

Backcountry Day Hikers at Grand Canyon National Park



Erik A. Backlund, William Stewart, Zvi Schwartz, Cary McDonald

October 2006



Park Planning & Policy Lab

Department of Recreation, Sport and Tourism, University of Illinois at Urbana-Champaign

**BACKCOUNTRY DAY HIKERS AT
GRAND CANYON NATIONAL PARK**

**PARK PLANNING AND POLICY LAB
UNIVERSITY OF ILLINOIS
CHAMPAIGN, IL 61821
WWW.PARKLAB.UIUC.EDU**

Erik A. Backlund, William Stewart, Zvi Schwartz, Cary McDonald

SUBMITTED TO GRAND CANYON NATIONAL PARK

OCTOBER 2006

EXECUTIVE SUMMARY

This report presents findings of a study of backcountry day hikers at Grand Canyon National Park. Day hikers account for the majority of backcountry use at Grand Canyon yet they are not well-understood. The purpose of this study was to provide evidence regarding the number and patterns of day hikers as well as assessing their informational needs and experiences. Specifically the objectives were to:

- 1) Estimate the number and distribution of backcountry day hikers.
- 2) Identify day hiker characteristics in terms of socio-demographic characteristics, group characteristics, hiking experience, hiking behaviors, and motivations.
- 3) Assess hiking preparedness of day hikers, and their support for management actions designed to increase day hiker safety.
- 4) Assess day hikers' attitudes toward resource protection and their knowledge of appropriate low-impact hiking behaviors.
- 5) Assess day hikers' level of satisfaction with their Grand Canyon experience.
- 6) Suggest management actions that best meets the social needs of day hikers.

Data collection procedures included the collection of trail traffic via infra red counters, hand counts of day hikers, and trailside exit interviews of day hikers. During the study period of May through October 2004, counters were placed near trailheads for durations corresponding to onsite interviews for the particular trailhead. On the sampled days, researchers both interviewed day hikers as they exited the trail and counted all exiting day hikers. An interview schedule was developed so that the sample of day hikers was representative in terms of days of the week (weekday/weekend) and times of the day between 6:00 am and 8:00 pm on the South Rim Corridor trails, the South Rim Threshold trails, and North Rim trails (North Kaibab, Widforss, and Ken Patrick). At each trail, a sampling interval of n hikers was determined so that every n th hiker appearing over the age of 18 was approached and invited to be interviewed. Each questionnaire contained a core set of items asked of all interviewees, followed by one of four thematic "modules" with each module being asked of about one-fourth of the interviewees. The modules of each questionnaire covered the four themes of hiking safety and preparedness, resource protection and low-impact hiking knowledge, overall satisfaction, and preferences for various recreational experience items.

Results of the trail count indicate that the daily averages ranged from 464-787 day hikers for the Bright Angel, 302-567 day hikers for the South Kaibab, and 146-208 day hikers for the North Kaibab. The counts on the other trails were too small to provide reliable daily averages, however the counts ranged from 1 to 76 day hikers on the days sampled. For the Bright Angel, Saturdays were the peak-use days, and the second highest use occurred on Fridays. In general across all three Corridor trails, there was a steady flow of visitors hiking uphill across the hours of the day, with daily peaks of uphill visitors between noon to 3:00 pm. Close to 15% of Corridor respondents were hiking more than 10 miles, and 4% reported hiking more than 14 miles.

There was a broad diversity of respondents' past hiking experiences, preferred recreational experiences, and preferences for managerial and social conditions. Respondents' past experience in day hiking at Grand Canyon varied by trailheads. More experience hikers tended to be found

on South Rim Threshold trails and North Rim trails. Less experienced hikers tended to be found on the South Rim corridor trails. Despite the differences in hiking skill and experience, hikers at all trailheads generally indicated that solitude was a highly preferred experience. The Bright Angel Trail serves the bulk of novice hikers as well as groups with young children. The facilities on the Bright Angel Trail provide these groups with an opportunity to have a backcountry experience that they otherwise would not risk, nor would they be likely to hike on other trails at Grand Canyon.

The *Hike Smart* campaign was effective in changing behavior of a significant portion of respondents and in the direction of insuring a safe hiking experience. Evidence from the trend in SAR events before and after the *Hike Smart* program and its predecessors suggests that the rate of SAR events has declined. Furthermore, one-fifth of the respondents indicated that they changed their plans based on the information they received on day hiking. The greatest proportion of those who changed behavior carried more water (39%), shortened their hike (36%), and/or changed their route of travel (27%). Close to 6% of respondents reported that they were not prepared for their hike. These unprepared day hikers were most likely found on the Bright Angel, South Kaibab, and Grandview trails.

