

**A MAP-DIARY SURVEY OF BACKPACKER ITINERARIES
IN MOUNT RAINIER NATIONAL PARK**

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October 2009

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The success of this project depended in large part on park staff, who distributed the survey to backpackers. The field manager for the 2004 data collection, Mark Husbands, also was essential. Many MORA staff members provided important feedback, review, and support during data collection. Barbara Samora was particularly helpful. Finally, National Geographic - Trails Illustrated Maps made the project possible by providing maps at a discounted cost.

1. INTRODUCTION

The University of Washington Protected Area Social Research Unit administered this project. It was proposed and funded by Mount Rainier National Park (MORA).

Mount Rainier National Park manages 228,480 acres of designated Wilderness. One of the primary uses in much of that area consists of overnight backpackers who camp in designated trailside camps or in dispersed camps. Park managers are using the Visitor Experience and Resource Protection (VERP) planning framework to select indicators and set standards for visitor experience quality in the wilderness. The permit and backcountry camp allotment system that has been employed at Mt. Rainier for many years provides good information about the total number of overnight users on the trail system and in each backcountry camp. However, the VERP planning framework would benefit from more detailed information about visitors' actual routes of travel (including travel off the inventoried trail system), resting and eating sites, time spent traveling, camping, and resting, and areas where visitors perceive crowding. The map-diary method of data collection was devised to collect this information. A mail-back trip itinerary map was used to collect information regarding a) hiking routes, b) places and times where stops occur for more than ten minutes, c) places and times where camps are made, and d) places and times where the number of other hikers present made the respondents feel crowded. These data will provide park managers with information useful for effective planning of visitor management. More specifically, the information will be used in the VERP planning framework.

1.1 The Visitor Experience and Resource Protection (VERP) Framework

The VERP framework is a tool developed by the National Park Service to address user capacities and thus protect both park resources and visitor experience from impacts associated with visitor use. VERP was used in developing the Mount Rainier National Park General Management Plan, and the park has made a commitment to implement VERP throughout MORA. The VERP framework is an ongoing, iterative process of determining desired conditions (including desired cultural resource conditions, desired natural resource conditions, and desired visitor experiences), selecting and monitoring indicators and standards that reflect these desired conditions, and taking management action when the desired conditions are not being realized. VERP is a decision-making framework, but does not diminish management's role in decision-making.

Information about visitor use is essential because VERP is, at its core, a means of managing the impacts associated with visitor use. It is difficult to imagine how decisions intended to limit the impact of visitation could be made in the absence of information describing current levels and patterns of visitor use.

1.1.1 Management Zones in the VERP Framework

MORA is a large park with diverse environments and recreation opportunities. Within the VERP framework, managers deal with such diversity by designating a variety of management zones for a given park. At MORA, the General Management Plan describes 10 recreation zones. The geographic information collected by this survey is critical for making it as useful as possible within the VERP framework. Using the geographic information, analyses can relate the survey results to the specific management zones proposed in the General Management Plan. For example, analyses can determine the proportion of campsites that were located in pristine, primitive, or semi-primitive zones.

1.2 The Purpose and Limitations of this Report

Due to time and budgetary constraints, this document does not include an analysis or discussion of the results for the map-diary survey of backpacker itineraries. Instead, this document is intended to serve primarily as a guide for future analysis of the survey database. Thus, it includes a full description of the methods used to collect the survey information, the content of the database (including metadata), and a discussion of some analyses that might prove useful to MORA managers.

2. METHOD OF DATA COLLECTION

The map-diary survey was designed to contact a representative sample of backpackers and to obtain from them accurate information regarding their actual routes of travel (including travel off the inventoried trail system), resting and eating sites, time spent traveling, camping, and resting, and areas where visitors perceive crowding.

2.1 Sampling and Visitor Contact

2.1.1 Respondent Universe

The universe to which generalization is intended is all overnight users of the Mount Rainier backcountry over the age of 17 during the study period (i.e., July 2 through early September, 2004).

2.1.2 Sampling Schedule

Initial sampling was planned for five permit issuing sites: 1) Longmire Wilderness Information Center, 2) White River Wilderness Information Center, 3) Wilkeson Ranger Station, 4) Jackson Visitor Center, and 5) Ohanapecosh Ranger Station. Packets were distributed to each sample site according to the fraction of backpacker permits those sites had issued during corresponding sample weeks during the 2003 summer season. The packets were sent out at four different times during the visitation season and park staff were instructed to ask all backpacking parties to participate in the survey until the packets were used up. This method of distribution was intended to distribute the survey sample across the season while making the sampling procedure as simple as possible for park staff.

