical counts, car counts, groups entering, individuals entering) for both number of encounters reported by visitors and encounters as measured by trained observers. The variation explained by the indirect predictors exceeded 90% in the more heavily used locations; however, there was a decrease in predictive power for areas with the least use. Watson et al. concluded that all four indirect predictors used in this study can be successful in predicting encounter rates in some locations.

However, it should be noted that Watson et al. studied a small, contained use area; hence relationships would be expected to be stronger than in other settings with more complexity. Indeed, for other types of settings, Shelby and Heberlein (1986) found much lower correlations. Due to the variably or uniqueness of use patterns in individual areas it is likely that the relationship between an indirect measure and encounters would need to be assessed for each location. This could be a laborious process and may reveal weak relationships that invalidate the approach. In such cases, recording perceived or actual encounters may be the only valid option.

To summarize this discussion of encounters as a measure, it is apparent that there are many variations of the encounter measure that have been and are being used. There is no one measure that is best for all wilderness areas. In the previous section we discussed thinking about the purpose of your encounters program. This purpose should help you select an encounter measure or measures that will best capture the opportunities for solitude being provided within your wilderness. Again the two most common encounters measures are of the number of encounters while traveling and encounters while camped. We would encourage measures of encounters that are specific and reliable, while capturing the most holistic picture of the opportunities for solitude being provided.

Collecting Data on Encounters

Now that the purpose of your encounter monitoring program has been decided and the general type of encounters have been identified, it is time to go out and collect the data. It is at this point in the process that many details are decided. From talking to managers, it quickly becomes apparent that there are many details that arise once data collection begins. Therefore, it can be helpful to pilot test your protocol prior to fully implementing it.

QUICK POINTS:

- Have a good protocol.
- Pilot your protocol and make necessary changes.
- Choose your approach to sampling: opportunistic, purposeful, simple random, or stratified random.
- Think about how you will standardize your observations for comparison during analysis.
- Consider how to best utilize scarce resources.

Developing a detailed protocol for the collection of encounter data is critical. It is important to have a clear, explicit protocol that tells staff what to do in different situations. As you specify decision rules for handling different circumstances, this restricts data collectors' abilities to deal with unique situations, but it makes the data more comparable. Only by having encounter data collected in a consistent way by all observers will the data be reliable for analysis. For example, if one employee is counting all the groups he sees – whether they pass him on the trail or he sees them on a distant ridge top – while another employee counts only the encounters she has with groups that pass her on the trail, the data will not be comparable. In fact, each observer is using a different measure of encounters, and the data could not be pooled for analysis.

In our interviews, several managers stressed the need to train employees, but also to listen for circumstances that occur that do not fit into the protocol and use these for further refinement and adaptation of the protocol. Managers have identified several attributes that need to be defined in the protocol; these include the following (remember there are no single "right" answers to these questions, though there may be "wrong" ones):

What is an encounter? Spell it out in detail and then review how it works in the field.

- What about multiple encounters with the same groups, either on a single day or on different days?
  - Others have: either recorded only the first encounter or recorded each additional encounter with the same group with the notation "seen before." Generally, a group is recorded every day that it is encountered.
- How do you deal with groups seen in the distance vs. passed on the trail?
  - Others have: recorded every group seen; only recorded groups passed

on the trail; recorded both, but noted a difference between groups that pass close to the observer and those in the distance.

- How do you deal with high use destination sites where people congregate?
  - Others have: used people-at-one-time (total people seen); used persons-per-viewscape; recorded these as they would groups they passed on the trail.
- How do you deal with the situation when the observer passes groups camping?
  - Others have: recorded encounters while camped (occupied campsites visible from a group's camp) as a separate measure of encounters; recorded this as a normal encounter from the perspective of the observer; not recorded this as an encounter.
- What should you do if you encounter a group while deviating from a "normal" travel pattern, for example leaving the trail to go check campsites?
  - Others have: recorded this as an encounter; not recorded this as an encounter.

Where do you collect data?

Hopefully you have a good feel of how visitors use your wilderness. Generally there are logical destinations and points where use changes dramatically. It makes sense to record encounters separately for each zone. These logical geographic and use zones may correspond to pre-existing Wilderness Opportunity Class zones, but often Opportunity Class zones are too large for the type of analysis you want to do related to encounters (because they may include both high and low use destinations within a single zone). Therefore, many protocols further refine the areas for logical analysis within pre-existing Opportunity Classes.

Zones may include trail corridors, destination sites, off-trail locations, etc. The important point is to create zones that are large enough for logical analysis (e.g., more than a segment of trail that is only 0.5 miles long) but that tend to have uniform use patterns within them. For example, if there is a 2-mile trail to a popular lake, it may make sense to include the trail and the lake as one zone. If a low use trail takes off from the far end of the lake and climbs to a viewpoint, that might logically be its own zone. If there are large expanses of impenetrable vegetation with no trails, each such block might be its own zone.

It is important to record encounter data separately by zone. This is especially true if the purpose of encounter monitoring is to compare to a standard that is different for different Opportunity Classes.

For example, the Bob Marshall Wilderness Complex has been divided into opportunity class zones with associated encounter standards and then further divided onto "GeoUnits" or logical geographic areas. The map in Figure 2 is carried by wilderness rangers while on patrol. The colors denote the opportunity class zones and the numbers indicate the GeoUnit. When a ranger crosses from one zone boundary to another a new encounter record is begun, so each zone's data are noted separately and can be analyzed independently.

How much data is enough?

This is a question that everyone asks. Unfortunately, the answer is not simple – there is no one size fits all prescription. What is an "adequate" sample size depends on many factors:

- How variable is use across time and space? Where use varies substantially across days of the week, you need more data. Similarly, if use varies spatially, you will need more data to characterize the wilderness as a

whole. However, if use is very uniform, fewer data points are needed.

- How confident do you want to be in the conclusions you base on the data? There is always some error associated with sampling a population; the more accurate you would like to be, the more sampling days are likely to be required. For instance, if the use season is 100 days, conclusions you would draw on a sample of 3 days are likely to be unreliable, and you might have had very different encounters on the three days. But if you sampled for 75 of the 100 days, you would be much more confident in conclusions you draw from the data.
- What is riding on the data? The more there is at stake, the more data you are likely to want before you draw conclusions and decide what actions might be required.

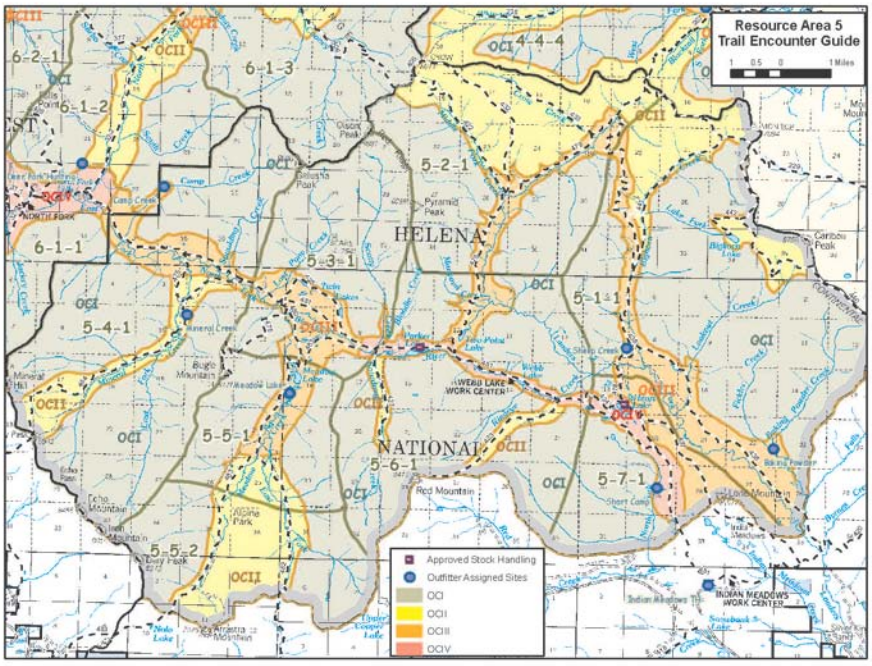

Figure 2. Opportunity Class Zone and Geographic Unit Map Bob Marshall Wilderness Complex

In the case studies at the end of this document, you will see a range of approaches to sampling. The Obsidian Falls example gathered approximately 100 days of encounter data over two years for one location. On the other hand, the Desolation Wilderness protocol requires collecting data on only 6 days per season for high use trails. Table 1 provides guidelines for sample sizes needed under different conditions, assuming that the margin of error would be 10%. The columns show different levels of confidence in the data (from 70% confidence to 90% confidence), while the rows show the percentage of time that encounters would exceed a given standard. For instance, if you thought your situation was one in which an encounter standard was exceeded about 20% of the time, and you wanted to be 80% confident in the results of your monitoring, you would need a sample of 27 days. On the other hand, if you suspect that encounters exceed the standard about half of the time, you would need a sample of 40 days to generate an estimate with 80% confidence. These sample sizes are the number of observation days you would need for each location you are monitoring.

As should be clear from the table, the sample size you need depends on whether you think you need to be highly confident, versus just pretty sure, as well as your guess about how often your conditions exceed your standard. Additionally, the sample size depends on what margin of error you are willing to accept – for instance, in the case where you expect that standards are exceeded 50% of the time, and you want to be 90% confident, a 10% margin of error requires a sample of 68. But allowing a margin of error of 20% would require a sample of only 17! There are many useful sample size calculators available on-line.

Table 1. Sample size requirements for 10% margin of error

Expected	Desired Confidence Level		
Distribution:*	**70**	**80**	**90**
20%	18	27	43
30%	23	35	57
40%	26	40	65
50%	27	40	68

* This is your best guess about the percentage of time that standards are exceeded.

What form of sampling should you use?

Sampling strategies for encounter monitoring range from random sampling to opportunistic or "convenience" sampling. Choose the method that meets your purpose while fitting with the resources available.

- Randomly selecting days and locations for monitoring provides the most rigorous approach and eliminates bias that may occur using other sampling methods. It may make sense to stratify your sample between weekdays and weekends due to the uneven distribution of use across the week in many locations (see the Desolation case study). Staffing a random sampling schedule while fulfilling the work priorities of a wilderness management program is challenging. Because of this, other sampling methods are more commonly used by management programs.
- Opportunistic or convenience sampling entails collecting encounter data in conjunction with other wilderness field responsibilities. This is the most common sampling strategy employed by management programs (see the Bob Marshall and Clifty case studies). Wilderness rangers and other field employees collect encounter data while performing their other job duties. This strategy adds very little to the work load beyond the normal duties already being performed, which makes it appealing. However, a drawback is that it can generate data that are biased towards certain locations or times of day, week or season. For example, it is common for programs using wilderness rangers to have a majority of data collected on weekend days and virtually non on Tuesday and Wednesday (the employees' normal days off). Furthermore, if rangers do no travel in a way similar to visitors (for instance, if they seek out visitors for contact), their data may systematically differ from the data obtained by observers who are trained to travel the way visitors do.
- Purposeful sampling entails selecting sampling days based on desired elements wanted in the sample. For example, an equal proportion of high and low use days may be desirable based on the purpose, so specific high and low use days throughout the season can be selected and employees can be sent out at these times. The advantage is more deliberate sampling than pure opportunistic methods with more flexibility than random sampling. The disadvantage is the potential for bias and thereby misrepresentation of true conditions. This type of strategy might make sense, for instance, in a low use wilderness where managers decide to monitor encounters on four weekend days in the peak use season, reasoning that if there is no problem on those days, there is no problem at other times.

How long do you have to spend on any given day monitoring encounters?

Once you've decided on your approach to sampling locations and know how many days of data you need, you still need to decide how long to spend in the field collecting data on any given day. Obviously use is variable across the day, and if you are only present for one hour, this might not give a very good representation of what use is like over the full day. On the other hand, you

want to be efficient with your time, and not spend any more time than necessary within any given zone. In the Obsidian Falls case study, we discuss the analysis that was used to determine that 3.5 hours of data were required within a given zone on each sampled day (see Obsidian Falls case study).

If you need more data than you can collect in one season with your own staff, you have a couple different options. The first is to use volunteers to collect encounter data. Volunteers may not be appropriate everywhere, but some wildernesses have established volunteer organizations with many members. Volunteers can easily be trained to collect encounter data, and this type of work is not strenuous, which might be appealing to some types of people. Yosemite National Park, for example, is using volunteers to supplement what can be collected by rangers. Using a random sample of days, the park is assigning rangers to dates in ways that make the most sense given other work duties, and volunteers are being used to fill in the gaps.

Another option is to stagger your monitoring, so that you either collect data intensively for a few locations in one year or use several years' of data to characterize encounters for each location. At Shenandoah National Park, given constraints on resources, it was decided to monitor encounters intensively along a small subset of trails in the first year of monitoring, and then shift to other trails in subsequent years.

How will you make the data from different observers comparable?

It is necessary to collect the data in way that one observation can be compared to another and that data for a given location can be combined. For example, if one observer records encounter data in a location for one hour, and another observer records for four yours, we would expect that the person there for a longer period would have more encounters. But does this really mean that the typical number of encounters across the whole day would have been different? If both observers had been present for the same amount of time, perhaps they would have had a similar number of encounters. This reveals the need for standard units of time and space.

How you go about determining your unit of comparison is dependent on your purpose and your measure. A common technique is to note the start and end time of the encounter observation periods and then convert the encounters to an average per hour; thus different lengths of observations can be compared (see the Obsidian Falls case study). Other protocols call for a trail segment to be hiked at a consistent rate and compare data collected in this consistent manner (see the Desolation case study). Some protocols have collected the actual time each encounter occurred, providing the most options for analysis. Because this is easy to do, it is highly recommended.

What should you record about each encounter?

Several attributes that are commonly recorded for each monitoring session:

- The area in which the observations are being made
- The date and day of week
- The time the observations began and ended

Other attributes that have been noted about each encounter are:

- The time the encounter occurred
- The number of individuals in each group encountered
- The length of stay of the group encountered (day or overnight)
- The number of stock
- Whether the group had been seen before that day
- Which direction the party was traveling in relation to the observer

- Whether the party was within or outside of some distance from the observer

As long as you are recording encounters, it often makes sense to keep track of other information that may be valuable for your specific wilderness management program. For example other items that have been recorded along with encounters are permit compliance, presence of dogs, specific campsites that are occupied, presence of campfires, and more.

The case examples at the end of this document include different variations of protocols – there are many examples that you may draw from.

How will the quality of the data be ensured?

In order to ensure the quality of data being collected it is necessary to train observers in the protocol being used. A couple common problems reported are:

- Not filling out header information correctly such as route, zone, or trail segment and start and end time.
- Not starting a new encounter record when the observer crosses from one zone to the next.
- Not recording data on days with no encounters. (This is important data to capture.)
- Confusion about how to document camping encounters (either including them with daily traveling encounters, separately for occupied sites monitoring, or both).

Managing Your Encounter Data

QUICK POINTS:

- Actively manage your data so you know if what you are collecting is what you want to be collecting.
- Use a method or software that you are comfortable with, or become proficient with the software that will best meet your needs.

Data management should begin as soon as data collection begins. It is important to regularly review data forms and field notebooks to be sure that people are collecting all the data and doing it properly. Be prepared for questions – if it is possible for someone to interpret something differently, the chances are they will! For example, a common problem with camp encounter monitoring is for observers only to record cases where a group is camped in view of one or more other groups, forgetting to document groups that are camped alone. Such omissions would invalidate all the data.

In interviews, managers described the importance of following up early with new encounter observers, checking their data, and providing feedback to correct errors in data collection. Managers also stressed the importance of discarding questionable data in order to maintain the overall reliability of the aggregated data.

You will want to do different things with your data, which may require different formats. The options range from hand computations to Excel- or Access-based spreadsheets (see the Bob Marshall case study). The Forest Service also has a module in the corporate database, InfraWILD. Using InfraWILD ensures that data will not be lost, and the system may provide simple analysis tools.

Unfortunately, there is no easy canned software available. But the good news is that it is relatively easy (though sometimes time consuming) to manage and analyze your data on your own.

If you are using a database, you want to be sure that data are entered promptly, so they don't get lost. Ideally, having one person in charge of data entry and analysis is best. If you are planning to analyze the data by hand, be sure you have a place where you can keep the data sheets or notebooks as they come in over time. Especially if you are collecting data over a couple seasons, you want to be sure you're able

to find the data when the time comes for analysis!

Analyzing Your Encounter Data

In most cases you will have data for each encounter as a separate record, and will need to consolidate these data to some type of aggregate data point, for example, the number of encounters per day.

Generally, it makes sense to analyze data from each specified zone (area) independently. Because people naturally congregate in some places, while other trails or destinations see very low use, it doesn't make sense to combine observations from such different areas into a single analysis. Besides, you may have different Opportunity Classes identified in planning documents, and therefore you would need to analyze the data for each one separately.