Respondents generally were concerned about their recreational impacts and were knowledgeable about low impact behavior, however many were confused about proper disposal of toilet paper. When asked their level of agreement with the statement “It is important for day hikers to minimize their impact on the resource,” 97% indicated that they either “agree” or “strongly agree.” In addition, 91% indicated that they were well informed about appropriate behavior to protect park resources. Responses to a short “quiz” on appropriate low impact techniques assessed respondents’ knowledge. The large majority of respondents identified the correct response on at least 9 out of 11 true/false items on this quiz. The item most likely to be answered incorrectly was directed at whether toilet paper should be buried when toilets are not available. There were 58% who incorrectly reported that toilet paper should be buried.

The vast majority of sampled day hikers were satisfied with their experiences, the current use levels, and with managerial operations; the behavior of other visitors was the most important factor influencing hikers’ satisfaction. When asked if they enjoyed their hike, 98% of the respondents agreed. Factors most likely to detract from a high quality experience were mule waste, litter, and encountering inconsiderate behavior of other groups. Respondents were asked to rate the importance of a series of social and managerial conditions regarding their effect on the quality of their experience. “Considerate behavior of other groups” was reported as the most important factor affecting a high quality experience, and it was reported as such by 96% of respondents. The proportion rating various managerial conditions as important was generally below 60% whereas social conditions were generally above 60%.

Recommendations to best meet social needs of day hikers were developed, and based upon evidence from this study, discussion with NPS staff, various management documents and value statements identified from these documents, an understanding of park management research and current management techniques, and opinions of the authors. The five recommendations of this study are:

1. *Maintain and further define the spectrum of day hiking opportunities.* The park should manage the unique aspects of each trail by continuing to vary the level and degree of managerial presence and vehicle access.
2. *Continue to maintain and care for facilities and conditions along the Bright Angel Trail Corridor in order to benefit day hikers.* The Bright Angel Trail provides outstanding day hiking opportunities for a variety of visitors, including families with young children and hikers without a high degree of backcountry day hiking experiences.
3. *Maintain and improve preventative search and rescue activities.* Facilitating visitors to have safe hiking experiences has been an important priority for park management. The current PSAR effort is effective, and its development could be further explored to increase its reach.
4. *Minimum impact education should emphasize behaviors related to human waste, hiking etiquette, and littering.* The study shows that litter along trails, and encountering inappropriate or rude behavior of others were the most likely condition to detract from day hiker satisfaction. In addition, a significant portion of respondents did not know proper disposal of toilet paper in places where facilities were not available.
5. *Develop and implement a program to monitor visitor's perceptions and evaluations of the social, managerial, and environmental conditions* to assess management objectives related to site conditions and experience quality. The study estimated the number of day hikers on each trail, the proportion of day hikers using the Canyon View Information Plaza, visitor knowledge of low impact techniques, and preferences for solitude, as examples of parameters that could be connected to managerial objectives and a monitoring program.

These recommendations are provided in the spirit of improving upon an already good job of providing high quality day hiking experiences at Grand Canyon.

ACKNOWLEDGMENTS

This research project could not have been completed without the assistance, thought and effort of many people. In particular, the following people made significant contributions of time and effort:

James Barkley, University of Illinois
Mathieu Brown, Grand Canyon National Park
Yong Soon Chang, University of Illinois
Lori Crystal, Grand Canyon National Park
Brian Forist, NPS Washington Office
Jim Gramann, NPS Washington Office
Kirstin Heins, Grand Canyon National Park
Linda Jalbert, Grand Canyon National Park
Lil Jonas, Jonas Consultants
David Jonas, Jonas Consultants
Amy McDonald, Data Entry Clerk
Steve Sullivan, Grand Canyon National Park
Bil Vandergraf, Grand Canyon National Park
Ken Weber, Grand Canyon National Park - Retired