In practice, Ohanapecosh accounted for such a small volume of backpacker traffic that it was eliminated from the sampling plan after the first sampling period. The small number of map packets planned for Ohanapecosh was redistributed to the other sampling sites. The table below shows the distribution of map packets to each of the sample sites for each sampling period.

Start Date	Longmire Wilderness Information Center	White River Wilderness Information Center	Wilkeson Ranger Station	Jackson Visitor Center	Ohanapecosh Ranger Station
July 2	14	12	9	6	1
July 19	41	36	26	17	
Aug 9	46	40	29	19	
Aug 30	32	28	20	14	

Table 1. Distribution of map packets to sample sites by sampling period

Not all the packets were actually distributed to backpackers as intended. In some cases lower than expected backpacker traffic meant that packets were left over when the next sampling period began. In other cases miscommunication with Ranger staff meant that sampling was discontinued early. Of the 390 map packets delivered to the sample sites, 342 were distributed to backpacking park visitors.

2.1.3 Visitor Contact

Survey packets were distributed either by park staff who issued wilderness permits or by survey workers employed for the wide variety of research conducted in 2004. Survey packets were given to backpackers who had completed the backpacking permit process. Backpackers were given a brief contact questionnaire (see section 2.2 *Instruments* below) and then given the map packet and told to follow the instructions describing how to write information on the map that described their hiking trips. The instructions also asked respondents to return the map in the supplied postage-paid envelope at their earliest convenience. All respondents who provided mailing information on the contact questionnaire were sent a “Thank you/Reminder” letter on October 1.

2.1.4 Response Rates and Potential Non-response Bias

From the 342 map packets that were distributed, 223 maps were returned (65%). A total of 168 completed maps were returned prior to October 1, and the remaining 55 maps were returned following the sending of the “Thank you/Reminder” letter.

The actual response rate may have been slightly lower than 65 percent for two reasons. First, a small number of maps were distributed by park staff without receiving a completed contact sheet. Second, park staff did not consistently record refusal rates at the permit sites. Because of the lower than expected map return rate after the first two sampling periods, survey workers performed visitor recruitment during the two final sampling periods. The experience of those workers, consistent with informal reports from park staff, indicated that the initial refusal rate was quite low. Thus, the overall response rate was probably not lower than 60%.

As the previous discussion indicates, the response rate was slightly lower than expected. It was also slightly lower than the rate from past mail-back questionnaires that have been employed at MORA with similar user groups. One potential reason for this low response rate is the complexity of the instrument and the burden on participants. While every effort was made to simplify the information recording process for participants, the instrument still required consistent recording of trip information at multiple locations and times for each day in the backcountry. It is probable that some participants found the process more burdensome in the field than they expected at the time of initial contact. Unfortunately, it is also possible that some participants accepted the instrument just to acquire the map and never intended to complete the study. This risk was partially addressed by describing the study process to potential recruits prior to displaying the map packet.

It is mathematically possible that the proportion of backpackers who did not return the map could be sufficiently different from the respondents so as to affect the accuracy with which the sample represents the population. Some information was available from the contact questionnaire that allowed statistical tests comparing respondents and non-respondents. Comparisons were made for gender, age, and party size. Respondents were found to be significantly older (mean = 40.7) than non-respondents (mean = 37.2); $F(1, 315) = 5.31, p = .022$. Respondents were also found to visit in significantly smaller parties (mean = 2.20)

than non-respondents (mean = 2.67); $F(1, 330) = 6.95, p = .009$.

Both of these differences had the potential to bias the survey results because they are plausibly related to the types of hiking behavior measured by the survey. For example, older backpackers may hike shorter distances than younger backpackers. Analyses of the numeric information provided by respondents might adjust for the potential non-response bias by using data that are weighted so as to better reflect the target population.

2.2 Instruments

2.2.1 Contact Questionnaire

The primary survey instrument was a map-diary questionnaire. However, a brief contact questionnaire was the first instrument filled out by participating backpackers. The contact questionnaire asked backpackers for some basic information about themselves and the other members of their party, and also asked for a mailing address. The contact questionnaire can be found in Appendix A.