Let's look at an example of data from one location in Shenandoah National Park, Cedar Run. It Table 2, you can see data collected on four different days (this is just a subset of all the data actually collected). Each row represents one group encountered; observers collected data on the time each encounter occurred, the number of people in each group, whether each group was on a day or overnight (ov) trip, and whether the group had been encountered at a previous time on that day (y=yes, seen before; n = no, first encounter). The observers recorded their beginning and ending times on each day, so that the data could be standardized for comparison with the wilderness management plan standard of 10 encounters per day [need to check std]. The number of encounters differed a great deal across the individual observation days, from none on August 29 to 18 on August 17.

How can we analyze these data in relation to the management plan standard? First, the number of hours of observation for each day was computed (Table 3). The total number of groups (and people) were computed for each day. For instance, on August 17, the observer recorded 18 groups for a total of 60 people. It is important to note that, in this example, groups seen more than one time were counted as a separate encounter each time they were observed. (But it is perfectly ok to use only "unique" encounters, if that makes sense for your context.) Next, the number of groups and people were divided by the number of hours of observation for each day. This standardized value shows that "groups per hour" (GPH) ranged from a low of zero to a high of 8.24. Assuming that the management plan standard of 10 encounters per day refers to an 8-hour day (it is not explicit in the plan), this would be equivalent to 1.25 groups per hour. From the data, it is apparent that 8 of the 17 days had GPH higher than this value. In fact, all of the weekend days exceeded the standard. From this analysis, it is concluded that the number of encounters at Cedar Run exceeds what is permissible in the wilderness plan.

Occupied sites data can be even easier to analyze. Table 4 shows (fictitious) data from a lake in Mt. Jefferson Wilderness. On 4 days of monitoring, 10 groups were observed camping. Four groups had no others camped within sight or sound. If the standard for this area is that there should be an 80% chance of having no more than one other group camped within sight or sound, it appears that this area exceeds the standard (6 groups had zero or one other group within sight or sound, while 4 groups – 40% - had 2 or more other groups within sight or sound).

These examples show that analysis can be relatively simple, though perhaps time consuming if you have a lot of data. It is important to be clear about your assumptions (e.g., how long is a "day") and to maintain good records with your spreadsheets so that managers in the future can go back to your data.

Exactly how you analyze your data will depend on the purpose of the encounter monitoring program, that is whether you are comparing to

a standard, describing an inventory, or some other function. It will also depend on the how your measure has been conceived and the level of rigor needed within the results. In our interviews with managers, we found many forms of appropriate analysis for each program's unique needs. The important consideration is whether you are answering the questions posed within the purpose of your program.

Table 2. Shenandoah National Park, Cedar Run Data Collected on Four Days

Date	Time	People	Length	Seen Before?
Saturday, August 17. Begin 1:50, End 6:00. Hot, cloudy				
8/17/2002	2:05	1	day	n
8/17/2002	2:05	2	day	n
8/17/2002	2:22	2	day	n
8/17/2002	2:40	1	day	y
8/17/2002	2:55	2	day	n
8/17/2002	2:56	3	day	n
8/17/2002	3:08	2	day	n
8/17/2002	3:21	2	day	n
8/17/2002	3:30	6	day	n
8/17/2002	3:35	2	day	n
8/17/2002	3:35	3	day	n
8/17/2002	3:35	3	day	y
8/17/2002	3:45	3	day	n
8/17/2002	3:35	2	day	n
8/17/2002	3:55	2	day	n
8/17/2002	4:00	20	day	n
8/17/2002	4:35	2	day	n
8/17/2002	5:00	2	day	n
Friday, August 23. Begin 8:30, End 11:30. 70s-80s, Sunny				
8/23/2002	8:30	2	ov	n
8/23/2002	8:40	2	ov	y
8/23/2002	10:45	2	ov	y
Thursday, August 29. Begin 9:15, End 12:30. Mid 60s, cloudy, rain				
8/29/2002		None		
Wednesday, September 4. Begin 8:30, End 11:30. 70s-80s, sunny				
9/4/2002		None		

Table 3. Computing Groups per Hour for Cedar Run

Cedar Run			Total		Per hour	
		Hours	Groups	People	Groups	People
7/7/2002	Sun	3.2	6	8	1.88	2.50
7/11/2002	Thu	3.0	1	2	0.33	0.67
7/13/2002	Sat	3.4	28	72	8.24	21.18
7/19/2002	Fri	3.0	4	8	1.33	2.67
7/27/2002	Sat	3.4	14	27	4.12	7.94
8/7/2002	Wed	3.0	4	9	1.33	3.00
8/17/2002	Sat	4.1	18	60	4.39	14.63
8/18/2002	Sun	4.1	14	40	3.41	9.76
8/23/2002	Fri	3.0	3	6	1.00	2.00
8/29/2002	Thu	3.3	0	0	0.00	0.00
9/4/2002	Wed	3.0	0	0	0.00	0.00
9/8/2002	Sun	3.0	6	14	2.00	4.67

Table 4. Occupied Site Data for Russell Lake

				Other groups camped within:		
Date	**Time**	**Site #**	**People**	**Sight**	**Sound**	**Total (sight or sound)**
July 4	5:50 pm	1	2	0	0	0
July 4	6:00 pm	4	2	1	1	1
July 4	6:15 pm	5	3	1	0	1
July 4	6:30 pm	8	1	0	2	2
July 5	5:00 pm	1	2	2	0	2
July 5	5:20 pm	4	2	1	1	2
July 5	5:43 pm	6	5	0	0	0
July 6	6:20 pm	1	2	0	0	0
July 6	6:32 pm	9	4	3	0	3
July 7	6:10 pm	1	4	0	0	0

Four Examples of Encounter Monitoring Programs

Introduction to the Examples

Four examples have been chosen to represent a range of possible encounter monitoring programs. It is acknowledged that these four programs do not represent all possible approaches, for example we do not provide examples of monitoring encounters on rivers or alpine climbing routes. From discussions with managers of wilderness areas with water based travel, it is apparent that there are unique challenges with encounter monitoring in such environments. We also do not include examples where visitor surveys are used to document perceived encounters. However, the examples cover the primary approaches to monitoring encounters and they illustrate some novel ways of approaching different situations.

Three of the wilderness areas monitor encounters as part of assessing compliance with standards set forth within management plans. These examples are valuable because they illustrate the integration of the monitoring elements of purpose, data collection, data management, and analysis. Showing not only the data but also how all the steps fit together may assist others.

The Bob Marshall Wilderness complex was chosen as an example of an encounter monitoring program whose purpose is to assess encounter rates against the standards prescribed according to wilderness opportunity classes in the wilderness management plan. Data collection is accomplished with paid field staff using a convenience sampling method while employees are engaged in routine wilderness work. Protocols for field data collection and data entry are well defined. The Bob Marshall represents a large, remote wilderness with complex use and extensive overnight use.

The Desolation Wilderness was chosen to highlight the use of a random sample accomplished through the use of volunteers with the assistance of paid field staff. The Desolation Wilderness also receives heavy use from nearby large urban centers, which is much different than the Bob Marshall.

The Clifty Wilderness in Kentucky represents a smaller wilderness with a variety of recreation activities occurring both within the wilderness and in the surrounding area. Recreational visitors from the local region comprise a significant portion of the use. Group encounters were chosen as an indicator as part of an LAC process for the larger Red River Gorge area. Data are collected by wilderness rangers and seasonal interns during normal work patrols.

The Three Sisters Wilderness in Oregon was chosen as an example to demonstrate the use of a highly rigorous sampling design focused on one high use area within the larger wilderness, Obsidian Falls, with the purpose of helping inform management action. Field protocols were implemented by wilderness rangers and university employees, and use data were collected at the same time through a mandatory self-issue permit. Extensive analysis was performed to best inform management decision making.

Each example follows the same outline as presented in the body of this document: the purpose of monitoring is first addressed, then data collection, data management, analysis, and concluding thoughts. An effort has been made to represent each element with material gathered from the programs themselves and to show how all elements interrelate.

The Bob Marshall Wilderness Complex, Montana

Wilderness Area Description

The Bob Marshall Wilderness Complex, located in Montana, is made up of three contiguous wilderness areas: the Bob Marshall, the Great Bear and the Scapegoat. These three designated wildernesses comprise more than 1.5 million acres. The Bob Marshall is more remote from urban populations than the other case studies presented here and thus represents lower use levels than the other cases. It also represents a wilderness with high levels of overnight use and long trips.

Figure 3. Map of Bob Marshall Wilderness Complex

The Bob Marshall Wilderness was designated as wilderness in 1964, the Scapegoat in 1972, and the Great Bear in 1978. These wildernesses contain a broad expanse of mountains, with extensive conifer forests, large low elevation meadows, rugged peaks, wide river valleys, and subalpine and alpine lakes. The wildernesses contain excellent habitat for a variety of wildlife species, attracting hunters and anglers. On the approximately 1,775 miles of trail, stock use is common, in addition to hiking. Rafting also occurs through the heart of the wilderness.

Purpose of Monitoring

The Bob Marshall Wilderness Complex Recreation Management Direction outlines standards for both trail encounters and camp encounters. The purpose of monitoring is to assess whether standards are being met (Tables 5 to 7)

The trail encounters indicator focuses on the number of parties encountered per day, specifically on the trail being traversed by the observer. The occupied sites indicator focuses on the number of other parties camping within sight or continuous sound. The Bob Marshall Wilderness complex also monitors "other parties observed." Because "trail encounters" is defined in the plan as only those encounters actually on the same trail as the observer, other types of encounters (e.g., float trips or people off trail)

would not be included. The "other parties" indicator accounts for these types of encounters, giving a fuller picture of the actual visitor experience. Thus it provides useful information, even though there is no formal standard within the wilderness plan. By capturing all three measures of encounters – on trails, at campsite, and other parties observed – a more complete picture of opportunities for solitude may be developed.

Tables 5 to 7 present the indicators collected by the Bob Marshall with their associated standards. The text is taken directly from *The Bob Marshall Wilderness Complex LAC Monitoring Guidebook.*

Table 5. Bob Marshall Protocol: Definition and Standards for Trail Encounters

Trail Encounters Inventory

The inventory of trail encounters serves to collect the data necessary for monitoring one of the two **Social Indicators** outlined in the Recreation Management Direction. This indicator is: Number of Trail Encounters with other parties. *(The other social indicator is the number of parties camped within sight or continuous sound. See Occupied Campsites.)*

Standards for the Social Indicator #1:

Number of Trail Encounters with Other Parties:

- OC I - 80% probability of no (0) encounters per day.
- OC II - 80% probability of 1 or fewer encounters per day.
- OC III – 80% probability of 3 or fewer encounters per day.
- OC IV – 80% probability of 5 or fewer encounters per day.

(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook, 2007, pp. 17)*

Table 6. Bob Marshall Protocol: Definition and Standards for Campsite Encounters

Occupied Campsites Inventory

The inventory of occupied campsites serves to collect the data necessary for monitoring one of the two **Social Indicators** outlined in the Recreation Management Direction. This indicator is: Number of Other Parties camped within sight or continuous sound. *(The other social indicator is the number of trail encounters with other parties. See Trail Encounters.)*

Standards for the Social Indicator #2:

Number of Other Parties camped within sight or continuous sound:

- OC I - 80% probability of no (0) other camps within sight or continuous sound.
- OC II - 80% probability of no (0) other camps within sight or continuous sound.
- OC III – 80% probability of no more than 1 other camp within sight or continuous sound.
- OC IV – 80% probability of no more than 3 other camps within sight or continuous sound.

(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook, 2007, pp. 19)*

Table 7. Bob Marshall Protocol: Definition and Standards for Other Parties Observed

Other Parties Observed Inventory

Encounters with "other parties observed" is not one of the Indicators identified in the LAC Recreation Management Direction and there are no established standards for these encounters. These observations are recorded for the purpose of documenting those encounters a Wilderness Ranger experiences that do not fit into the definitions of a trail or occupied camp encounter. This information will be used collectively with other formal monitoring data to give an overall snapshot of the types and frequency of interactions wilderness visitors have with each other and with low flying "intrusive" aircraft.

(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook, 2007, pp. 21)*

Data Collection

Data collection is accomplished with paid wilderness staff during their normal patrol duties. This leads to heavier sampling of more popular areas. During a typical season, data are collected by approximately 10 field staff for about 150 total days each. Managers and trails staff may also add to the data collected during a season. Over a 20-year period, the agency has collected an extensive dataset.

A detailed protocol is used for collecting both trail and occupied campsite data (Tables 8 to 10). Table 11 presents the field data collection form, and Figure 4 provides an example of maps carried by field staff that depict opportunity class zones. Data are collected for individual "geographic units" (specific corridors or locations) within each opportunity class. When a ranger enters a new geographic unit, a new encounters form is started. This enables analysis of encounter rates by both individual locations and for each opportunity class as a whole.

Several things are notable in the Bob Marshall Protocol. For Trail Encounters, the unit of analysis is the group (party), and the number of people per party is recorded. This approach allows analysis of encounters on a "number of groups" or "number of people" basis. (However, information about the number of people is NOT recorded for "Other Parties Observed.") Observers also record the number of stock as well as whether parties encountered are on day or overnight trips, which can be useful for tracking trends or highlighting whether certain types of use occur in certain locations. Repeat encounters with the same group are handled by having observers record each encounter separately, but note repeats. One limitation of the protocol is that – although data are recorded for specific geographical units – the amount of time spent collecting data in each unit is not. This makes it impossible to standardize the data; a larger number of encounters on one day versus another might be a result of spending more time in a geographical unit that day.

The protocol for Occupied Campsites is somewhat different from protocols commonly used elsewhere. In the Bob Marshall, when an observer encounters a cluster of groups camping, occupied site encounters are recorded only for the centrally located site. (Other protocols record the information for each occupied site separately.) Information is recorded about the general location of the campsite, but not specific campsite numbers.

Table 8. Bob Marshall Trail Encounters Data Collection Protocol

Trail Encounters Field Measurement:

1. The trail encounters data should be recorded on the form entitled: Bob Marshall Wilderness Complex – Social Encounters Form. The block related to Trail Encounters is located directly below the header.
2. Fill out the header information completely. This includes, Geographic Unit (GeoUnit), Opportunity Class (OC), Date, Page, Trail Number (Trail #), and Ranger Name. Record only one Ranger, First and Last name.
3. Tally trail encounters each day you are on the trail, regardless of whether you have encounters. **It is essential that days with no encounters are documented; otherwise, probabilities cannot be calculated.** If there are no encounters for that trail segment that day, enter a "0" in the Type Party field of Trail Encounters block on the field form. Note: Party type codes A, C, F and S are not valid for Trail Encounters, these codes should be used in the Other Parties Observed block only.
4. The intent of the measurement of the trail encounters is to provide a picture of the "sense of solitude" that visitors traveling on a trail are experiencing. Keep this factor in mind when deciding how to record encounters or groups of encounters that may not fit a clear definition. Parties observed along rivers, at lakes or on an adjacent trail should be tallied in the Other Parties Observed block on the social encounters form. Parties observed in campsites should be recorded in the Occupied Campsites block on the social encounters form.
5. If more than one trail segment or trail within an opportunity class and geographic unit is traversed in a day, tally encounters on separate trail encounter field form pages; fill out a new header completely for each page. In other words, any time a GeoUnit or opportunity class line is crossed while traversing a trail, the ranger must fill out a separate trail encounter field form.
6. A party is a **group of people readily recognized as traveling together**. There should be no more than 1/8 mile and/or 15 minutes between the first and last members of the party. If in doubt as to whether parties are associated and traveling together, tally as separate encounters. Pack strings traveling separate from the main party (more than 1/8 mile and/or 15 minutes between) should be counted as a separate party.
7. Count all parties met or passed on the trail (including FS crews) while you are traveling only. The exception to this would be: taking a break or performing a work related task for a short period of time (5 minutes or less), then it may be appropriate to count parties passing. Keep in mind; the intent is to replicate the public's experience, so you may have to use your own judgment.
8. Stationary crews like trail construction crews should be recorded as an encounter by the ranger filling out the field form. Stationary crews **should not** be used as a source for gathering trail encounter data by counting parties passing their location.
9. Visitors to Forest Service administrative sites **are not counted** under this standard.
10. In the instance of repeat encounters of the same party on the same day (leapfrogging), count as a separate encounter when the repeat is over 20 minutes and/or 1 mile from the initial contact. Mark an "R" in the notes section of the field form to indicate that it is a repeat encounter. If the encounter is less than 20 minutes and/or less that 1 mile, do not count as a separate encounter.
11. If other forms or equivalents are used to tally trail encounters it is the ranger's responsibility to record all information needed to complete the Social Encounters field form at a later time. Trail encounter data **must be recorded on the Social Encounter form** prior to data entry. Data that is not recorded on the form or is not complete will not be used for LAC monitoring.
12. Secondary sources may be used to gather encounter data. Every effort should be made to insure that the secondary information meets the criteria listed above. If you have any doubts about the

quality of the information, discard it. To record secondary source encounter data; fill out a separate field form and record "SECONDARY" as the Ranger Name.