DAY HIKER QUICK FACTS

MAXIMUM DAILY VOLUME OF DAY HIKERS ON THE BRIGHT ANGEL TRAIL: 790

% DAY HIKERS WHO HIKE SOLO: 14

% WHO HIKE WITH ONE PARTNER: 48

% HIKING AT GRAND CANYON FOR THE FIRST TIME: 57

% ON THEIR FIRST VISIT TO GRAND CANYON: 47

AVERAGE DAY HIKE DISTANCE: 5 MILES

AVERAGE DAY HIKE DURATION: 3.5 HOURS

% DAY HIKERS WHO HIKER MORE THAN 10 MILES: 11

% WHO REPORT EXERCISING FOR AT LEAST 20 MINUTES EVERY OTHER DAY: 81

% WHO INDICATED THAT THEY DISAGREED WITH THE STATEMENT "I WAS WELL PREPARED FOR MY HIKE": 6

% WHO BELIEVE IT IS IMPORTANT FOR HIKERS TO MINIMIZE THEIR IMPACT: 98

% WHO WOULD CHANGE THEIR BEHAVIOR TO AVOID IMPACTING PARK RESOURCES: 53

TOP TWO INFORMATION SOURCES USED BY DAY HIKERS:
BOOKS/MAGAZINES, GRAND CANYON WEBSITE

% WHO KNOW HOW TO PROPERLY DISPOSE OF THEIR TOILET PAPER: 42

INFORMATION SOURCE MOST LIKELY TO BE USED BY THOSE WHO KNOW HOW TO CORRECTLY DISPOSE OF THEIR TOILET PAPER: CANYON VIEW INFORMATION PLAZA (CVIP)

% OF ALL DAY HIKERS WHO VISITED CVIP: 7

% OF VISITORS WHO THOUGHT THAT THE CONSIDERATE BEHAVIOR OF OTHERS WAS IMPORTANT TO THE QUALITY OF THEIR EXPERIENCE: 96

% WHO THOUGHT THAT THE NUMBER OF OTHER GROUPS ENCOUNTERED WAS IMPORTANT: 59

% WHO SAID THAT THEY THOROUGHLY ENJOYED THEIR HIKE: 98

TABLE OF CONTENTS

EXECUTIVE SUMMARY i

ACKNOWLEDGMENTS iv

DAY HIKER QUICK FACTS.....v

TABLE OF CONTENTS..... vi

LIST OF TABLES vii

LIST OF FIGURES xi

INTRODUCTION 1

 OBJECTIVES 4

ESTIMATING THE NUMBER AND DISTRIBUTION OF
BACKCOUNTRY DAY HIKERS 5

 RESULTS OF TRAIL COUNTS.....8

 HOUR-BY-HOUR DISTRIBUTION 9

 DESTINATIONS OR ROUTES WITHIN TRAILS..... 11

 CONCLUSION..... 15

METHODS OF DAY HIKER INTERVIEWS..... 16

 PROCEDURES 16

 ANALYSIS 16

DAY HIKER AND HIKING GROUP CHARACTERISTICS..... 18

 SOCIO-DEMOGRAPHIC CHARACTERISTICS 18

 GROUP CHARACTERISTICS & HIKING BEHAVIOR..... 21

 HIKER MOTIVATIONS..... 25

 CHARACTERISTICS OF LONG DISTANCE HIKERS 28

 CONCLUSIONS 30

HIKER PREPAREDNESS 31

 INFORMATION SOURCES..... 31

 PHYSICAL FITNESS CHARACTERISTICS..... 34

 SUPPORT FOR PSAR ALTERNATIVES 35

 UNPREPARED HIKERS 38

 CONCLUSION..... 39

RESOURCE PROTECTION ATTITUDES & KNOWLEDGE..... 40

 RESOURCE PROTECTION ATTITUDES..... 40

 KNOWLEDGE OF BACKCOUNTRY REGULATIONS 40

 CONCLUSIONS 43

DAY HIKER SATISFACTION.....45
 OVERALL SATISFACTION45
 RESOURCES IMPACTS46
 SOCIAL AND MANAGERIAL CONDITIONS50
 CONCLUSIONS55