2.2.2 Survey Packet

The survey packet was contained in a plastic bag and included instructions, a map, a pen, and a postage-paid return envelope. Respondents recorded their diary entries by writing directly on the map to show the party's hiking route, places and times where they stopped for more than ten minutes, places and times where they camped, the number of other camps within sight or sound of their campsites, and the places (if any) where they felt crowded by the number of other hikers. The map provided was a commercial product (National Geographic Trails Illustrated Map) that is intended for use in hiking navigation and was thus likely to be kept handy and filled out during the course of the day.

The instruction sheet for the map diary explained the procedure for recording diary entries and included an example illustrating how a typical trip might be recorded. The instruction sheet can be found in Appendix B.

3. DATA CODING

Two of the 223 returned maps reported trips that did not include an overnight stay. These trips were not included in the final dataset.

The information recorded on the returned maps was entered in an electronic database in the form of points placed on a digital map of MORA. Each point was identified with one of six labels:

1. **Start** – The place where the party began their backpacking trip.
2. **End** – The place where the party finished their backpacking trip.
3. **Campsite** – A place where the party camped overnight.
4. **Stop** – A place where the party stopped hiking for more than 10 minutes.
5. **Crowded** – A place where the party felt crowded by the number of other visitors.
6. **Other** – Points used to indicate hiking routes other than the trails included in the MORA GIS "Trails" layer.

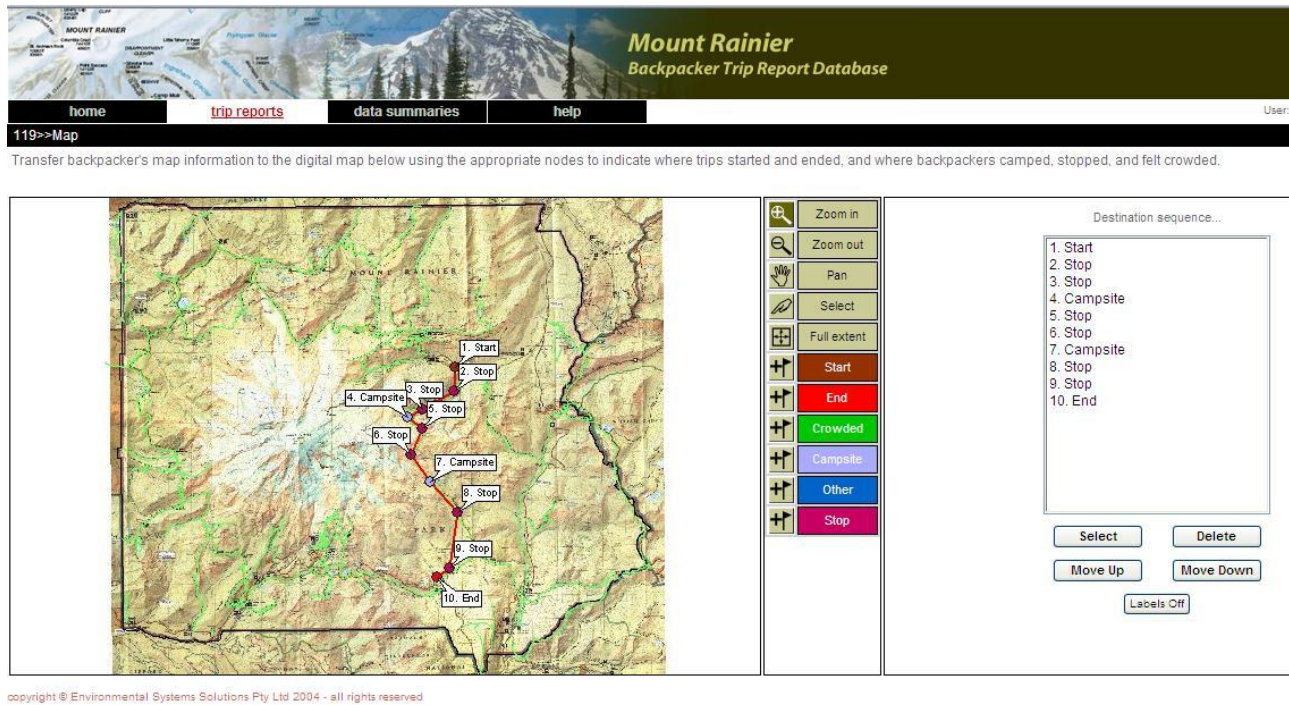


Figure 1. Screenshot of web-based data entry program.