13. Trail encounter or social encounter data should not be taken on trails or any areas where there is a closure for administrative reasons, such as, but not limited to, fire closures, resource damage related closures, or wildlife related closures.

(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook,* 2007, pp. 17-18)

Table 9. Bob Marshall Campsite Encounters Data Collection Protocol

Occupied Campsites Field Measurement:

1. The other parties camped within sight or continuous sound data should be recorded in the block of the Social Encounters Form entitled: Occupied Campsites located in the lower left side of the form.
2. The intent of the measurement of parties camped within sight or continuous sound is to provide a picture of the "campsite solitude" that visitors are experiencing. Keep this factor in mind when deciding how to record situations that may not fit a clear definition.
3. **Continuous sound:** sounds like conversation, routine camp activities, etc can be regularly heard from one campsite to the next.
4. This indicator is measured only in an area where at least one campsite in an area meets the definition of occupied camp under the context of LAC monitoring. Remember, the people do not have to actually be present in the camp at the time, but evidence that someone is currently using the camp must be, i.e. tent, gear, hanging food, etc.
5. Rangers should perform a cursory review, walking around and getting a feel for the area before determining which campsite to tally from. This should be the occupied site from which you can see or hear the greatest number of other occupied sites in the area. From the center of the selected camp, count the number of other occupied campsites within sight or continuous sound. Record this number in the Other OCC Sites field of the form. Once an occupied campsite is counted for one area, do not count it again on that form on that day.
6. **C**omplete the Parties camped within sight or continuous sound information for each day the campsite is observed. If you are working in the same area for several days, complete the survey each day the camp and/or additional camps are still occupied.
7. **It is essential that occupied campsites with no other camps within sight or continuous sound be tallied so that probabilities can be calculated**. Remember there must be at least one occupied campsite present to conduct the survey and record the data. If no additional occupied camps are within sight or continuous sound, enter a "0" in the Other OCC Sites field. **Note:** zeros entered in the Trail encounter block above, will not be used for computing probabilities for Occupied Campsites, the "0" must be entered as stated above in the Other OCC Sites field of the Occupied Campsites block.
8. Assigned or reserved outfitter camps, administrative sites and long-term Forest Service camps such as a trail construction camp will not be considered occupied camps and will not be tallied as such during monitoring.
9. If other forms or equivalents are used to tally campsites within sight or continuous sound it is the ranger's responsibility to record all information needed to complete the Social Encounters

field form at a later time. This data must be recorded on the Social Encounter form prior to data entry. Data that is not recorded on the form or is not complete will not be used for LAC monitoring.

10. Secondary sources may be used to gather encounter data. Every effort should be made to insure that the secondary information meets the criteria listed above. If you have any doubts about the quality of the information, discard it. To record secondary source encounter data, fill out a separate field form and record "SECONDARY" as the Ranger Name.
11. The majority of the time Occupied Campsites data is recorded on the same page as trail encounter data taken that day. Occasionally, you may have Occupied Campsite data filled out on a form where trail encounter data has not been taken. An example of when this could occur would be getting occupied campsite data from a secondary source where no trail encounter data was taken. Be sure to fill out the header of the Social Encounters form completely with the exception of the trail number and trail name (You can supply the trail adjacent to the campsite and it will be recorded in the database). Write "not surveyed" across the trail encounters block to alleviate questions or confusion during data entry.

(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook*, 2007, pp. 19-20)

Table 10. Bob Marshall Other Parties Observed Encounter Data Collection Protocol

Other Parties Observed Field Measurement:

The "encounters with other parties observed" should be recorded in the Other Parties Observed block located in the lower right hand corner of the Social Encounters Form. These encounters should be documented any time a Wilderness Ranger observes another party or group that does NOT fit into the specific criteria for "Trail Encounters" and "Other Occupied Campsites within site or continuous sound". Examples of these types of observations are parties traveling on a different trail than the one currently being traversed by the ranger, float parties on the river or on shore when observed from the trail.

(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook*, 2007, pp. 21)

Table 11. Bob Marshall Social Encounters Field Data Form

Field Forms

Bob Marshall Wilderness Complex - Social Encounters Form

*GeoUnit:	*OC:	*Date:	PG of
*Trail #:	Trail Name:	*Ranger Name:	

Trail Encounters

Type Party	*Party Size	# Stock (S-saddle)	# Stock (P-pack)	Length of Trip	Notes: (R for Repeat Encounter, Start & Finish points, Name of Outfitter, Etc.)
	Record 0 if no encounters				

Occupied Campsites (Number of parties camped within site or sound)				Other Parties Observed	
Campsite Location	Other OCC Sites	Days at this Site	Type Party	Type Party	Number of Parties

*Minimum fields to be completed

Use back of sheet for additional comments

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(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook,* 2007, pp. 50)

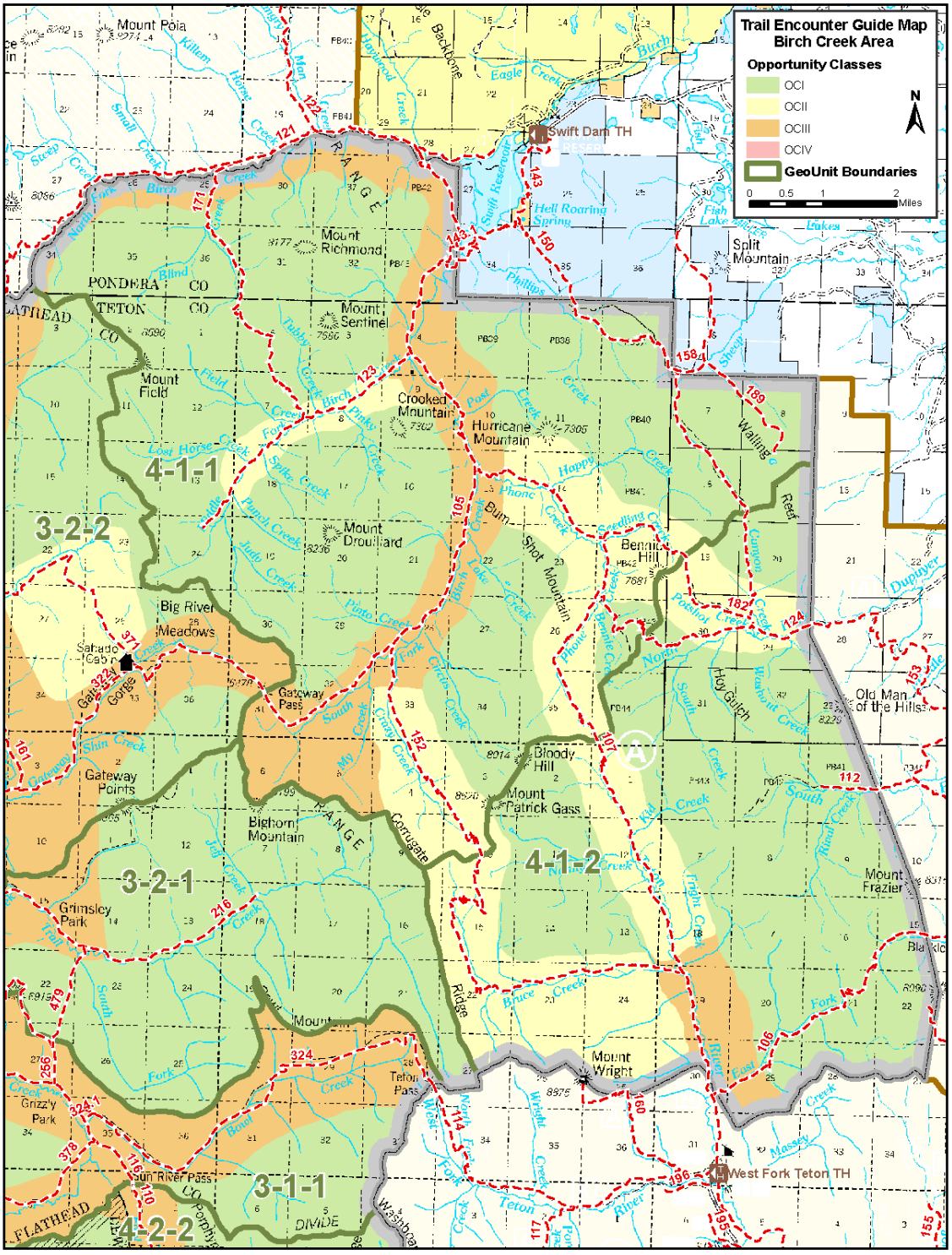


Figure 4. Bob Marshall GeoUnit and Opportunity Class Zone Map for Field Use

Data Management

The Bob Marshall Wilderness complex maintains all of its LAC monitoring data – including encounters – within an electronic database. The database is maintained by a data steward. Field employees enter their data into the database, and the quality of the data is checked by the data steward. *The Bob Marshall LAC Monitoring Guidebook* provides an in-depth description of the database and how to use it for field employees; it is a great example of a guide for data management. Figures 5 and 6 reproduce screen shots of only the Trail Encounters and Occupied Camps data screens. Although the entire data management system is extensive, the particulars are of less interest than the fact that the wilderness does utilize a database system and has provided guidance for multiple users to impute their data when returning from the field.

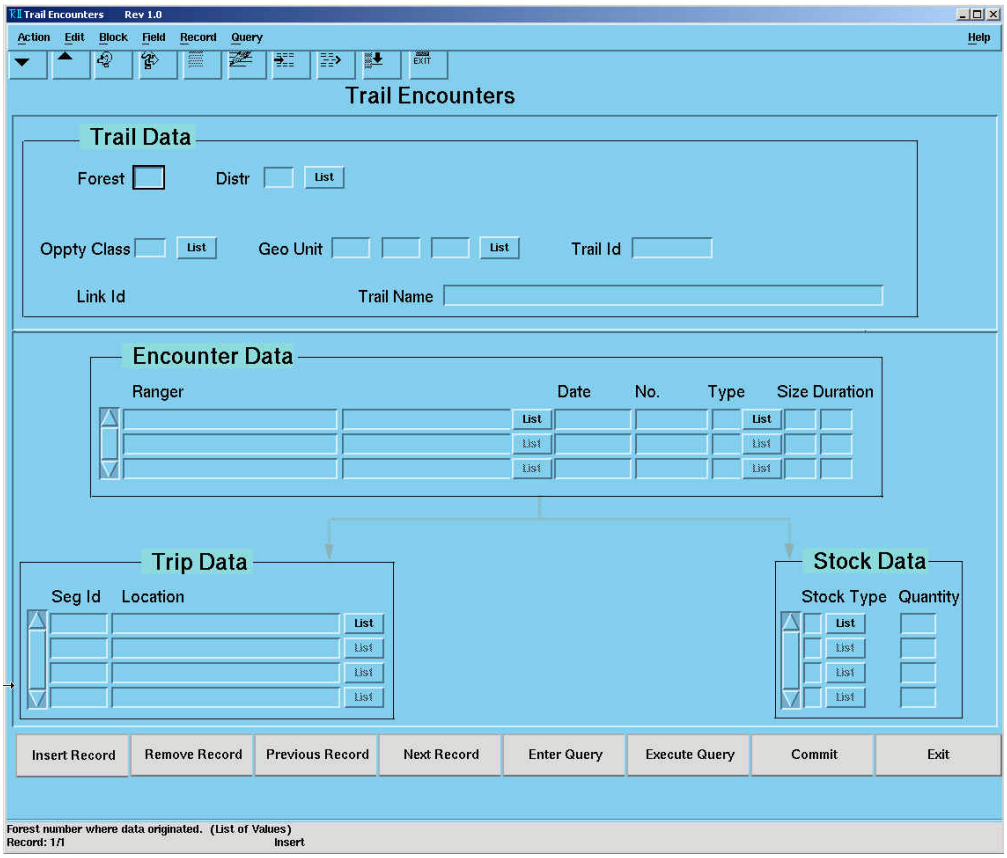


Figure 5. Bob Marshall LAC Database Trail Encounters Data Entry Screen

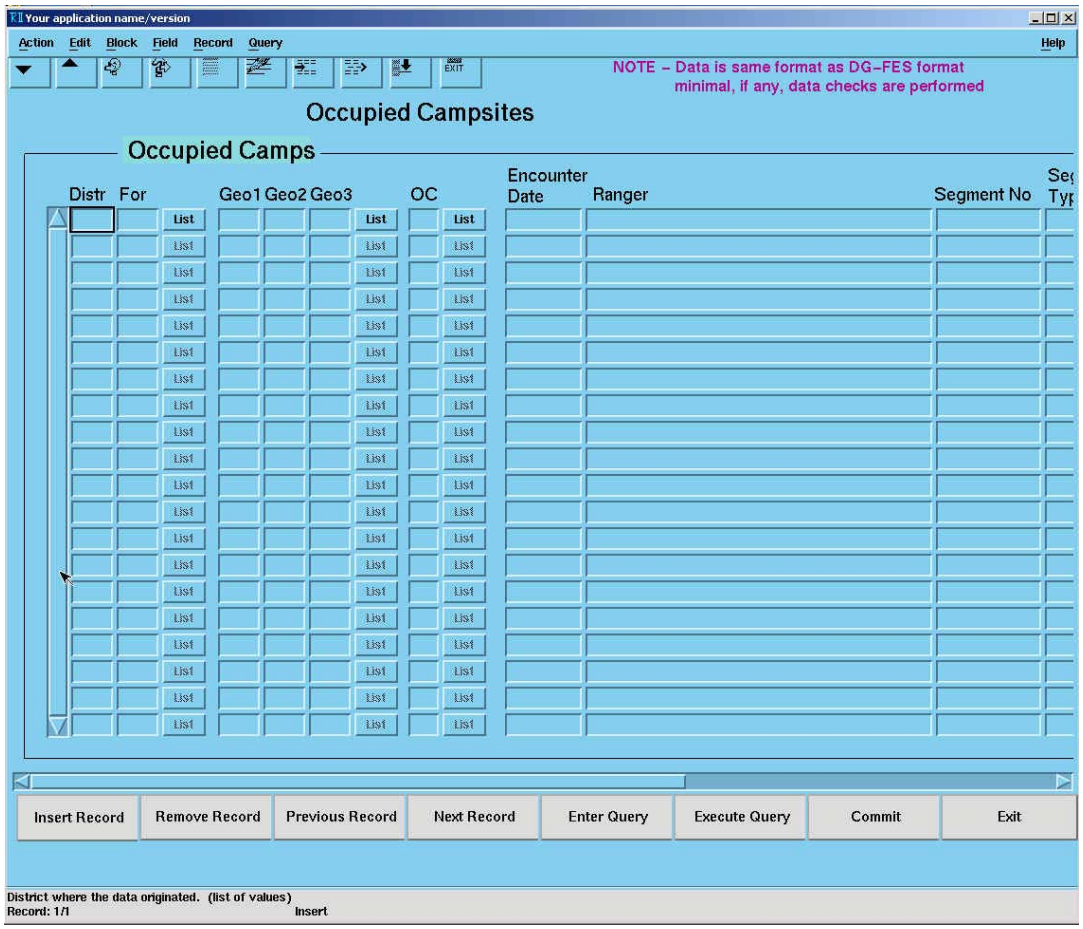


Figure 6. Bob Marshall LAC Database Occupied Campsite Encounters Data Entry Screen

Data Analysis

In 2007 the Bob Marshall Wilderness Complex completed its 4th 5-year period of Limits of Acceptable Change Monitoring. In this section we present several documents related to data analysis. First, *The Bob Marshall Wilderness Complex LAC Monitoring Guidebook* provides direction for compiling and reporting encounters indicators. Next we include examples from the analysis that was performed to summarize the LAC monitoring data from 1988 to 2007.

Data analysis is guided by the standards in the wilderness plan (Table 12). For instance, the analyst simply tallies the number of days on which encounters did not exceed the standard and computes a percentage on the basis of the number of days on which data were collected. This analysis can be performed for different spatial units. The Bob Marshall Complex is divided into six "Resource Areas" (Figure 7) and each Resource Area has Opportunity Class zones and geographic units within it (see Figure 4). The analysis procedure allows managers to know if conditions conform with standards across the wilderness as a whole, as well as to determine whether certain destinations have especially high encounter rates. A similar approach is used for occupied campsites data. Because there is no standard for "other" encounters, the report simply documents the total number of groups encountered and the number of days of data collection, by geographical unit.