CONCLUSIONS AND RECOMMENDATIONS.....56

REFERENCES64

APPENDIX A: METHODOLOGY TO CALIBRATE THE
 INFARED COUNT DATA.....65

APPENDIX B: DAY HIKER INTERVIEW QUESTIONNAIRES:
 FREQUENCY DISTRIBUTIONS75

APPENDIX C: INTERVIEW SCHEDULE.....84

APPENDIX D: STATE/COUNTRY OF ORIGIN FREQUENCIES92

APPENDIX E: MOTIVATION ITEMS ANALYSIS96

LIST OF TABLES

TABLE	PAGE NUMBER
1.1. SAR EVENT RATES SINCE 1987	2
2.1. DATA COLLECTION FOR INFRARED COUNTS	6
2.2. DATA COLLECTION FOR EXIT COUNTS	7
2.3. PROPORTION OF DAY HIKERS EXITING THE TRAIL BY HOUR	9
4.1. DAY HIKERS’ DEMOGRAPHIC CHARACTERISTICS COMPARED TO THE 2000 CENSUS	18
4.2. AGE BY LOCATION AND OF HIKE AND SEASON COMPARED TO THE 2000 CENSUS AND RIM VISITORS.....	19
4.3. DAY HIKERS’ SOCIO-ECONOMIC CHARACTERISTICS	20
4.4. RESPONDENTS’ GEOGRAPHIC REGION OF ORIGIN	21
4.5. SIZE OF GROUPS BY TRAILHEAD	22
4.6. TOTAL DAYS SPENT AT GRAND CANYON DURING CURRENT TRIP BY PAST EXPERIENCE DAY HIKING AT GRAND CANYON	22
4.7. DAY OF VISIT HIKER WAS INTERVIEWED	23
4.8. DURATION OF DAY HIKES.....	23
4.9. DISTANCE HIKED BY LOCATION OF HIKE.....	24
4.10. PAST HIKING EXPERIENCE	24
4.11. PAST HIKING EXPERIENCE AT GRAND CANYON BY LOCATION	25
4.12. IMPORTANCE OF MOTIVATION DOMAINS	26
4.13. DAY HIKERS’ MEAN SOLITUDE RATINGS BY TRAILHEAD	27
4.14. FAMILY TOGETHERNESS BY SEASON.....	28
4.15. DISTANCE HIKED BY AMOUNT OF WATER TAKEN, HIKING ALONE, AND GENDER	29
4.16. DISTANCE HIKED BY DAILY EXERCISE LEVEL, ITEMS TAKEN ON HIKER, AND TIMING OF DECISION TO DAY HIKE	30

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

5.1. INFORMATION SOURCES USED BY DAY-HIKERS31

5.2. CONTENT OF INFORMATION RECEIVED32

5.3. INFLUENCE OF INFORMATION RECEIVED ON HIKING BEHAVIOR32

5.4. ITEMS TAKEN ON HIKE.....33

5.5. MEAN WATER PER PERSON PER MILE HIKED BY SEASON AND TRAILHEAD34

5.6. FITNESS OF DAY-HIKERS34

5.7. AGREEMENT ON NECESSITY OF RANGER PATROLS35

5.8. AGREEMENT ON HIKING SAFETY ITEMS36

5.9. SUPPORT FOR MANAGEMENT ALTERNATIVES.....37

5.10. PROPORTION OF PREPARED AND UNPREPARED HIKERS BY TRAILHEAD38

5.11. PROPORTION OF PREPARED AND UNPREPARED HIKERS BY NUMBER OF DAYS
AT THE PARK.....38

5.12. PREPARED AND UNPREPARED HIKERS WITH WATER CARRIED ON HIKE39

6.1. DAY HIKERS’ ATTITUDES TOWARD LOW-IMPACT BEHAVIORS41

6.2. PROPORTION TRUE OR FALSE TO QUESTIONS ABOUT BACKCOUNTRY REGULATIONS41

6.3. QUIZ SCORES ON KNOWLEDGE OF LOW IMPACT BEHAVIOR BY HIKING EXPERIENCE.....42

6.4. QUIZ SCORES ON KNOWLEDGE OF LOW IMPACT BEHAVIOR BY DAY
HIKING EXPERIENCE42

6.5. QUIZ SCORE BY RESPONSE TO “DID THE INFORMAITON YOU RECEIVED
INCLUDE LOW IMPACT HIKING TECHNIQUES?”43

6.6. DIFFERENCE BETWEEN PROPORTION OF CORRECT RESPONSES BY INFORMATION
SOURCES AND PROPORTION THAT USE THAT INFORMATION SOURCE44