The digital information was recorded using a custom web-based data entry program (see Figure 1) that allowed workers to click on a map of MORA to place the point geographically (i.e., the program recorded GIS coordinates locating each point) and then add a variety of specific information relevant to that point. Points were recorded in the same sequence in which they occurred during the trip, and that sequential order was retained in the database. The additional data recorded for each type of point (in addition to the geographic coordinates placing that point on the map) were:

1. **Start** – Date, Time.
2. **End** – Date, Time.
3. **Campsite** – Setup Date, Setup Time, Takedown Date, Takedown Time, Other Camps in Sight/Sound.
4. **Stop** – Beginning Date, Beginning Time, Ending Time.
5. **Crowded** – Beginning Date, Beginning Time, Ending Time.
6. **Other** – Optional note.

The data recorded from the maps was recorded in a Microsoft Access database. These data can be linked to the information from the brief contact questionnaire. Thus, information about the party such as party size, presence of children, and ages of party members could be used in analysis of the map data.

4. DATA ANALYSIS

A wide variety of analyses could yield information that is of potential interest to managers. In this section, two examples of such analyses are discussed.

4.1 Campsite Isolation

One of the indicators of visitor experience quality recommended for use in the Pristine and Primitive wilderness zones is the ability to camp out of sight and sound of other parties. The map-diary survey collected information that could be used to assess this indicator for backpackers in 2004. A simple analysis that was conducted for this purpose illustrates the use of geographic and textual information to answer questions about backpackers' experiences.



Figure 1. Campsites reported by backpacking parties in the map-diary survey. Note that multiple party-nights camped at backcountry camps show up as single red dots.

Figure 1 shows all the campsites reported in the map-diary survey. The first step in the analysis of campsite isolation for these sites was to select camps that were made in the Pristine or Primitive wilderness zones. This was done using GIS algorithms to select all camps that were 400 meters or more from an official trail (the semi-primitive trail zone extends for $\frac{1}{4}$ mile from the trail). A total of 656 campsites were recorded in the map-diary database. Of these, only 25 were 400 meters or more from an official trail, and 21 of those 25 (84%) were reported to have no other camps within sight or sound of other parties.

This analysis is interesting both, a) because it suggests that the vast majority of camps are made in the semi-primitive trail zone (probably in trail-side camps, although their spatial distribution could also be

examined using this database), and b) because it shows that a large majority of camps outside the semi-primitive trail zone are made in isolation.

4.2 Crowding

One of the defining characteristics of visitor experiences in wilderness is the opportunity for solitude. Thus, reports of crowding are of particular interest to wilderness managers. Figure 1 (below) shows that the map-diary survey found that 65 percent of backpackers reported no points at which they felt crowded by the number of other visitors, 15 percent recorded one point, 11 percent recorded two points, and 9 percent recorded more than two points. These data do not indicate the actual number of other visitors that backpackers encountered, but do suggest that most backpackers did not feel crowded by the encounters they had. A spatial analysis of the points at which backpackers reported feeling crowded would be of considerable interest to managers. One might hypothesize that feelings of crowding would be more common in higher-density areas such as Transition Trail zones. Multiple indications of crowding in lower-density zones would be cause for greater concern.