Table 12. Bob Marshall Direction for Encounters Analysis

OFFICE COMPILATION AND REPORTING

Trail encounters

1. Enter trail encounter data per data entry directions into the Wild LAC database.
2. Summarize all encounter data for each opportunity class and trail segment (trails are segmented by geounit and OC) sampled during the season.
3. Tally the total number of days the maximum encounter level was not exceeded (Days monitored within standard) and divide by the total number of days sampled (Days monitored) to determine if the 80% probability level was met.
4. Annual Report should demonstrate and report by Resource Area the attempt to meet the annual monitoring frequencies outlined on page 42 of the Recreation Management Direction.
5. How this might look:

Resource Area #

OC Trail # $\frac{\text{Days monitored - Days Standard is exceeded}}{\text{Days Monitored}} \times 100 = \%$ probability

Occupied Campsites

1. Enter occupied campsites data per data entry directions into the Wild LAC database.
2. Summarize occupied campsite data for each Resource Area by Opportunity Class.
3. Tally the number of days the occupied campsite level was not exceeded and divide by the total number of days sampled to determine if probability levels were met.
4. How this might look:

Resource Area #

OC $\frac{\text{Days monitored - Days Standard is exceeded}}{\text{Days Monitored}} \times 100 =$ % probability

Other Parties Observed

1. Enter other parties observed data per data entry directions into the Wild LAC database.
2. Summarize other parties observed data for each Resource Area by Opportunity Class.
3. How this might look:

Resource Area #

OC Total Number of Other Parties Observed Days Sampled

(*The Bob Marshall Wilderness Complex LAC Monitoring Guidebook, 2007, pp. 44)*

Although encounter data are collected by geographic unit, they are summarized by opportunity class for reporting purposes. In the examples of actual analysis here, encounters have been summarized by both Opportunity Class (Figures 8 and 9) and for one Resource Area, the Rocky Mountain Front, Area 4 (Figures 10 and 11). The included report examples are generated by a combination of query outputs and summaries from the LAC database.

Bob Marshall wilderness managers recognize that their data are opportunistically collected. Hence, they view the findings as serving the function of a "red flag" warning – indicating if conditions warrant concern. It is evident in these figures how extensive the dataset is for the Bob Marshall, and how – across the wilderness – typical conditions are well within standards. For instance, based on 20 years of data on occupied camps, it is clear that standards for solitude are being met and there is no concern –between 83 and 100% of the time, depending on Opportunity Class, there are fewer other sites within sight or sound than stipulated in the wilderness plan. However, it is also evident how little data is available for Opportunity Class 1 (probably because rangers rarely encounter visitors in that zone).

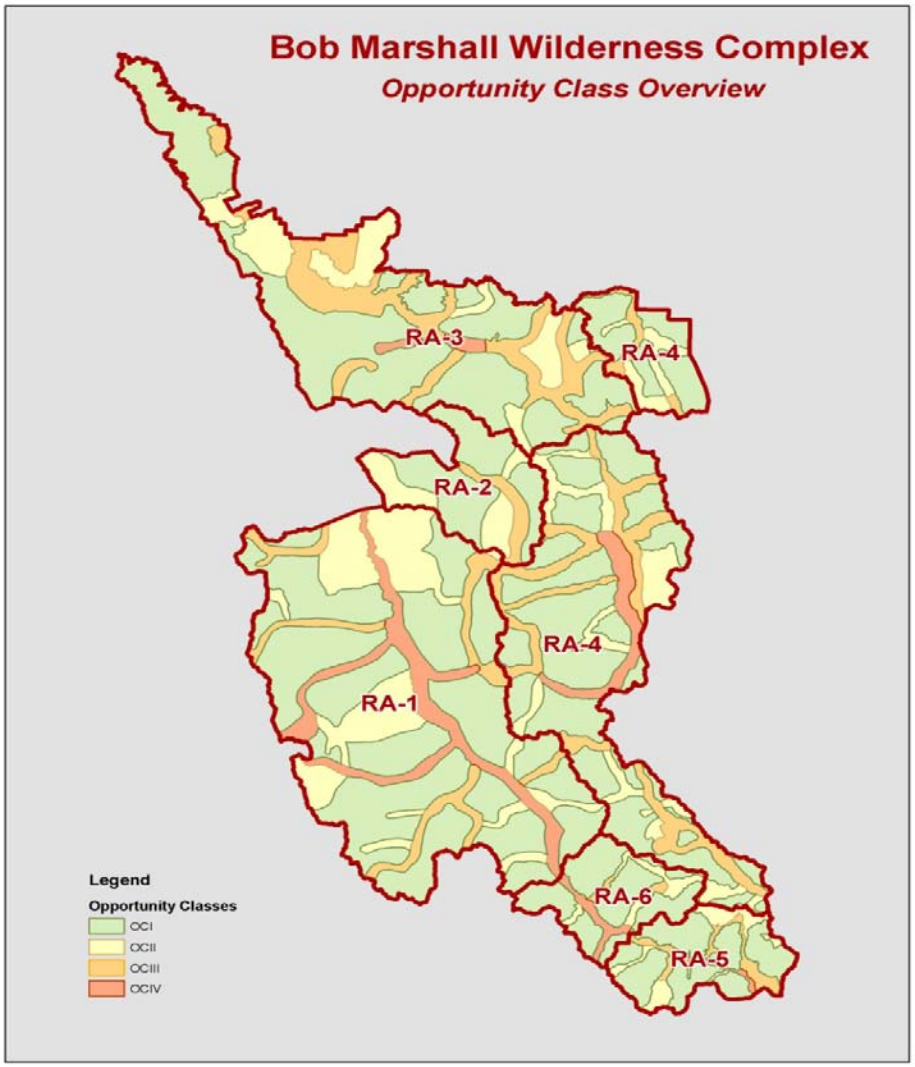
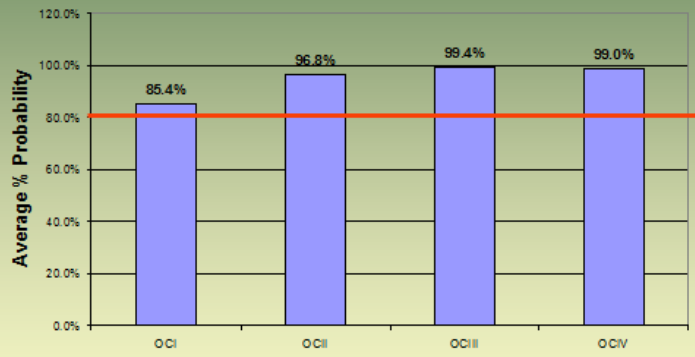


Figure 7. Bob Marshall Complex Opportunity Class and Resource Area Overview Map

Trail encounters with other parties

1. Number of trail encounters with other parties	80% probability of 0 encounters per day	80% probability of 1 or fewer encounters per day	80% probability of 3 or fewer encounters per day	80% probability of 5 or fewer encounters per day



	OC	# of Days Monitored	# of Days over Standard	Average % Probability
BMWC Totals	I	198	29	85.4%
	II	470	15	96.8%
	III	1094	7	99.4%
	IV	1519	15	99.0%

Figure 8. Data on Trail Encounters with Other Parties by Opportunity Class, BMWC

Other parties camped within sight and sound

2. Number of other parties camped within sight or continuous sound	80% probability of 0 parties per day	80% probability of 0 parties per day	80% probability of 1 or 0 parties per day	80% probability of 3 or fewer parties per day

	OC	# of Occupied Campsites Monitored	Camp Encounters over Standard	Average % Probability
BMWC Totals	I	2	0	100.0%
	II	23	4	82.6%
	III	63	2	96.8%
	IV	219	1	99.5%

Figure 9. Data on Other Parties Camped within Sight and Sound, by Opportunity Class, BMWC

SOCIAL CONDITIONS

I. TRAIL ENCOUNTERS

A. Indicator: Number of Trail encounters with other parties

B. Standard:

- **OCI – 80% probability of 0 encounters per day**
- **OCII – 80% probability of 1 or fewer encounters per day**
- **OCIII – 80% probability of 3 or fewer encounters per day**
- **OCIV – 80% probability of 5 or fewer encounters per day**

C. Monitoring Results

Year	OC	# of Days Monitored	# of Days over Standard	Average % Probability
2003	I	33	5	85%
	II	56	2	96%
	III	126	1	99%
	IV	182	1	99%
2004	I	8	0	100%
	II	70	0	100%
	III	109	0	100%
	IV	96	0	100%
2005	I	17	2	88%
	II	58	0	100%
	III	120	0	100%
	IV	157	1	99%
2006	I	24	0	100%
	II	84	1	99%
	III	208	0	100%
	IV	197	0	100%
2007	I	17	0	100%
	II	28	0	100%
	III	86	0	100%
	IV	66	0	100%
Total	I	99	7	93%
	II	296	3	99%
	III	649	1	100%
	IV	698	2	100%

Monitoring comments:

For the monitoring period 2003-2007 all areas within Resource Area 04 are well within the standards set in all Opportunity Classes relative to the LAC Indicator established for the Number of Trail Encounters with Other Parties Per Day. Although not reflected by monitoring data, there remains a management concern about the number of people going to Prairie Reef Lookout via trail #224 in an OC I area. Lookout records show between 250 – 400 visitors to Prairie Reef Lookout each summer.

Figure 10. Trail Encounter Data for Resource Area 4 Rocky Mountain Front, Rocky Mountain RD

II. CAMPSITE ENCOUNTERS

A. Indicator: **Number of other parties camped within site or continuous sound of an occupied site.**

B. Standard:

- **OCI – 80% probability of 0 parties per day**
- **OCII – 80% probability of 0 parties per day**
- **OCIII – 80% probability of 1 or 0 parties per day**
- **OCIV – 80% probability of 3 or fewer parties per day**

C. Monitoring Results

Year	OC	# of Occupied Campsites Monitored	Camp Encounters Over Standard	Average % Probability
2003	I	1	0	100%
	II	1	1	0%
	III	6	0	100%
	IV	42	0	100%
2004	I	0	0	100%
	II	2	0	100%
	III	6	0	100%
	IV	33	0	100%
2005	I	0	0	100%
	II	6	0	100%
	III	2	0	100%
	IV	18	1	94%
2006	I	0	0	100%
	II	0	0	100%
	III	12	1	92%
	IV	71	0	100%
2007	I	0	0	100%
	II	0	0	100%
	III	2	0	100%
	IV	8	0	100%
Total	I	1	0	100%
	II	9	1	89%
	III	28	1	96%
	IV	172	1	99%

D. Monitoring comments:

For the monitoring period 2003-2007, all areas within Resource Area 04 are well within the standards set in all Opportunity Classes relative to the LAC Indicator established for the Number of Other Parties Camped within site or continuous sound of an occupied site**.** One area in OC II was monitored in 2003 that exceeded the standard for this indicator (Ahorn Meadow). Due to an extremely low sample size and the remote location of this area, the situation was determined not to be a concern in the larger context of monitoring of this indicator.

Figure 11. Campsite Encounter Data for Resource Area 4 Rocky Mountain Front, Rocky Mountain RD

Concluding Thoughts

The Bob Marshall Wilderness Complex encounters monitoring program exemplifies the most prevalent monitoring strategy currently implemented by managers: convenience sampling utilizing wilderness staff on routine patrols. The protocol development for encounters monitoring is very detailed and has been refined over time to clarify operationally challenging nuances inherent in encounters monitoring, such as “leap frogging” and how to count groups seen in the distance. Managers recognized that the two indicators in the management plan (trail encounters and occupied campsite encounters) did not include all encounters, so they adapted their protocol to collect data relevant for reporting compliance with their plan’s standards, as well as other managerially relevant data. The supporting documents for field staff – such as maps with opportunity classes and geographic units shown, field data collection forms, and instructions for gathering data – are a model example. The Bob Marshall LAC database is also one of the best examples of data management for encounters monitoring found during our review of monitoring programs. The documents for field staff with instructions on data entry procedures are very thorough. It should also be mentioned that the active role of the Bob Marshall data steward has not only resulted in quality data management, but has also increased the quality of the data being collected by field staff.

Desolation Wilderness, California

Wilderness Area Description

The Desolation Wilderness occupies nearly 64,000 acres west of Lake Tahoe in the Sierra Nevada Mountains of California (U.S. Forest Service, 1998a). It is well known for its glacier-carved peaks and lake basins. All told there are approximately 130 lakes, and the wilderness encompasses the headwaters of major regional rivers. Backpacking, day hiking, and stock use are all common in the Desolation Wilderness, and it is considered one of the most heavily used wildernesses in the NWPS, with an estimated 311,000 Recreational Visitor Days in 1996 (U.S. Forest Service, 1998a). However, the use tends to be concentrated along trails and at lakes near the edges of the wilderness that are more easily accessible. On some summer weekends, popular portal trails may see hundreds of day hikers. Forest Service managers expect that rapid growth in the surrounding area will increase recreational use within the wilderness.

Purpose of encounter monitoring

The Desolation Wilderness Management Guidelines (U.S. Forest Service, 1998a) include "number of groups encountered per day while traveling" as an indicator of opportunities for solitude. Note that the guidelines apply to the "high use season," which necessitates defining the season and monitoring within that time frame. Standards for each of the five opportunity class zones have been established (Table 13), and there is a separate standard for a "special management" area. The monitoring program is designed to assess whether these standards are being met on a sample of indicator trails – the data need to be analyzed both for the "average number of groups per day" as well as the "maximum number of groups per day." The Guidelines also specify management actions that should be taken if standards are exceeded.

Given the expectation that use will increase, and therefore that management actions might be necessary, the monitoring is based on a random sample. This involves six days (3 weekend days, 3 weekdays) per segment during a monitoring season, with areas of highest concern being monitored every three years and other areas monitored every five years. If standards are exceeded, first there is to be more extensive sampling (an additional 10 days) in the area to confirm that conditions are in fact above the standard.

Table 13. Desolation Wilderness Traveling Encounters Indicator and Standards

INDICATOR: Number of groups encountered per day while traveling

This indicator has been selected to measure the solitude available while traveling within the wilderness. The indicator will be measured through a combination of techniques including visitor surveys, observations by wilderness rangers and volunteers, informal conversations with users, and use level records.

Standards

Opportunity Class	Average # groups encountered per day over the high use Season	Maximum # groups encountered per day over the high use season
1 (most Primitive)	0.5	2
2	2	4
3	4	8
4	15	20
ELSMA*	35	50

*Eagle Lake Special management Area

(*Desolation Wilderness Management Plan*, 1998, pp. 35)

Data Collection

Data collection is accomplished through a combination of trained volunteers and paid field staff. Trail encounter monitoring is done in plain clothes, and observers attempt to approximate the pace of a typical visitor. The observer counts any group of one or more people that they see "traveling along or within 25 feet of the trail corridor" using a pocket notebook with entry fields for each encounter. This restriction helps to standardize the measurements across different observers. In a wilderness like the Desolation, which has large alpine areas with excellent visibility into the distance, how to count people glimpsed from afar becomes a challenge that must be explicitly addressed. The fact that observers do not count groups seen at destinations seems problematic; if groups congregate at lakes, for example, the protocol may be missing an important impact on opportunities for solitude.

Encounters are recorded separately for individual "monitoring segments" within the different opportunity class zones (Table 14). Training volunteers to recognize and separate encounter data by opportunity cases zone has been one of the more challenging aspects of the protocol. Nevertheless, wilderness managers report that using volunteers has worked with for the Desolation wilderness.

Tables 14 to 16 present the monitoring direction from the Management Guidelines and the supporting District field protocols; Figure 12 provides a map depicting the opportunity class zones. The protocol lays out clear guidance about where to monitor (e.g., not outside the wilderness boundaries; only when the observer is on the trail; where segments begin and end). Observers are instructed to record data separately on their way into the wilderness and out of the wilderness, which allows for the two counts to each be divided by the factor for that trail (see discussion under Analysis), at which point they can be

combined in analysis. Like in the Bob Marshall, the Desolation protocol documents group size, length of stay (day or overnight), and number of stock, but it also includes number of dogs.

Table 14. Desolation Wilderness Encounters Monitoring Direction

Monitoring Group Encounters: Desolation Wilderness

Monitoring Objective: To measure solitude available while traveling within the Wilderness in accordance with established indicator standards.

Monitoring Technique: Wilderness Rangers or volunteers (out of uniform) will count and document encounters with other parties of one or more people along a pre-determined segment of trail (within 25 feet of the trail). Encounters will be documented in two segments; the hike in and the hike out. Encounters at destinations will not be counted; only *group encounters on trail will be documented*. Data will be collected separately for weekdays and weekends, given different use levels at those times.

Monitoring Frequency: Routes will be monitored every three years in areas of highest concern or highest use; every 5 years in other areas. Each designated trail segment will be monitored at least 6 times a season. Monitoring days will be randomly selected and will include at least 3 weekend-days and 3 weekdays to cover a variety of use. Study period is from June 15- September 15.

Monitoring factor: The average hiker in Desolation hikes 6.2 hours a day. The total number of hours hiked in a day, along with the number of encounters will be calibrated to a 6.2 hour day. Data collected on the differences between encounters up trail and down trail will not be distinguished in the total group encounter count for the day.