7.1. PROPORTION OF RESPONDENTS INDICATING THEIR LEVEL OF AGREEMENT WITH
FIVE SATISFACTION STATEMENTS45

7.2. DISTRIBUTION OF SATISFACTION INDEX SCORES46

7.3. APPARENTNESS OF RESOURCE IMPACTS46

7.4. MEAN “APPARENT” RATINGS BY TRAILHEAD.....47

7.5. RESOURCE IMPACTS AND LEVEL OF FEELING DISTURBED.....48

7.6. “APPARENT” AND “DISTURBING” CORRELATIONS FOR RESOURCES IMPACTS.....49

7.7. APPARENTNESS BY FEELING DISTURBED FOR LITTER ALONG TRAIL.....50

7.8. APPARENTNESS BY FEELING DISTURBED FOR TRAIL EROSION.....50

7.9. IMPORTANCE OF SOCIAL AND MANAGERIAL CONDITIONS51

7.10. MANAGERIAL AND SOCIAL CONDITIONS: MEAN IMPORTANCE RATINGS
BY TRAILHEAD.....52

7.11. SATISFACTION WITH SOCIAL AND MANAGERIAL CONDITIONS.....53

7.12. PROPORTION OF RESPONDENTS INDICATING LEVEL OF SATISFACTION WITH
MANAGERIAL CONDITIONS BY TRAILHEAD54

LIST OF FIGURES

FIGURE	PAGE NUMBER
1.1. TREND IN SAR EVENTS 1987-2005	3
2.1. DAY USER EXIT TRAFFIC	8
2.2. BRIGHT ANGEL HOURLY DAY HIKERS EXITING TRAIL (MAY –OCTOBER)	10
2.3. BRIGHT ANGEL HOURLY DAY HIKERS ON THE TRAIL (MAY-OCTOBER)	10
2.4. DESTINATION OR ROUTES OF BRIGHT ANGEL DAY HIKERS BY SEASON	11
2.5. DESTINATION OR ROUTES OF SOUTH KAIBAB DAY HIKERS BY SEASON	12
2.6. DESTINATION OR ROUTES OF NORTH KAIBAB DAY HIKERS BY SEASON.....	12
2.7. DESTINATION OR ROUTES OF GRANDVIEW DAY HIKERS BY SEASON.....	13
2.8. DESTINATION OR ROUTES OF HERMIT DAY HIKERS BY SEASON.....	13
2.9. DESTINATION OR ROUTES OF WIDFORSS DAY HIKERS BY SEASON.....	14
2.10. DESTINATION OR ROUTES OF KEN PATRICK DAY HIKERS BY SEASON.....	14
4.1. BOXPLOT OF SOLITUDE RATINGS BY TRAILHEAD	27

INTRODUCTION

In 2004, Grand Canyon National Park received 4.3 million visitors. While most visitors viewed the park from rim overlooks, a significant portion day hiked into the park's backcountry. Day use visitation has been difficult to both monitor and manage, yet it accounts for the vast majority of visitation in Grand Canyon's backcountry. Several studies have indicated that day hikers are different than overnight backcountry users (Roggenbuck & Lucas, 1987; Roggenbuck, Marion, & Manning, 1994; Cole, 2001). An important first step in the review of backcountry management policies is to assess day hiking and understand the attitudes and behavior of this important user group.

The park's 1995 General Management Plan (GMP) provides a rationale and conceptual foundation to assess characteristics, experiences and behavior of backcountry day hikers. The ten management objectives identified for "visitor experience" generally are directed at providing high quality visitor experiences compatible with protection of the park's resources and purposes (pp. 7-8). In addition, the GMP indicates that limitations on day use visitation (for both South and North Rims) may be necessary at some point in the future, in part, if the qualities of visitor experience change in directions not compatible with park purposes, such as decreases in solitude, naturalness of conditions, primitiveness, remoteness, and inspirational values. The GMP also distinguishes the South Rim Corridor trails from the Hermit and Grandview trails by indicating, among other things, that the visitor experiences on the latter two need monitoring to insure their status as "threshold" trails (p. 55).

Part of the intentions of the Canyon View Information Plaza was to educate visitors on various day hiking opportunities, appropriate day hiking behavior, and to influence the distribution of day hikers to match their skills and preparedness levels with the appropriate trail. With its opening six years ago, this is an appropriate time to assess its impact on day hiking. Finally, the Grand Canyon Greenway plan indicates that the array of day hiking and bicycling opportunities will be enhanced. The need to assess the effects of this enhancement would be important to monitor regarding the current status of day hiker characteristics, experiences, and behavior, and effectively, develop a baseline from which to compare.