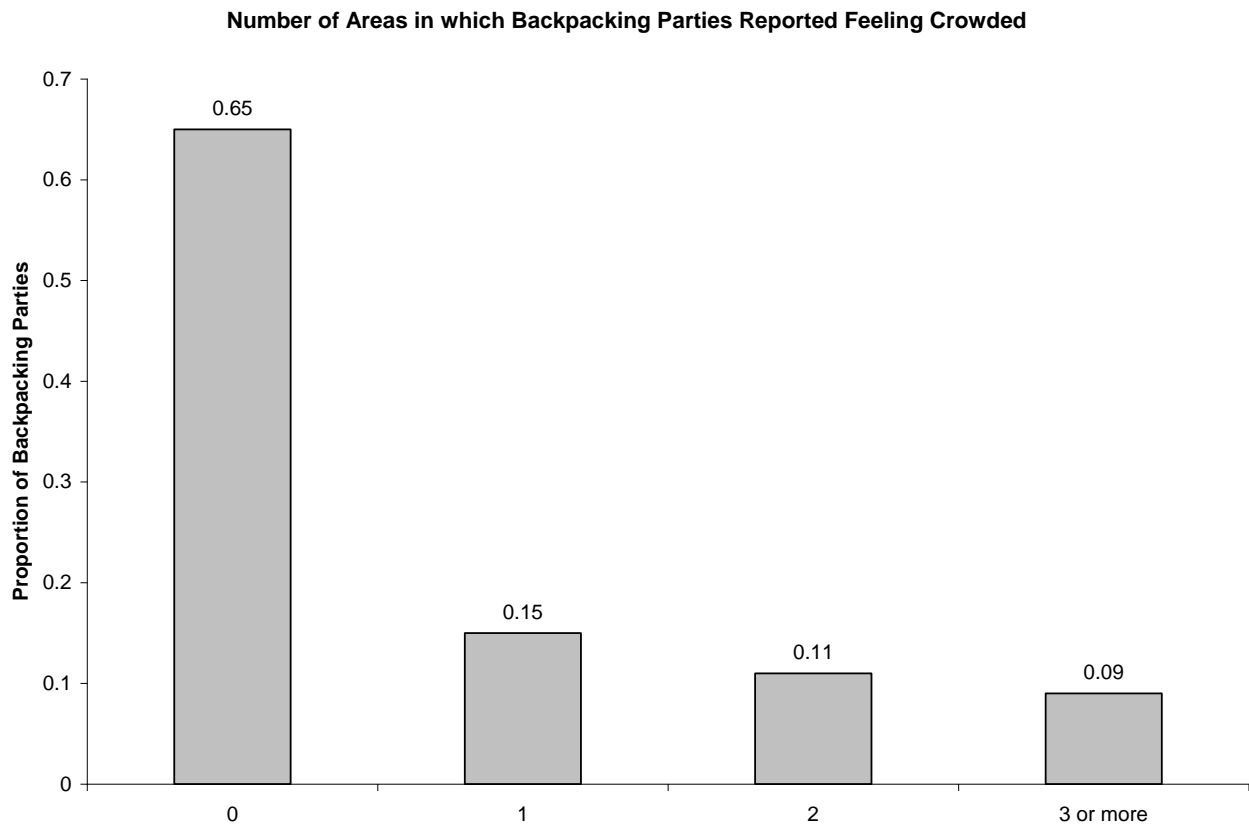


Figure 2. Crowding reported by backpackers.

4.3 Future Analyses

Information describing visitor use can be analyzed in ways that range from simple to very sophisticated. VERP planning can benefit greatly from relatively simple summary statistics that describe visitation in terms of the number of visitors or parties and the distribution of their activities. Further analyses of these data might focus on summary statistics that answer questions such as: Where do backpackers

commonly spend time when they are not hiking? How much time per day do backpackers generally spend in motion? What are the most common non-official trails or routes used by backpackers?

Information about visitation can also be used to develop sophisticated computer simulation models of visitor distribution. Such simulation models could be built using the form of itinerary information collected by the map-diary survey. Depending on the questions about backpacking use that prove important to MORA managers, the development of a computer simulation model of backpacking use may be desirable to help managers protect both visitor experiences and physical resources.

APPENDIX A: CONTACT QUESTIONNAIRE

2004 Mount Rainier National Park Backpacker Trip Itinerary

Mount Rainier National Park has asked the Protected Area Social Research Unit at the University of Washington to conduct this study of visitors who request wilderness camping permits. The statement below provides important information about the study.

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. Your name is requested for follow-up mailing purposes only. When analysis of the questionnaire is completed, all name and address files will be destroyed. Thus the permanent data will be anonymous. Data collected through visitor surveys may be disclosed to the Department of Justice when relevant to litigation or anticipated litigation, or to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting a violation of law. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Burden estimate statement:

Public reporting burden for this form is estimated to average 4 minutes per respondent. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, WASO Administrative Program Center, National Park Service, 1849 C Street, N.W., Washington, D.C. 20240.

Mount Rainier managers are gathering information about wilderness trips so that they can provide visitors with opportunities for high quality experiences. The survey has two parts because some information is available now and other information must be collected later. The first part of the survey takes less than five minutes and asks about your hiking party and trip plans. The second part of the survey is a map diary that asks you to keep track of your movement during this backpacking trip. It is estimated to take 10 minutes per day to report. This survey is voluntary, and any information you provide is confidential.