Standard of Comparison:
Opportunity Class I: average of .5 groups, high of 2 groups
Opportunity Class II: average of 2 groups, high of 4 groups
Opportunity Class III: average of 4 groups, high of 8 groups
Opportunity Class IV: average of 15 groups, high of 20 groups
ELSMA: average of 35 groups, high of 50 groups

(*Monitoring Group Encounters: Desolation Wilderness*)

Table 15. Desolation Wilderness Encounter Monitoring Trail Segments

Monitoring Segments	OPPORTUNITY CLASS	TOTAL MILES (one-way)	MILES MONITORED (beginning at wilderness boundary)
Lyons trailhead to Sylvia Lake	III	4.6	1.6
Wrights trailhead to Hemlock Lake	IV	2.6	0.8
Hemlock Lake to Smith Lake	II	0.5	0.5
Tallac trailhead to Tallac Peak	IV	4.7	3.2
Meeks- From end of Rubicon Lake to just before Middle Velma	II	4.7	4.7
Van Vleck trailhead to junction to Lake #3	I	4.3	2.6
Junction to Lake #3 to Lake #3	II	0.4	0.4
Rubicon trailhead to small pond beyond Rockbound Lake	III	3.5	2.5
Pond beyond Rockbound Lake to Camper Flat	II	6.8	6.8

(*Monitoring Group Encounters: Desolation Wilderness*)

Table 16. Desolation Wilderness Encounter Monitoring Data Collection Protocol

Protocol for Group Encounter Monitoring

1. On encounter book cover, put your name. You do not have to put the date, because this book should cover several monitoring dates.
2. On inside of book, please put the date at the top of the page and under comments, the trail section you will be monitoring and the word "Hike In". You will be monitoring the trail segment in two sections, the hike in and the return hike out. They will be recorded separately, as if you are starting over on your hike back (see #4 below). Record the Start Time when you begin monitoring under the comments.
3. The monitoring will occur along a designated section of trail, as shown on the maps. All monitoring will occur within the Wilderness boundary, therefore the monitoring for some trails will begin at the Wilderness boundary while other trails will be at specific geographic locations. Travel at the pace of a typical visitor (Wilderness Rangers and volunteers will not be uniform). As you hike on your designated section of trail, please be observing the groups you pass on the trail. Your observations will be recorded in the columns in the book. Use one row for each group you encounter. A group encounter is one or more people, traveling along or within 25 feet of the trail corridor. The group you are recording can be traveling the same direction as you, or in the opposite direction. For each group you encounter, you will record the following:

Group size: how many people are in the group. If it is hard to distinguish who is traveling with whom, please make your best guess at who is with what group. This column will have a numerical value.

Day or overnight visitor: Look at the size backpacks the group is wearing. Do you think they are intending an overnight trip or a day trip based on what they are carrying. Place either a D or an O in this column to record a day visit or an overnight.

Number of dogs: Does this group have any dogs? If yes, please note how many dogs are associated with the group. If there are no dogs with the group, you write a 0.

Seen before: Have you already passed this group at some point today? Even if you have seen this group before, you will need to record them again in another row. Exception: if you are "leapfrogging" a group (you are traveling at about the same speed in the same direction, and you keep passing each other) you do not need to record every time you see them. If you encounter a group you have seen before (to the best of your recollection) please put a Y in the "seen before" column. If this is the first time you have encountered this group, put a N in this column.

Method of travel: Is the group hiking or are they on horseback? Please indicate whether they are on foot (F) or on horseback (H).

Number of stock: Does this group have any horses or pack animals with them? Record the number of stock and specify the type of stock using "H" for horses, "M" for mules, and L for llamas. For example, if a group has 3 llamas then record "3L" in the column. If they are on horseback, include the horse they are riding on in recording the number of stock. If the group is hiking and has no pack stock, please put a zero (0) in the number of stock column

4. Continue the group encounter monitoring the entire length of the designated trail section. When you reach the end of the trail section, you finish recording by writing "END" and the Time under the last row completed. Note: Be sure to stop monitoring when you reach the end of the trail segment. If the end is at a lake or a trail junction, you will not record encounters at those destinations. You will only be monitoring when you are traveling on the trail (or resting on the side during your travel). When you begin hiking back down the designated section of trail, you will begin on a new page. Write your name, date, and under the comments section, write the trail section with "RETURN HIKE" and the Start Time. Begin monitoring the designated trail section for the return hike, observing and recording as you go, just like on the hike in. Be sure to end monitoring at the place you began earlier that day (i.e. the wilderness boundary or junction).

(*Monitoring Group Encounters: Desolation Wilderness*)

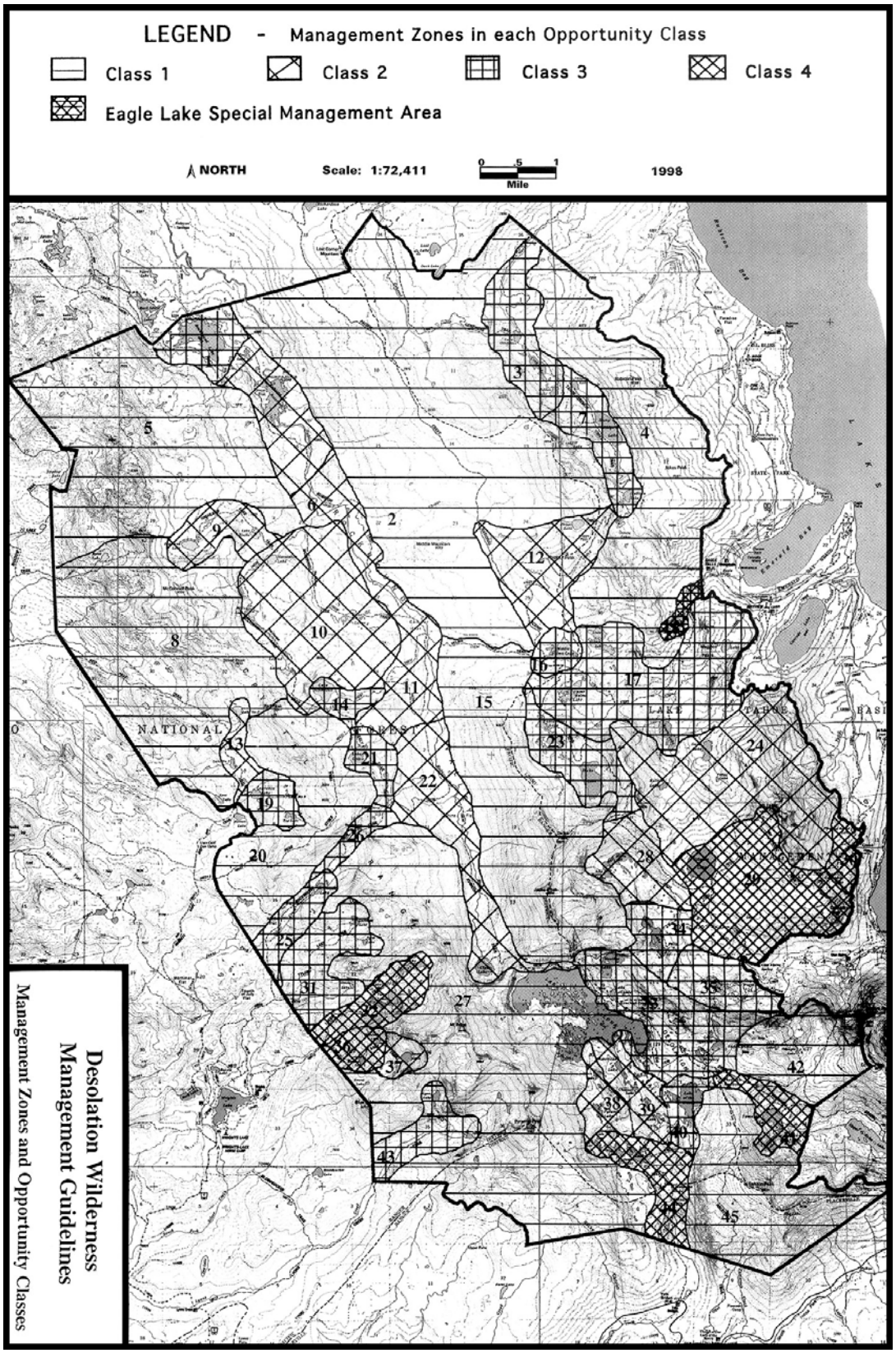


Figure 12. Desolation Wilderness Opportunity Class Zones Map

Data Management

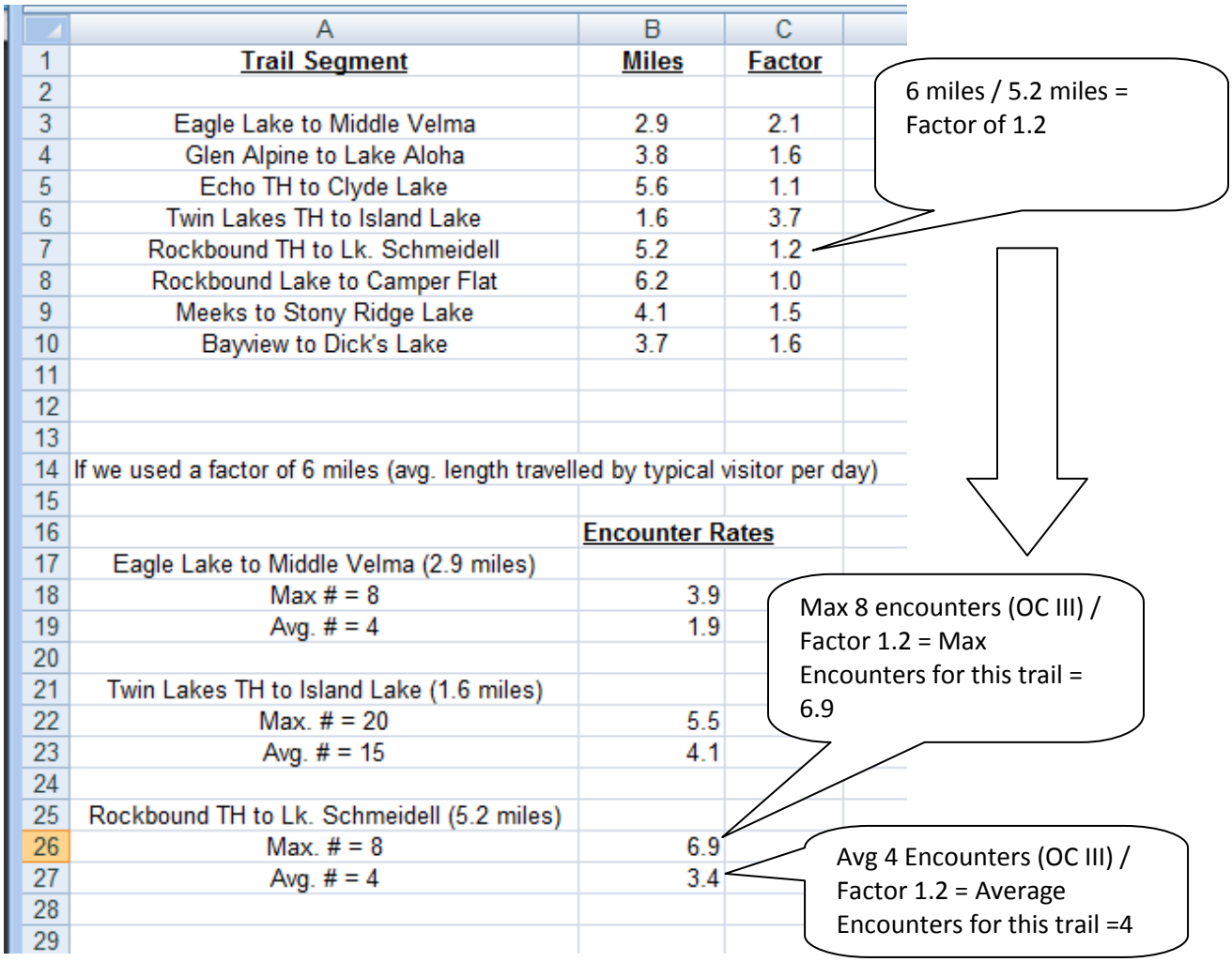
At this time, data are being managed using paper records. However, the appropriate electronic format is currently being explored. Under consideration is a custom Access database developed specifically for the Desolation monitoring program.

Data Analysis

Desolation Wilderness managers aggregate their trail encounter data on a 3-year basis for the higher use areas and on a five year basis for the lower use areas, as specified in their plan. Currently, they are reaching the end of their second five year period; therefore they have not yet analyzed all the data and generated a report.

The indicator and standards in the plan specify number of groups encountered "per day," and a decision had to be made about how to standardize the data (i.e., define what a "day" meant). Unlike the other protocols in this document, the decision was made to standardize according to the typical *distance* traveled, not a unit of time. From other research, it was determined that 6 miles is the average distance a visitor travels in the Desolation Wilderness, and therefore the encounter data collected over trails of different lengths are standardized to a 6 mile distance through a conversion factor (Figure13). For example, the Eagle Lake to Middle Velma segment is 2.9 miles. In order to calculate the encounter standard for this distance we divide 6 miles (average daily distance) by 2.9 miles (this segment), which equals 2.1; this becomes our "factor." Now, we divide the maximum encounter standard of 8 (the value for Opportunity Class III) by the factor of 2.1, which gives us a maximum encounter rate on the Eagle Lake to Middle Velma trail segment of 3.9 encounters. We also take the average encounter standard of 4 groups (for Opportunity Class III) and divide this by our factor of 2.1 to get an average encounter standard of 1.9 encounters for this trail segment. Another way to think of this is the Eagle Lake to Middle Velma trail, at 2.9 miles, is just under half the distance the average visitor travels (6 miles), so the proportion of the standard accounted for by this trail segment is just under half. Once the data are standardized in this way, the data from different observers can be compared to the proportion of the standard. For example, occurrences of more than 3.9 encounters on this trail segment can be documented, and the average observer encounter rate for the trail can be calculated and compared to the 2.1 maximum specified for this trail. Each trail segment has its own unique factor value, and data are analyzed separately for each trail segment.

This method for standardizing based on the average distance hiked by visitors and distance of trail segments on which observations take place works well for the monitoring program in the Desolation Wilderness. While it is clear that not every visitor travels six miles (some may travel much less, while others travel much more), the approach represents a reasonable approach to analyzing encounter data. However, it is only one way to standardize encounters data for analysis and may not be the appropriate method for your program.



	A	B	C
1	**Trail Segment**	**Miles**	**Factor**
2			
3	Eagle Lake to Middle Velma	2.9	2.1
4	Glen Alpine to Lake Aloha	3.8	1.6
5	Echo TH to Clyde Lake	5.6	1.1
6	Twin Lakes TH to Island Lake	1.6	3.7
7	Rockbound TH to Lk. Schmeidell	5.2	1.2
8	Rockbound Lake to Camper Flat	6.2	1.0
9	Meeks to Stony Ridge Lake	4.1	1.5
10	Bayview to Dick's Lake	3.7	1.6
11			
12			
13			
14	If we used a factor of 6 miles (avg. length travelled by typical visitor per day)		
15			
16		**Encounter Rates**	
17	Eagle Lake to Middle Velma (2.9 miles)		
18	Max # = 8	3.9	
19	Avg. # = 4	1.9	
20			
21	Twin Lakes TH to Island Lake (1.6 miles)		
22	Max. # = 20	5.5	
23	Avg. # = 15	4.1	
24			
25	Rockbound TH to Lk. Schmeidell (5.2 miles)		
26	Max. # = 8	6.9	
27	Avg. # = 4	3.4	
28			
29			

Figure 13. Desolation Wilderness Trail Factor Worksheet for Computing Standards by Trail

Concluding thoughts

The Desolation Wilderness encounters monitoring program represents an example of a thoroughly planned monitoring program. The purpose is to collect encounter data for comparison to established standards for opportunity class zones. The use of a random sample of trail segments and instructions that observers should travel like typical visitors helps insure that the sample days and data are not biased. A comparable unit for analysis has been determined for trail segments using the length of trail and travel distance of the typical visitor to determine the standardization "factor" for each trail. By accumulating data over the course of three seasons for areas of concern or higher use and five years for other areas, a balance is being struck between amassing enough data for more substantive analysis and the constraints of available resources. If standards are exceeded in an area, it will receive additional monitoring to determine if encounters are indeed above standard before management actions are taken.

We have presented the example of the Desolation encounter monitoring program as an example of a highly rigorous monitoring program in an area receiving high levels of visitor use. It is also an example of

a design in which each component of the monitoring program from purpose, to data collection, to data analysis has been thought through to avoid the pitfalls of discovering that the data that have been collected for the past three years cannot be analyzed in a way that addresses the original purpose for gathering them.

Clifty Wilderness, Kentucky

Wilderness Area Description

The Clifty Wilderness was designated in 1985 and now includes a total of 13,344 acres. The wilderness is located entirely within Kentucky, in the Red River Gorge Geological Area, and is managed by the Forest Service. Clifty Wilderness is a rugged area characterized by miles of high cliffs, steep valleys, numerous sandstone arches, rock shelters and boulder-strewn creeks. The area is known for its unusual geology and diversity of plant species. An added feature of this Wilderness is the Red River, a National Wild and Scenic River, which bisects the Wilderness. People visit the Clifty Wilderness for backpacking, canoeing, fishing and hunting, though day use is the dominant activity. The Clifty Wilderness was chosen to represent a smaller wilderness area near populated areas.