Backcountry management operations for day hikers have become more focused in the past couple decades. During the mid-1990s, there were several unusually hot summers that led to increases in search and rescue (SAR) efforts of backcountry visitors. Backcountry management directed efforts to prevent SARs from occurring, in part, through improvement of day hiker safety and preparedness. The "Heat Kills, Hike Smart" campaign emerged as a response to the increase in SARs, and has been evaluated and slightly revised since its inception (Manning et al., 1999, General Management Plan, 1995). The purpose of this campaign was to reduce the number of backcountry visitors who need NPS assistance to ensure their safety. The campaign involved several managerial actions, particularly on extremely hot days, including restrictions on length of day hikes, restrictions on start time of hikes, increased ranger presence near trailheads to check equipment and make recommendations to day hikers and increased use of media to detail ways to hike smart. With increased management efforts during the 1990's focused on day hikers, this user group and became proactive in developing strategies to ensure safe hiking experiences.

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 1.1 displays the number of SAR events, fatalities, total recreation visits, and the rate of SAR events per 1,000 recreation visits since 1987. These data cover recreation for the entire park including day hikers, overnight backcountry visitors, river runners and other activities connected to search and rescues efforts. Figure 1.1 shows the trend found in the data table. Prior to the implementation of the PSAR program there were on average 0.11 SAR events per 1,000 recreation visits, after its implementation the rate of SAR events per 1,000 recreation visits declined to 0.08 on average. This decline is positive news and could be explained by several factors including the effectiveness of the park’s PSAR campaign. The “Hike Smart” initiative has been directed at preparing visitors for the rigors of hiking the Canyon, and its messages have been included in the *Guide*, visitor brochures, websites, interpretive programs and many other outreach activities. In addition to the PSAR campaign, the drop in SARs also could be attributed to cooler weather (compared to the mid- 1990’s), and indirect effects of the PSAR campaign such as word-of-mouth, books and magazines that provide coverage of hiking safety, and other websites and concessions connected to the park’s backcountry.

Table 1.1. SAR event rates since 1987.

Year	SAR Events ¹	Fatalities ¹	Total Rec. Visits ²	SAR Rate
1987	282	1	3,513,030	0.0803
1988	327	1	3,859,886	0.0826
1989	383	1	3,966,209	0.0966
1990	400	2	3,776,685	0.1059
1991	413	1	3,886,031	0.1063
1992	421	1	4,203,545	0.1002
1993	404	1	4,575,602	0.0883
1994	474	0	4,364,316	0.1086
1995	380	1	4,557,645	0.0834
1996	482	5	4,537,703	0.1062
1997	397	0	4,510,251	0.0880
1998	346	0	4,239,682	0.0816
1999	325	1	4,575,124	0.0710
2000	449	1	4,460,228	0.1007
2001	420	0	4,104,809	0.1023
2002	357	0	4,001,974	0.0892
2003	296	2	4,124,900	0.0718
2004	262	2	4,326,234	0.0606
2005	307	2	4,401,522	0.0698

¹Data Source: SAR Event data and Fatality data come from EMS Reports since 1998.