**IF YOU ARE WILLING TO PARTICIPATE IN THE FIRST PART OF THE SURVEY
PLEASE FILL OUT THE QUESTIONS ON THE BACK OF THIS SHEET**

2004 Mount Rainier National Park Backpacker Survey Contact Questions

Your participation in this survey will help us to better meet the needs of visitors to the park. Thank you for your time.

1. Please provide the following information for each member of your party:

#	Age	Gender	Home Zip Code (or country if non-US)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

2. When will your party's hiking trip start and end?

_____ Start Date _____ End Date

3. At what trailhead will your party's trip start?

_____ T
railhead

4. At what trailhead will your party's trip end?

_____ T
railhead

We would like you to keep track of your movement during this backpacking trip by writing on a map that we will provide. It is estimated to take 10 minutes per day to report. If you would be willing to participate in this second part of the survey, *please pick up a map and instruction packet from the registration desk* when you return this form.

Also, please provide your name and address so that we are able to send you a thank you, and if necessary, remind you to return your map. The contact information will not be used for any purposes other than this survey.

Name

Address

City State Zip Code

APPENDIX B: INSTRUCTIONS FOR COMPLETING THE MAP-DIARY

PRIVACY ACT and PAPERWORK REDUCTION ACT statement:

16 U.S.C. 1a-7 authorizes collection of this information. This information will be used by park managers to better serve the public. Response to this request is voluntary. No action may be taken against you for refusing to supply the information requested. Your name is requested for follow-up mailing purposes only. When analysis of the questionnaire is completed, all name and address files will be destroyed. Thus the permanent data will be anonymous. Data collected through visitor surveys may be disclosed to the Department of Justice when relevant to litigation or anticipated litigation, or to appropriate Federal, State, local or foreign agencies responsible for investigating or prosecuting a violation of law. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Burden estimate statement:

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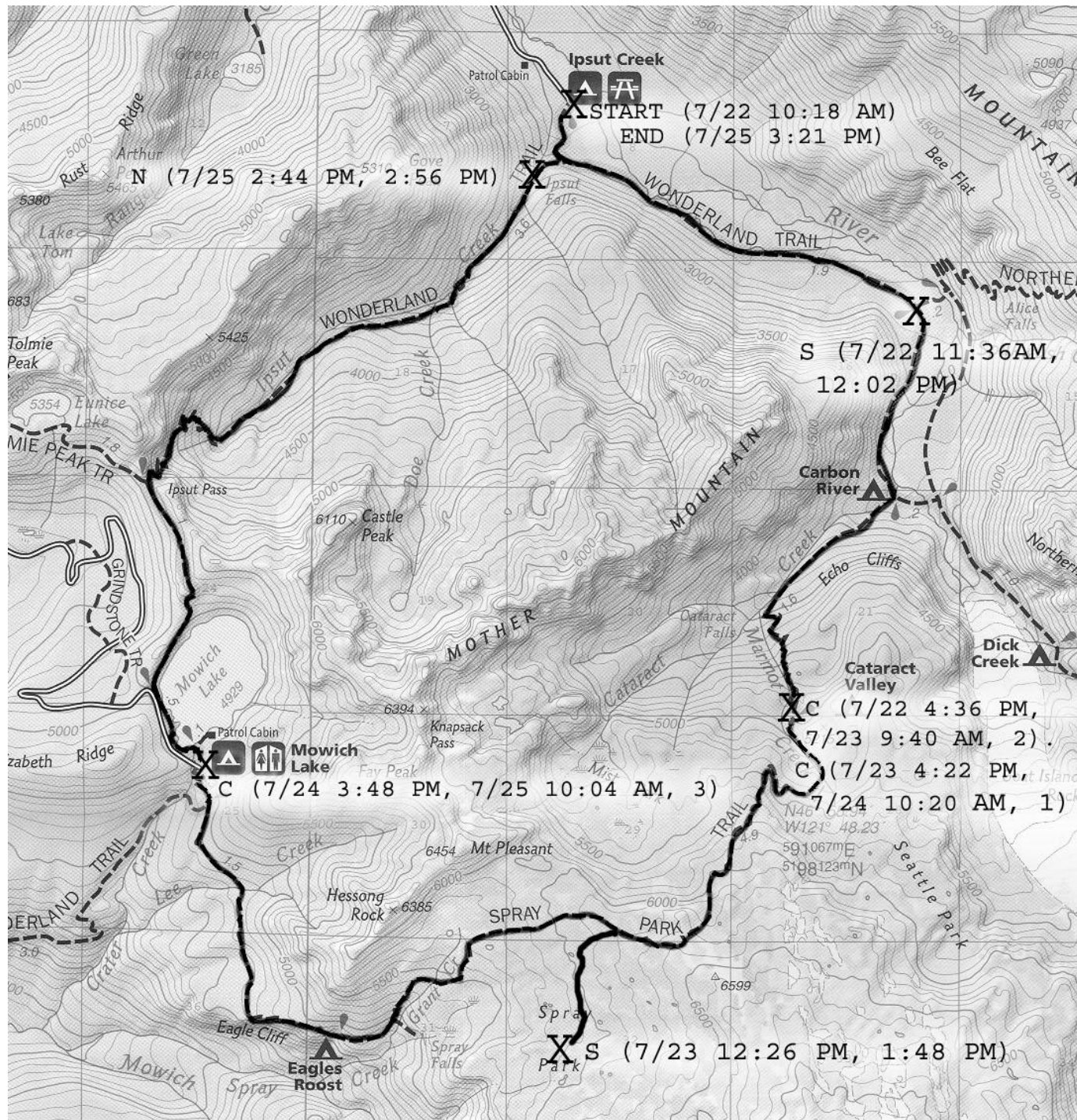
Instructions for Completing Your Map Diary