Purpose

As part of a Limits of Acceptable Change (LAC) planning process, the Daniel Boone National Forest developed indicators and standards. The LAC process encompassed the larger Red River George Area and was not focused solely on the Clifty Wilderness. Opportunity zones of pristine, primitive, semi-primitive, roaded natural, and concentrated use were described for the entire management area, and designated wilderness was included within the most natural zones. The Forest chose encounters and proximity of campsites to each other as relevant indicators for solitude in wilderness. At this time the indicators and standards from the LAC process have not been added as an amendment to the Forest Plan. However, monitoring of encounters is currently being performed. The indictor for campsite proximity has not yet been defined and therefore monitoring is not occurring, although the number of campsites occupied is being monitored.

Indicators were chosen based on the desired conditions associated with specified opportunity classes, and associated standards were set. For encounters the standard developed during the LAC process is 80% satisfaction reported by visitors with encounter rates 80% of the time, known as the “80/80 rule.” This is the only one of our case examples to use visitor input (surveys) as a way to monitor encounters. Actual encounter rates are monitored to compare to the satisfaction percentages of visitors. Table 17 provides the social indicators from the LAC process. Note that the mechanisms for collecting satisfaction data are not well developed; a final monitoring protocol will need to address all the issues associated with sampling, such as the amount of data to be collected, how questions will be asked, and who will be surveyed.

Table 17. Clifty Wilderness LAC Social Indicators and Standards

FINAL STEP 5 SOCIAL STANDARDS (12/18/08)

12/18/2008	SOCIAL INDICATORS (Step 3):	5 OPPORTUNITY ZONES (from Step 2) PRISTINE	PRIMITIVE	SEMI-PRIMITIVE	ROADED NATURAL	CONCENTRATED USE
MOBILITY - (system trails, user trails, rivers)	1) Trash	No #'s. Employ visitor feedback and 80/80 rule---------->				
	2) # People Encountered	No #'s. Employ visitor feedback and 80/80 rule---------->				
	3) Max Group Size	6 (off trail only)	NA	10 (on trail wilderness)	NA	NA
	4) Effectiveness of signs	NA	NA	Employ visitor feedback. 80/80 rule----->		
STATIONARY - OVERNIGHT USE (campsites)	1) Trash	15% micro	15% micro	20% some	20% some	20% some
	2) Max # People/Campsite	See note below ✧				
	3) Distance to System Trail	NA bc no system trails	NA bc no system trails	See note below✧		
	4) Proximity to each other	See note below ✧				
	5) Human Waste	0	0	2%	2%	2%

80/80 RULE: By employing some sort of participant visitor feedback mechanism relative to recreational activity (comment cards, websites, visitor surveys, etc…), we may be able to determine perceptions about some of the above indicators and standards. If 80% of the particpants are satisfied 80% of the time, then there is no need to modify or change a particular social indicator or standard. For example, there is no number standard for trash along trails (littering is illegal, what we are asking is at what point does visitor dissatisfaction get so great as to trigger a management action). If, through the use of a visitor participation system, we find out that less than 80% of the visitors are satisifed with the amount of trash observed along trails then some sort of management action should be employed to get that visitor satisfaction number up to 80%. There will be a need to flush out a survey to address all questions - similar to campsite criteria.

✧ **These camping social standards** will need to be defined with development of camping management plan to address where to designate sites & where to allow dispersed camping. Forest Supervisor will also make final decision on management action concerning minimum distance from system trails for designated campsites. See Step 7 for more details.

Data Collection

Encounter data are collected on a opportunistic basis as it fits with other work priorities. Paid backcountry rangers and seasonal interns collect data on 16 designated routes while also performing normal work duties. A folder has been developed to support data collection on each route and includes a map of the route, forms for data collection, protocols, and regulations for the area. Tables 18 to 21 provide the encounters monitoring instructions, forms, and route descriptions from the Red River George LAC monitoring program.

Some points are notable about this protocol. Clearly it utilizes a convenience sample, but it instructs observers to try to vary their routes and to split up during the day when working in pairs to maximize

the amount of data obtained. Routes are clearly defined and it is expected that on any given day the observer would travel an entire route (i.e., gather one data point). Observers also keep track of group size and any groups that might potentially need to have special use permits, the number of dogs, and primary activities. Occupied campsites are explicitly included as encounters. Some limitations include: it is not clear what "over counting" means; it is not clear what observers should do if they can only travel a portion of a route on a given day; and observers do not document the time they begin and end data collection on any given day.

Table 18. Clifty Wilderness Encounter Monitoring Protocol

High Country LAC Monitoring

Instructions for Group Contact Form

Use the Group Contact form to document the use you see in the High Country. Document use every day no matter what you are doing. Remember to note the zone you are in & specific location (trail, landmark). On weekends you will usually be asked to patrol and make lots of visitor contacts. These are good times for long hikes through the High Country.

Below are 10 routes to select to give you maximum exposure to a variety of trails and users. Please do as many different routes as possible. Try to do each of these 10 loops once a month if possible. Usually there are at least two backcountry rangers working in the High Country. If those two people split up, that is about 16 weekend days a month for these routes (8 weekend days x two people). Many times there are up to four people working as backcountry rangers. Do not do only foot trail loops or only horse trail loops or the data may be misleading.

On weekdays, you will often be asked to work on specific trail projects. On these days you may not cover a lot of ground, but still document the use you observe. Note at the bottom of the Group Contact form unusual observations or more specific information. For example, note time and place of search & rescue operations. Write down name, address, and phone numbers of groups you encounter. Many of these groups are commercial in nature and may need a permit. Others may be large groups over 10 & we would want to send them information on Leave No Trace.

Be careful not to over count. If two backcountry rangers split up, then try and do routes far away from each other and one do horse route and the other a foot route.

Table 19. Example of Routes for Encounter Monitoring in Clify Wilderness

Route #	Primary Use	Estimated mileage	In Wilderness?
1	Horse	9 miles	About half
2	Horse	9 miles	No
3	Horse	12 miles	About half
4	Horse	12 miles	No
5	Horse	4 miles	No
6	Foot	8 miles	About half
7	Foot	11 miles	Less than 20%
8	Foot	10 miles	Less than 20%

Table 20. Example of Clifty Wilderness Route Descriptions

Detailed route descriptions:

Route 1 – Crest Tr to Scales, First Peak Tr to Kabel Tr, then Kabel Tr to Big Wilson Creek Tr, up Big Wilson Creek Tr then Bearpen & Scales Tr back to Scales & up Crest Tr to cabin.

Route 2 – Crest Tr west past Rhodo Gap to Rhodo Gap Tr, then Rhodo Gap Tr to VHHT & back to Scales, then up Crest Tr to cabin .

Route 3 – Crest Tr to Scales, down VHHT to Orchard Spur Tr, Orchard Spur Tr to old Orchard Tr then up Old Orchard Tr past Old Orchard shelter to Lewis Fork Tr. Up Lewis Fork Tr to Crest Tr, then down Crest Tr to cabin.

Route 4 – Crest Tr west past Rhodo Gap to VHHT on Cabin Ridge. Go east on VHHT to Scales then up Crest Tr to cabin.

Route 5 – Crest Tr to Scales, down Scales Tr to Wilson Creek Tr. Up Wilson Creek Tr to VHHT & back to Scales. Up Crest Tr to cabin.

Route 6 – AT down to Old Orchard shelter, then Old Orchard Tr to Lewis Fork Tr then down Lewis Fork Tr to bottom of Cliffside Tr. Up Cliffside Tr to Pine Mtn Tr & back to AT & cabin.

Route 7 – AT to Pine Mtn Tr, then Pine Mtn Tr to Rhodo Gap. Then AT back through GHSP to Scales & then AT up to cabin.

Route 8 – AT to Pine Mtn Tr, then Pine Mtn Tr to Rhodo Gap. Then AT past Thomas Knob shelter & then up Mount Rogers Spur Tr to summit & back to cabin the way you came.

Table 21. Clifty Wilderness Encounters Data Collection Form (modified slightly)

RED RIVER GORGE LAC MONITORING FORM

GROUP CONTACT FORM

IF TWO OR MORE PEOPLE ARE WORKING TOGETHER, ONLY ONE SHOULD RECORD THE INFORMATION. EACH ROW IS A SEPARATE GROUP.

ROUTE #: THERE ARE 16 IDENTIFIED ROUTES TO FOLLOW WHEN USING THIS FORM. SEE LIST ON SEPARATE PAPER.

TIME: RECORD THE TIME YOU ENCOUNTERED THE GROUP.

TRAIL #: EVERY OFFICIAL USFS TRAIL HAS A 3 DIGIT NUMBER. THE NUMBERS ARE LISTED ON THE SEPARATE PAPER THAT LISTS THE 16 ROUTES. ALL USER TRAILS SHOULD BE CODED 999.

TRAIL SECTION: EACH OF THE 16 ROUTES HAS BEEN DIVIDED INTO SECTIONS (SEE DETAILED TOPOGRAPHIC MAP FOR EACH ROUTE).

GROUP TYPE: DH = DAY HIKER, BP = BACKPACKER, C = CAMPER (NO BACKPACK & WITHIN SIGHT OF ROAD), RC = ROCKCLIMBER, RP = RAPPELLER, H = HORSEBACK RIDER, O = OTHER. IF GROUP IS DOING MORE THAN ONE ACTIVITY, PICK THE ONE YOU THINK IS THE MAIN REASON FOR THE VISIT.

GROUP SIZE: HOW MANY PEOPLE IN THE GROUP.

 # DOGS: RECORD NUMBER OF DOGS WITH A GROUP.

DOGS LEASHED: YES OR NO.

WEATHER: C = CLEAR (NO-PRECIP, COULD BE CLOUDY), R = RAIN, S = SNOW, O = OTHER

TEMPERATURE: RECORD IN BLOCKS OF TEN (50'S, 60'S, 70'S).

OCCUPIED CAMPSITE: DID YOU GO PAST A CAMPSITE OCCUPIED BY PEOPLE AND/OR TENTS? RECORD YES OR NO. RECORD YES EVEN IF NO PEOPLE PRESENT, BUT CAMPSITE IS CLEARLY BEING USED. IN THIS SCENARIO, GROUP SIZE WOULD BE UNKNOWN.

 # TENTS: RECORD THE NUMBER OF TENTS AT CAMPSITE.

YOUR NAME:_____DATE/MONTH/YEAR:_____DAY OF WEEK:_____

ROUTE #	TIME ON TRAIL	TRAIL #	TRAIL SECTION	GROUP TYPE	GROUP SIZE	# DOGS	DOGS LEASHED	WEATHER	TEMP.	OCCUPIED CAMPSITE	# TENTS

COMMENTS: DID YOU ENCOUNTER ANY COMMERCIAL OR ORGANIZED GROUPS? IF YES, PLEASE LIST DETAILED INFORMATION ON GROUP IF YOU CAN (NAME, ADDRESS, PHONE #, LEADER'S NAME). THIS COULD COVER GROUPS, YOUTH CAMPS, SCHOOL GROUPS, & OUTFITTER & GUIDES.

_____

_____

_____

NOTE ANY POTENTIAL ILLEGAL ACTIVITY ON THE POTENTIAL ILLEGAL ACTIVITY FORM

Data Management

Data management for the Red River George LAC Monitoring program is being accomplished primarily with the use of Excel spreadsheets. Separate files have been created for each sample area. Figure 14 shows a sample of data for the Gray's Arch Loop trail. Data are presented for each group encountered, as well as for daily totals.

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Route #5 Grey's Arch Loop** (4 miles total)											
2	Date	Day/Week	Weather	Temp	Total # Groups	Total # People	Time	Group Type	Group Size	*# of Dogs*	Dogs Leashed	# Tents
3	5/5/2005	Monday	clear	70s	1	2	12:00-14:00	day hiker	2	0	-	0
4												
5	7/12/2005	Tuesday	overcast	80s	1	3	12:30	day hiker	3	0	-	0
6												
7	9/2/2006	Saturday	clear	70s			16:40	day hiker	5	0	-	0
8	9/2/2006	Saturday	clear	70s			16:41	rock climber	2	0	-	0
9	9/2/2006	Saturday	clear	70s			16:41	day hiker	9	0	-	0
10	9/2/2006	Saturday	clear	70s			16:42	rock climber	4	0	-	0
11	9/2/2006	Saturday	clear	70s			17:00	rock climber	2	0	-	0
12	9/2/2006	Saturday	clear	70s			17:20	backpacker	8	0	-	0
13	9/2/2006	Saturday	clear	70s			17:45	rock climber	2	0	-	0
14	9/2/2006	Saturday	clear	70s			17:50	rock climber	3	0	-	0
15	9/2/2006	Saturday	clear	70s			18:30	day hiker	2	0	-	0
16	9/2/2006	Saturday	clear	70s	10	41	18:49	camper	4	1	yes	1
17												
18	10/14/2006	Saturday	clear	60s			15:37	other	3	1	yes	0
19	10/14/2006	Saturday	clear	60s			15:43	backpacker	3	0	-	0
20	10/14/2006	Saturday	clear	60s			15:46	day hiker	7	1	-	0
21	10/14/2006	Saturday	clear	60s			15:48	day hiker	4	0	-	0
22	10/14/2006	Saturday	clear	60s			15:52	day hiker	2	0	-	0
23	10/14/2006	Saturday	clear	60s			16:00	day hiker	2	0	-	0
24	10/14/2006	Saturday	clear	60s			16:02	day hiker	2	0	-	0
25	10/14/2006	Saturday	clear	60s			16:03	day hiker	3	0	-	0
26	10/14/2006	Saturday	clear	60s			16:04	backpacker	3	0	-	0

Figure 14. Example of Clifty Wilderness Encounter Data

Data Analysis

Data analysis is being done with Excel. Analysis of the number of groups and individuals for each sample route has been performed. Also, the percentage of user types of both groups and individuals has been summarized; examples for the Grey's Arch area are shown in Figures 15 and 16. Recall that the standard from the LAC process is the "80/80 rule." So, it is the visitor satisfaction with encounter rates that would be assessed; the actual observed encounter rates could then be used to describe the visitor experience (number of encounters) being provided in each area.

Note that the data shown in Figure 15 simply aggregate the number of groups and people seen during all observations. This type of analysis can give an overall impression, but it does not take into account how much time was spent observing along Grey's Arch, so it would not be appropriate to compare these data to other routes. Furthermore, it is clear that on the 5 days of observations that generated these data, encounter rates were highly variable. Hence, it may be appropriate to analyze these data in additional ways (e.g., by weekend vs. weekday) to generate other insights into what is happening with encounters.

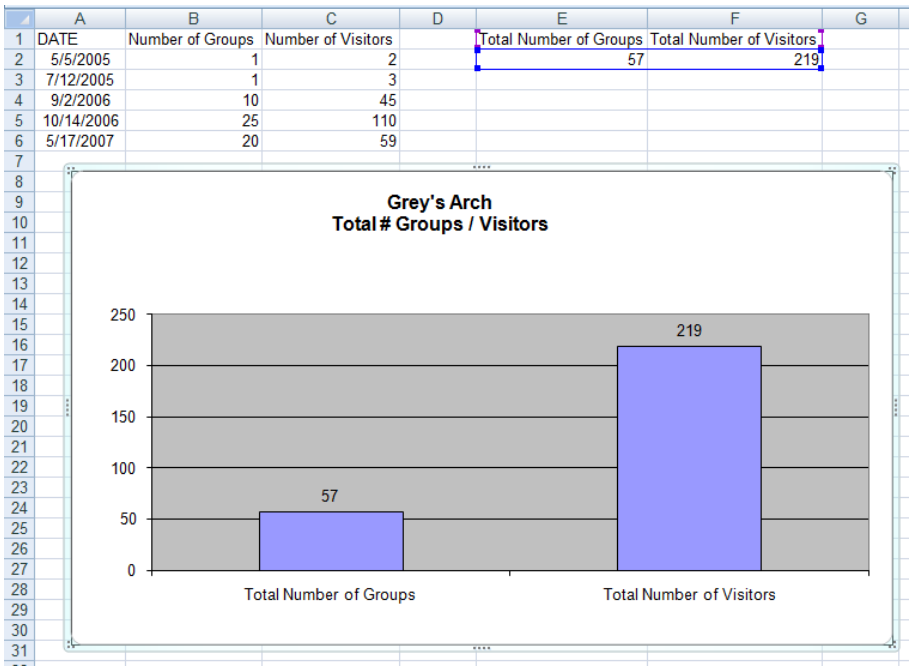


Figure 15. Example of Data Analysis for Clifty Wilderness: Encounters at Grey's Arch

Figure 16 provides useful information about the visitor activities along the Grey's Arch trail. Assuming that the visitors encountered on the five days of observation are typical of visitors at other times, this would give a good sense of activity participation rates and might provide guidance about what types of patrols should occur in this area. Over time, such data could also reveal trends in activities.

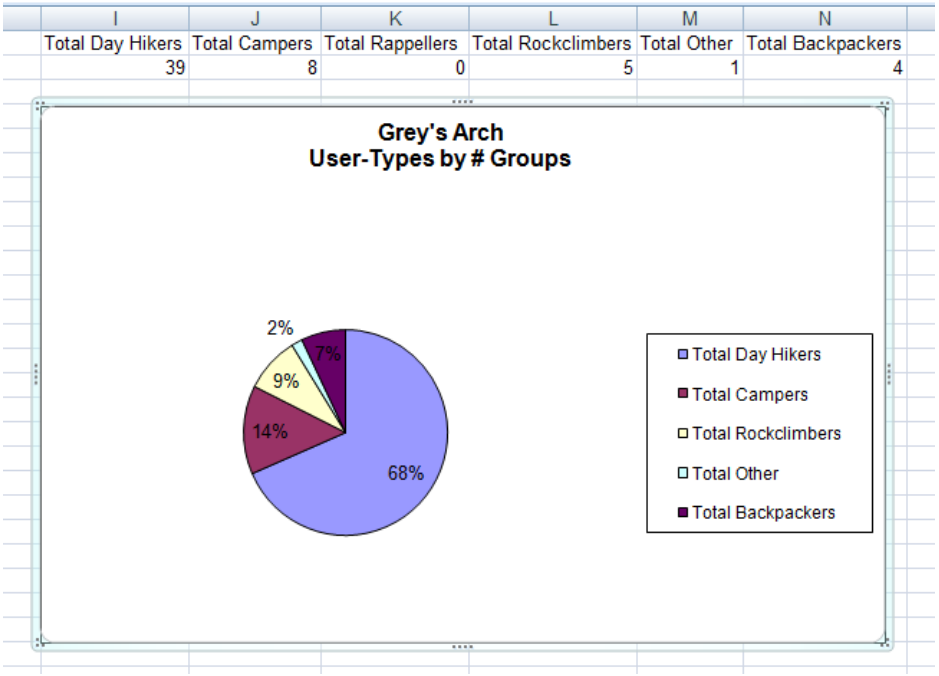


Figure 16. Example of Clifty Wilderness Data Analysis: User-Types at Grey's Arch

Concluding thoughts

The Clifty Wilderness has provided a good example of a geographically small wilderness with significant recreational use in the larger management area surrounding the wilderness. It also provides insight into the use of an LAC process with indicators for both wilderness and the surrounding non-wilderness lands. Monitoring protocols are explicit, and additional data useful for management are collected at the same time as encounters data. Again, as with our other examples, the encounters monitoring program has thoughtfully addressed the elements of purpose, data collection, data management, and analysis.

Obsidian Falls (Three Sisters Wilderness), Oregon

Wilderness Area Description

Three Sisters Wilderness encompasses 242,000 acres along the crest and slopes of the Cascades Mountains in central Oregon. Habitats range from low-elevation old growth forests on the west, to dry ponderosa pine forests on the east, and alpine meadows and rockfields along the crest. There are many low elevation lakes, as well as subalpine meadows, lakes, and streams. The three major peaks (the Sisters) are popular with climbers of all skill levels. Approximately 260 miles of trail attract primarily hikers, the majority of whom are day hikers from nearby urban areas.

In this case study, we describe monitoring at Obsidian Falls, one of the most popular destinations within Three Sisters Wilderness. Obsidian Falls is located approximately 6 miles from the trailhead, and a loop trail provides a highly attractive 11-mile trip for both day and overnight visitors. Although most of the trails are through forest, the central mile of the loop is formed by a segment of the Pacific Crest Trail, which passes through subalpine meadows and pockets of forest.

Purpose of Encounter Monitoring

The Willamette and Deschutes National Forest Land Management Plans identified encounters among groups and at camps as indicators for solitude in wilderness. At the time of the intensive monitoring discussed here, use levels had been increasing dramatically, and wilderness managers believed that standards for encounters were being exceeded in several high use destinations. The plans identified standards for both "trail encounters" and "camp encounters." However, as is evident in Table 22, the plan was rather vague about defining these encounters in an operational way, and decisions had to be made about what counted as a "trail encounter." Moreover, the camp encounter indicator was vague about whether a camping group should be in sight of another *campsite* or another camping *party* (the latter was implied). Obsidian Falls is within the "semi-primitive" Opportunity Class, and therefore the standard was for no more than 10 encounters with other groups per day, 80% of the time.

Table 22. Encounter Standards for Three Sisters Wilderness

Opportunity Class	Encounters	Camps
Transition	80% chance of not more than 12 encounters per day while on trails	80% probability that 5 or fewer camps are visible from any other campsite
Semi-primitive	80% chance of not more than 10 encounters per day while on trails	80% probability that 2 or fewer camps are visible from any other campsite
Primitive	80% chance of not more than 7 encounters per day while on trails	80% probability that 1 or fewer camps are visible from any other campsite
Pristine	80% chance of not more than 1 encounters per day while on trails	Campsites should not be visible or audible from any other campsites

Because it was clear from the outset that, according to management direction in the Forest Plan, if standards were exceeded, actions such as regulations on behavior or use limits would be required, managers realized that it was necessary to have a robust set of defensible data. Accordingly, a 2-year

plan for data collection was devised. Wilderness rangers and trained volunteers collected the majority of the data across the wilderness, while University staff provided additional data on randomly selected days at several focal destinations of management concern. One of these was Obsidian Falls.

Data Collection

Because the monitoring was taking place in conjunction with administrative studies of wilderness visitors and campsite impact monitoring, there was an opportunity for intensive data collection. This included both a convenience sample of data collected by wilderness rangers and a random sample of data collected by observers who were instructed to travel like "typical" visitors.

Rangers often traveled through Obsidian Falls on their way to other destinations. Therefore, it was necessary to determine the minimum necessary sampling period that would generate reliable estimates of daily encounter rates. To do this, initial data were used to understand the relationships between data collected during time blocks of different lengths and the total number of encounters for a day. Table 23 displays some of the data from Obsidian Falls. Each column represents a day, and each row records the number of encounters during a 1-hour block of time. The variability across the day is apparent – for instance, on August 17, there was one hour where only 1 encounter occurred, but there was another hour with 6 encounters. The "groups per hour" (GPH) for each day was computed by dividing the total number of encounters by the number of hours of observation.

Table 23. Example of Hourly Encounter Data Used for Determining Duration of Sampling Periods

	July					August			
Time	11	12	13	14	15	8	15	17	18
8:00									
9:00	0	0					2	4	
10:00	0	0	1	2	1	4	1	2	3
11:00	1	0	1	4	0	0	0	1	6
12:00	0	1	1	2	0	4	1	5	7
13:00	0	0	1	1	0	0	3	5	3
14:00	0	1	5	2	0	2	3	2	5
15:00	0	0	4	1	0	2	1	4	3
16:00		1	0			2		6	5
17:00		0							
HOURS	7	9	7	6	6	7	7	8	7
TOTAL	1	3	13	12	1	14	11	29	32
GPH	0.14	0.33	1.86	2.00	0.17	2.00	1.57	3.63	4.57

Following this process, the relationship between the total GPH for a day and estimates based on different blocks of time was examined. As an example, if data from August 17 were broken into 1-hour blocks, the relationship between those estimates (which range from 1 to 6) and the overall GPH (3.63) is highly variable. However, if the data are broken into all possible contiguous 2-hour blocks, the GPH

values range from 1.50 to 5.00. Using all possible contiguous 3-hour blocks generated GPHs for that day between 2.33 and 4.00. As this process shows, when the data are collected over a period of more hours, the estimated GPH is closer to the overall daily GPH. Figures 17 and 18 illustrate these relationships for Obsidian Falls for all possible 1-hour blocks of time (Figure 17) and all possible 4-hour blocks of time (Figure 18). The R^2 value indicates how strong the relationship is, with a value closer to 1.0 indicating a better relationship. The result of this analysis was the determination that 3.5 hours was the minimum amount of time that needed to be spent on any single day for encounter data to be used in analyses. This represented an acceptable trade-off between greater accuracy (longer observation periods) and greater efficiency (shorter observation periods).

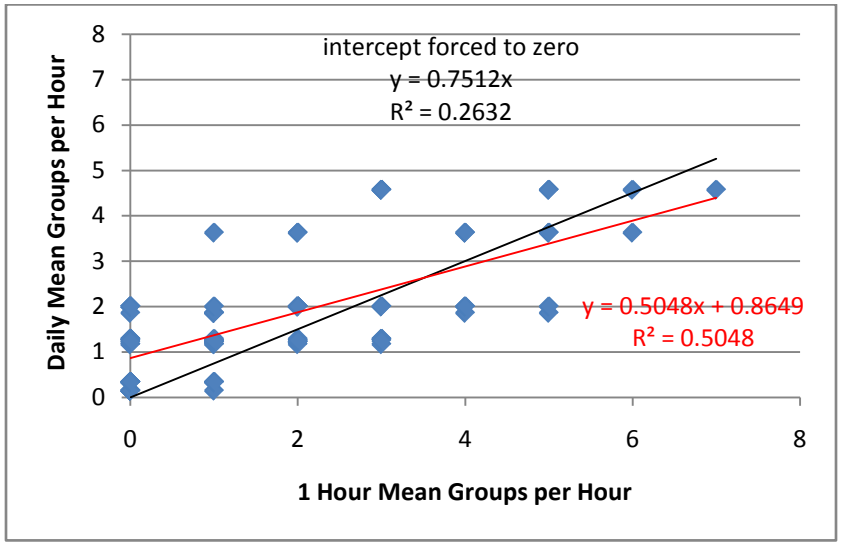


Figure 17. Relationship Between One-Hour Observation Blocks and Total Groups per Hour at Obsidian Falls

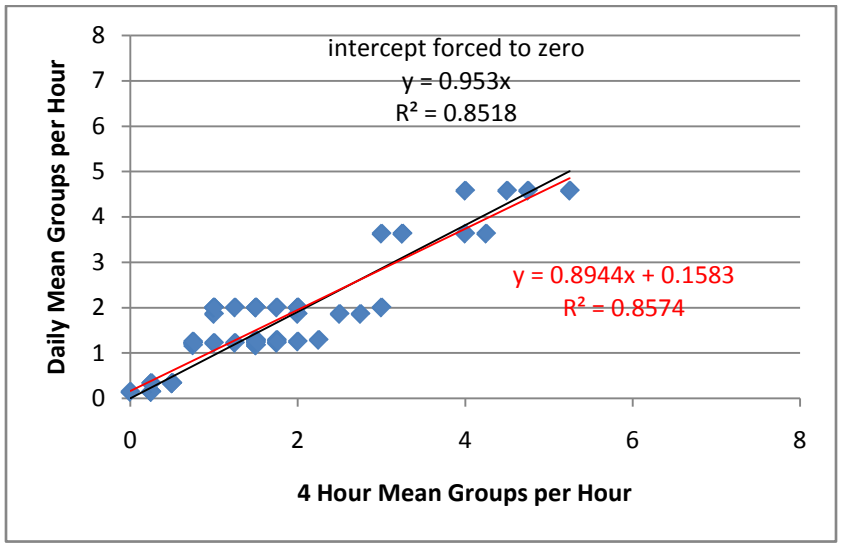


Figure 18. Relationship Between Four-Hour Observation Blocks and Total Groups per Hour at Obsidian Falls

The protocol for encounter monitoring specified that data would be collected separately for traveling encounters (which included both trail and off-trail encounters) and camp encounters, although when an observer saw an occupied site while traveling, it counted as a "traveling encounter" (because from the perspective of a hiker, it was an encounter). Pocket-sized notebooks using weatherproof paper were developed to facilitate data collection – one was for traveling encounters and the other for site occupancy (Figure 19).

Figure 19. Picture of Encounter Data Collection Notebooks for Three Sisters Wilderness

Data included documentation of the time each encounter took place, group size, day vs. overnight trip, presence of stock, and (for rangers) compliance with the wilderness permit regulation and related information (Figure 20). This last piece of information was important because one goal of the study was to assess the relationship between use levels (people/groups entering the trailhead) and the number of encounters.

Because of the debate about whether encounters should include only those in close proximity (on trail) or all encounters, it was decided to record all encounters, with a notation about whether the group encountered was on or off the trail. Similarly, because it was not clear from management direction whether encounters referred only to unique encounters or to multiple encounters with the same group, all encounters were documented, and multiple encounters were noted under "seen before."

For each occupied campsite, observers documented whether there were any other campsites occupied within sight or sound. This included camps set up nearby, as well as any in the distance. (This differs from the Bob Marshall protocol, which documents only camps within continuous sound.) Additionally, the data were being used to address campsite management, so careful documentation of which individual campsites were occupied on any given night provided valuable information about which sites were used, which were not, and the level of demand.

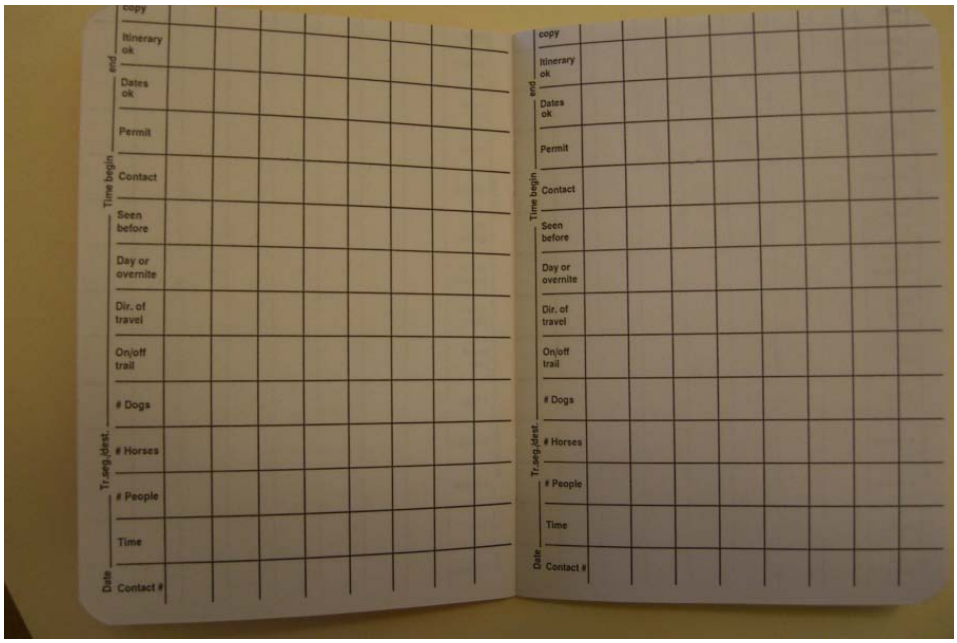


Figure 20. Three Sisters Encounter Data Collection Notebook (with Enlargement)

Data Management

Excel spreadsheets were developed for managing data. Datasheets similar to those presented in other places in this document were created to track all individual encounters, as well as separate spreadsheets for daily summaries (Table 24). The data on each individual group encountered were useful for determining, for example, the percentage of day and overnight visitors encountered, tracking compliance with the wilderness permit requirement, etc. The daily summary data were used for assessing whether encounters were within the standards specified in planning documents.

In Table 24, for each record (date), the number of hours of observation is recorded, along with the number of groups and people observed during that time. This is presented two ways – as "unique" groups (counting only the first encounter on any given day with any given group) and "multiple" (where all encounters with a group are counted). The data on unique encounters were converted to a "per hour" standard. There are also data on compliance with the wilderness permit requirement ("check" = the number of groups checked for permit compliance; "no P" = the number of groups that did not have

a permit). This information was used to correct the use level data on groups and people from the wilderness permits (the actual number of people using the Obsidian trailhead is shown in the final column).

Table 24. Excel Spreadsheet – Example of Daily Summaries of Encounter Data for Obsidian Lake

		Unique		Multiple		Permit Info		Per Hour (unique)		Actual
Date	Hours	GRP	PPL	GRP	PPL	Check	No P	Groups	People	People
7/4/1991	5.5	8	13	9	14	5	0	1.45	2.36	44
7/6/1991	7	9	34	14	54	9	0	1.29	4.86	72
7/11/1991	8	2	6	4	10	2	1	0.25	0.75	9
7/12/1991	4	7	27	7	27	7	2	1.75	6.75	40
7/13/1991	8	14	37	20	58	10	3	1.75	4.63	21
7/14/1991	7	12	29	16	37	3	1	1.71	4.14	31
7/15/1991	5.5	1	3	1	3	0	0	0.18	0.55	1
7/18/1991	6.5	11	28	11	28	10	2	1.69	4.31	36
7/19/1991	7	3	8	4	8	1	0	0.43	1.14	23
7/20/1991	7	4	13	5	18	4	0	0.57	1.86	77
7/21/1991	8	3	7	3	7	2	0	0.38	0.88	96
7/24/1991	5	5	7	5	7	3	0	1.00	1.40	33
7/26/1991	7	7	29	7	29	5	0	1.00	4.14	55
7/27/1991	6	14	33	17	40	11	1	2.33	5.50	99
7/28/1991	7	7	20	7	20	7	0	1.00	2.86	114
8/1/1991	8.5	4	13	4	13	4	1	0.47	1.53	45

Note: GRP = groups; PPL = people. Permit info = information on compliance with wilderness permit requirement (number of groups checked and number without a permit). Actual people = daily use level (from wilderness permits).