We are interested in specific information about hiking trips. In order to accurately record *your* trip information, please write down information at least once a day based on the instructions below. We recommend that you keep the map accessible so it can be used for navigation and filled out as you hike.

On the map provided:

- Please show your **hiking route** by drawing a line indicating the route you followed. Please include all side trips and hiking routes that are not on the official trail system.
- There are five types of significant points that should be labeled based on the table below. Please mark the specific location of each significant point by placing an X on your hiking route. To best understand how to mark and label the significant points refer to the sample map on the other side of this sheet while reviewing the table below.

Point Type	Label	Description
Start of Hike	START (date & time)	The place and time you start your hiking trip.
Hiking Stop	S (date & time began, time ended)	Each place you took stopped hiking for more than 10 minutes . Includes the time when you stop and the time you start again. The date allows us to tell when stops are made on the same trail but on different hiking days.
Felt Crowded	N (date & time began, time ended)	Each place that you felt crowded by the number of other visitors . Includes the time you start and stop feeling crowded. If the location extended along a section of trail or a cross-country area, carefully circle that area and label it.
Campsite	C (date & time stop hiking, date & time start hiking, # of camps in sight/sound)	Each campsite you used . Includes the time you entered camp and the time you started hiking again. If you use the same camp more than one night and day-hike more than ½ mile from camp, include a separate label for each night you stay and use the times to indicate when you went day-hiking. Note the number of other occupied camps within sight or sound of your camp.
End of Hike	END (date & time)	The place and time you end your hiking trip.



Sample Map:

This sample trip itinerary map will help clarify the method for marking significant points on your hiking route.

- **START (7/22 10:18 AM)** Started at *Ipsut Creek Campground*
- **S (7/22 11:36AM, 12:02 PM)** Took rest break at *Yellowstone Cliffs Trail junction*
- **C (7/22 4:36 PM, 7/23 9:40 AM, 2)** Camped at *Cataract Valley Camp*. Noted 2 other groups camped within sight and sound.
- **S (7/23 12:26 PM, 1:48 PM)** Day hiked into *Seattle Park* and stopped.
- **C (7/23 4:22 PM, 7/24 10:20 AM, 1)** Returned to *Cataract Valley Camp* for a second night. Noted 1 other group.
- **C (7/24 3:48 PM, 7/25 10:04 AM, 3)** Camped at *Mowich Lake Campground*. Noted 3 other groups.
- Took short walks within 1/2 mile of camp, but did not record them on the map.
- **N (7/25 2:44 PM, 2:56 PM)** Hiked the *Ipsut Creek Trail*. The person completing the map felt crowded at *Ipsut Falls*, and marked that area.
- **END (7/25 3:21 PM)** Finished the trip at *Ipsut Creek Campground*

X = Specific location of significant point.



= Hiking Route



As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environment and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interest of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under US administration.