Data Analysis

Data collected within the Obsidian Falls area were collected over different periods of time on different days. To combine these data, each day's observations were standardized to an 8-hour day. This was accomplished by dividing the number of groups encountered by the number of hours of observation, and then multiplying by 8 (for an 8-hour day). For the Semi-primitive Opportunity Class of Obsidian Falls, the standard stipulates that there should be no more than 10 encounters per day 80% of the time. The data (Figure 21) illustrate the difference between encounter rates on weekdays and weekends. While weekdays clearly fell within the standard (only approximately 10% of days had 12 or more encounters), weekend days were right at the standard.

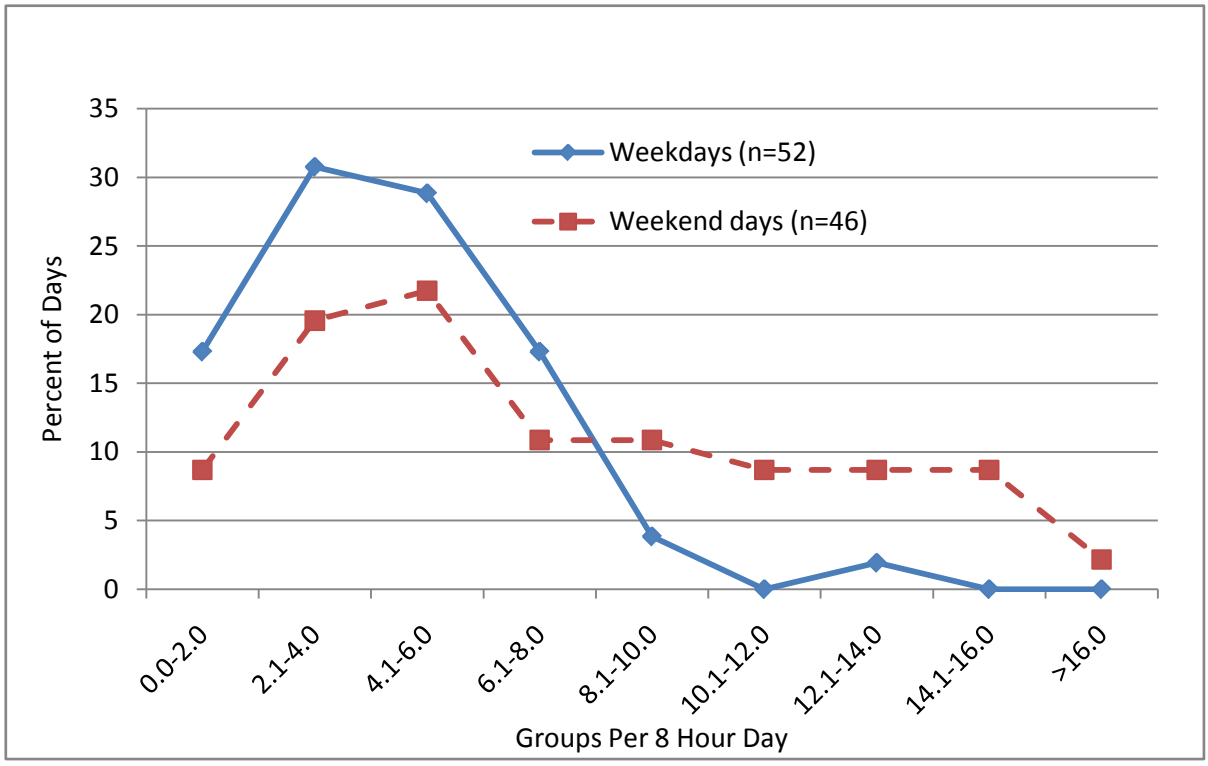


Figure 21. Encounter Rates at Obsidian Falls, 1991-92

Ultimately, through a process of analysis and public involvement, it was decided that use limits would be implemented at Obsidian Falls to keep the number of encounters from increasing further. Because the majority of the use in the area was from day hikers, the limits were applied to both day and overnight users. The rigorous approach to collecting data, and the large dataset, increased managers' confidence that encounter rates were an issue at this destination and helped them communicate this situation to the public.

Having made the decision to implement use limits, an important question was what number of permits should be issued each day. It was decided that permits for 20 groups would be issued per day to groups entering the major access trailhead. This number was arrived at by a rather straightforward reasoning process – the number of encounters was at the standard, meaning that existing use levels should be maintained. Twenty groups was the approximate number entering the Obsidian trailhead on a typical weekend day.

Concluding Thoughts

The Obsidian Falls case study illustrates the careful attention to identifying the purpose of encounter monitoring and designing protocols that collected data specifically related to standards, as well as the types of analysis that can be done with the data. It provides an excellent example of how monitoring data were used to develop management actions taken to protect opportunities for solitude.

Conclusion

How Has Encounter Monitoring Been Used?

Our interviews with managers revealed that – as with many types of monitoring in wilderness – many programs collect data, but some are unsure what to do with it. Perhaps due to lack of time or expertise, data sometimes are not entered into a spreadsheet or database from which analysis can proceed. Or, sometimes, the data reveal "uncomfortable" findings – for instance that encounter rates exceed standards – that may be politically difficult to address. We hope that examples given in this document illustrate how analysis can be quite straightforward, even without sophisticated software.

Encouragingly, beyond the case studies we presented, we did find several examples of where data are being used for a variety of purposes. The Okanogan- Wenatchee NF used its encounter data as part of an outfitter and guide needs assessment. Encounter rates were computed for geographic areas within the three wilderness areas on the Forests and assessed against the standard for encounters per day by opportunity class. Areas close to or exceeding standards were determined to have no potential for outfitting, while areas bellow standard were found to have outfitting potential, at least when considering encounters and opportunities for solitude, though other factors were obviously considered during the process. In several wildernesses, encounter data provide valuable information about visitor characteristics, activities, or permit compliance, which are critical elements in a wilderness stewardship program. In other cases, encounter inventories are being performed, even though there are no current standards for encounters, in order to inform pending planning efforts. As in the Obsidian Falls example, encounter monitoring has been used, in conjunction with biophysical impact monitoring, for decision making in areas experiencing high use. In the Forest Service, there has been more recent interest in encounter monitoring to address elements of the 10 year Chief's Wilderness Challenge. And in all the wilderness management agencies, tracking encounters has been recognized as important to protecting one of the four key qualities of wilderness character.

Parting Thoughts

If your wilderness or land management plan contains an indicator and sets standards for encounters, you are obligated to undertake some form of monitoring. But even if you don't have a formal standard, we hope the examples we have discussed show how useful encounter monitoring can be.

In this document, we have discussed many issues related to monitoring encounters in wilderness. Before undertaking a monitoring program, it is important to be clear about your purpose. If you are establishing a baseline inventory and don't anticipate many problems, it may not require much in terms of time or resources to collect encounter data.

Before you begin your monitoring, it is crucial to define encounters clearly, as well as to address all the various temporal and spatial considerations that accompany a monitoring program. We hope we have shown that analysis of encounter data does not need to be a very complex or arduous task. Certainly, analysis is facilitated by having software like what is used for the Bob Marshall Wilderness, but even without that, simple analyses can be conducted with Excel or even by hand.

The Bob Marshall case illustrates a typical scenario where no additional resources have been devoted to encounter monitoring (although some staff time is required for

analysis), yet over the years an extensive dataset has been generated, from which confident conclusions can be drawn about opportunities for solitude. The Desolation case provides an excellent example of a pragmatic approach, in which a small random sample of days is used as a red flag indicator to signal if additional monitoring will be needed. The Clify Wilderness case illustrates a different approach to pragmatic sampling, and provides some ideas about incorporating alternative indicators for solitude (such as visitor perceptions). The Obsidian Falls case illustrates a workable, though intensive, approach that might be appropriate if you think that you might be considering controversial actions, such as use limits, that require a large, defensible dataset.

Through the various examples presented in this document, it is clear that many different issues have been identified and resolved as encounter monitoring programs have evolved over the years. Hopefully, you have gained some insight into what aspects of encounters might be important for your wilderness.

References

Brown, P. J., & Haas, G. (1980). Wilderness recreation experiences: The Rawah case. *Journal Leisure Research, 12*, 229-241.

Cole, D. (2001). Visitor use density and wilderness experiences: A historical review of research.

Cole, D. (2004). Wilderness experiences: What should we be managing for? *International Journal of Wilderness, 10*(3), 25-27.

Cole, D. N., & Hall, T. E. (2005). Wilderness visitors and experiences in Oregon and Washington: Trailhead surveys in thirteen Forest Service Wildernesses. Retrieved May 30, 2009, from Aldo Leopold Wilderness Research Institute Web site: http://leopold.wilderness.net/research/fprojects/docs7/TrailheadSurvey.pdf.

Cole, D. N., & Hall, T. E. (2006). *Visitors to low use wilderness trailheads in Oregon and Washington: Do they differ from most wilderness visitors?* Retrieved May 30, 2009, from Aldo Leopold Wilderness Research Institute Web site: http://leopold.wilderness.net/research/fprojects/docs7/LowUse.pdf

Cole, D. N., & Hall, T. E. (2008). *Wilderness visitors, experiences, and management preferences: How they vary with use level and length of stay* (Res. Pap. RMRS-RP-71): USDA Forest Service, Rocky Mountain Research Station.

Cole, D. N., Watson, A. E., & Roggenbuck, J. W. (1995). *Trends in wilderness visitors and visits: Boundary Waters Canoe Area, Shining Rock, and Desolation Wildernesses* (Research Paper No. INT-RP-483): USDA Forest Service, Intermountain Research Station.

Graefe, A. R., Vaske, J. J., & Kuss, F. R. (1984). Social carrying capacity: An integration and synthesis of twenty years of research. *Leisure Sciences, 6*(4), 395-431.

Haas, G. E. (2002). *Visitor capacity on public lands and waters: Making better decisions*.

Hall, T., & Shelby, B. (1994). *Eagle Cap Wilderness: Recreational use and impacts*. Report prepared for Wallowa-Whitman National Forest. Corvallis, OR: Oregon State University.

Hall, T. E. (2001). Hikers' perspectives on solitude and wilderness. *International Journal of Wilderness, 7*(2), 20-24.

Hall, T. E., & Cole, D. N. (2007). *Changes in the motivations, perceptions, and behaviors of recreation users: Displacement and coping in wilderness.* Res. Pap. RMRS-RP-63. Fort Collins, CO: U.S. Dep of Agriculture, Forest Service, Rocky Mountain Research Station. 37 p.

Hammitt, W. E., McDonald, C. D., & Noe, F. P. (1984). Use level and encounters: Important variables of perceived crowding among nonspecialized recreationists. *Journal of Leisure Research, 16*, 1-8.

Hockett, K. S., & Hall, T. E. (1999). *Shenandoah National Park backcountry and wilderness visitor study*. Virginina Tech, Department of Forestry.

Hollenhorst, S. J., Frank, E., III, & Watson, A. (1994). The capacity to be alone: Wilderness solitude and the growth of the self. In J.C. Hendee & V.G. Martin (Eds.), *International wilderness allocation, management, and research* (pp. 234-239). Fort Collins, CO: International Wilderness Leadership (WILD) Foundation.

Johnson, A. K., & Dawson, C. P. (2004). An exploratory study of the complexities of coping behavior in Adirondack Wilderness. *Leisure Sciences, 26*, 281-293.

Kuss, F. R., Graefe, A. R., & Vaske, J. J. (1990). *Visitor impact management: A review of research*. Washington, DC: National Parks Conservation Association.

Landres, P., Barns, C., Dennis, J. G., Devine, T., Geissler, P., McCasland, C. S., et al. (2008). *Keeping it wild: An interagency strategy to monitor trends in wilderness character across the national wilderness*

preservation system. Gen Tech Report RMRS-GTR-212. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 77 p

Landres, P., Boutcher, S., Merigliano, L., Barns, C., Davis, D., Hall, T., et al. (2005). *Monitoring selected conditions related to wilderness character: A national framework*. Gen Tech RMRS-GTR-151. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station

Lawson, S., & Manning, R. (2002). Tradeoffs among social, resource, and management attributes of the Denali Wilderness experience: A contextual approach to normative research. *Leisure Sciences, 24*, 297-312.

Lime, D. W. (1977). When the wilderness gets crowded...? *Naturalist, 28*(4), 2-7.

Manning, R. (1985). Crowding norms in backcountry settings: A review and synthesis. *Journal Leisure Research, 17*(2), 75-89.

Manning, R. (1999). *Studies in outdoor recreation: Search and research for satisfaction* (Second ed.). Corvallis, OR: OSU Press.

Manning, R., & Ciali, C. P. (1980). Recreation density and user satisfaction: A further exploration of the satisfaction model. *Journal of Leisure Research, 12*, 329-345.

Manning, R., Valliere, W., Minteer, B., Wang, B., & Jacobi, C. (2000). Crowding in parks and outdoor recreation: A theoretical, empirical, and managerial analysis. *Journal of Park and Recreation Administration, 18*(4), 57-72.

Manning, R. E. (2007). *Parks and carrying capacity: Commons without tragedy*. Washington: Island Press.

Shelby, B. (1980). Crowding models for backcountry recreation. *Land Economics, 56*, 43-55.

Shelby, B., & Hall, T. (1992). *Wilderness monitoring in 1991: Mt. Jefferson, Mt. Washington, and Three Sisters Wildernesses*. Report for Willamette and Deschutes National Forests. Corvallis, OR: Oregon State University.

Shelby, B., & Heberlein, T. A. (1984). A conceptual framework for carrying capacity determination. *Leisure Sciences, 6*(4), 433-451.

Shelby, B., & Heberlein, T. A. (1986). *Carrying capacity in recreation settings*. Corvallis, OR: Oregon State University Press.

Shelby, B., Vaske, J. J., & Heberlein, T. A. (1989). Comparative analysis of crowding in multiple locations: Results from fifteen years of research. *Leisure Sciences, 11*, 269-291.

Shelby, B., Whittaker, D., Speaker, R., & Starkey, E. (1987). *Social and ecological impacts of recreation use on the Deschutes Fiver Scenic Waterway*. Report the Oregon Legislature.

Smyth, R., Watzin, M., & Manning, R. (2007). Defining acceptable levels for ecological indicators: An approach for considering social values. *Environmental Management, 39*(3), 301-315.

Stankey, G. H. (1980). *A comparison of carrying capacity perceptions among visitors to two wildernesses* (Res. Pap. INT-242). Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station

Stankey, G. H., & McCool, S. F. (1984). Carrying capacity in recreational settings: Evolution, appraisal, and application. *Leisure Sciences, 6*(4), 453-473.

Stewart, W. P., & Cole, D. N. (2001). Number of encounters and experience quality in Grand Canyon backcountry: Consistently negative and weak relationships. *Journal of Leisure Research, 33*(1), 106-120.

U.S. Forest Service (1998a). Desolation wilderness management guidlines: Land management amendment: USDA Forest Service, Pacific Southwest Region.

U.S. Forest Service (1998b). Okanogan National Forest Land and Resource Management Plan.

U.S. Forest Service (2003). *The Frank Church-River of No Return Wilderness Management Plan*: USDA Forest Service, Intermountain Region. http://www.fs.fed.us/r4/sc/recreation/fcronr/rod/plantoc/pdf.

U.S. Forest Service (2007). *Bob Marshall Wilderness Complex LAC monitoring guidebook (Revision 1.4)*: Retrieved April 19th, 2009, from http://www.wilderness.net/index.cfm?fuse=toolboxes&sec=vum.

Vaske, J. J., & Donnelly, M. P. (2002). Generalizing the encounter norm crowding relationship. *Leisure Sciences, 24*, 255-269.

Watson, A. E., Cronn, R., & Christensen, N. A. (1998). *Monitoring inter-group encounters in wilderness (Res. Pap. RMRS-RP-14)*. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Watson, A. E., Glaspell, B., Christensen, N., Lachapelle, P., Sahanatien, V., & Gertsch, F. (2007). Giving voice to wildlands visitors: Selecting indicators to protect and sustain experiences in the eastern arctic of Nunavut. *Environmental Management, 40*(6), 880-888.

West, P. (1982). Effects of user behavior on the perception of crowding in backcountry forest recreation. *Forest Science, 28*, 95-105.

Yosemite National Park (2007). Field monitoring guide: Visitor Experience and Resource Protection program. Retrieved from http://www.nps.gov/yose/parkmgmt/upload/VERP%20Field%20Guide%202007.pdf