²Data Source: <http://www2.nature.nps.gov/stats/>

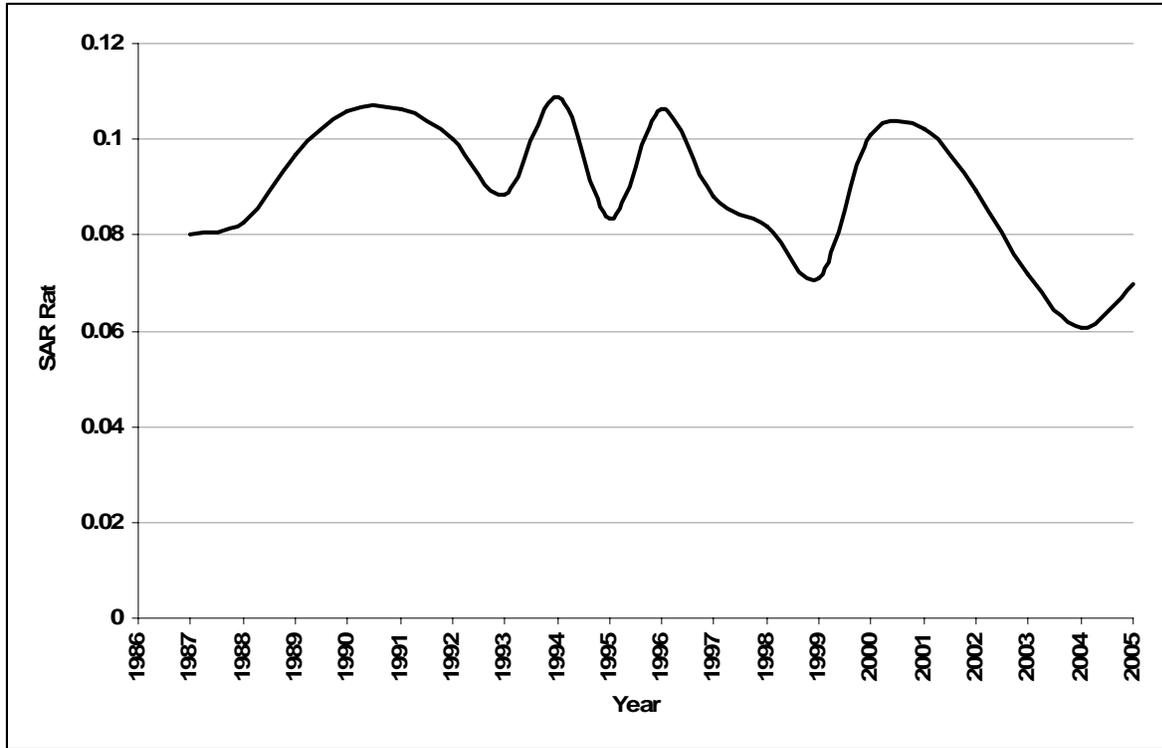


Figure 1.1. Trend in SAR events 1987-2005

As part of the effort to understand day hikers, Manning et al. (1999) interviewed day hikers on several different trails during summer and fall of 1997. Among other things, their study found that Grand Canyon day hikers generally reported substantial experience with day hikes elsewhere and at Grand Canyon, and that 35% of day hikers lived outside the United States. They also found that day hikers of threshold and primitive trails were going greater distances on their hike compared to those using corridor trails. Manning et al. (1999) also found that day hikers used various kinds of information sources to prepare for a safe day hike. Although most day hikers brought sufficient water on their trip, threshold day hikers were characterized as least prepared for a safe day hike. Compared to corridor day hikers, a significant proportion of threshold day hikers did not bring enough water (Manning et al., 1999, p. 49).

In a study focused on day hikers of the Bright Angel Trail that spanned the summers of 1994 and 1995, Stewart & Cole (1997) found that the installation of toilet facilities in fall 1994 at the mile-and-a-half rest house substantially decreased the number of day hikers reporting the use of an unofficial location as a “restroom.” They also found that the longer the hike, the more likely their respondents were to disagree with any kind of restrictions on day use hiking. In addition, their study estimated the number of visitors who day hiked on the Bright Angel Trail and traveled at least to the “cinch-up” (the first major switchback about 500 yards below the trailhead). With their limited data set, they estimated that on average 1200 people per day in the summer traveled at least to the “cinch up” on the BA Trail. Although each of these studies provided valuable information, there is a need to update and amplify information about current day hiking to facilitate planning for backcountry use.

Several issues currently facing the park surfaced during meetings between researchers and the park staff in July, 2003. Focus groups were held on the South Rim to identify current backcountry management issues. These issues included hiker preparedness, safety, and recreational impacts. Given that corridor trails attract hundreds of day-hikers on most summer days and similar proportions use during the off-season (Stewart & Cole, 1997, Manning et al., 1999), day hikers comprise a substantial proportion of backcountry users. Along with increase in numbers, day users may be hiking on trails outside of the corridor, and may not be aware of minimum impact practices. However, systematic evidence to support both the increased number and changed use patterns of day hikers, as well as their information needs and experiences, requires further development and establishment of baselines.

Objectives

The objectives of this research are to add to existing knowledge of Grand Canyon backcountry day hikers, and to provide a current assessment of day hikers characteristics, experiences, and behavior. Specifically, the objectives are:

- 1) To estimate the number and distribution of backcountry day hikers.
- 2) To identify day hiker characteristics in terms of socio-demographic characteristics, group characteristics, hiking experience, hiking behaviors, and motivations.
- 3) To assess hiking preparedness of day hikers, and their support for management actions designed to increase day hiker safety.
- 4) To assess day hikers' attitudes toward resource protection and their knowledge of appropriate low-impact hiking behaviors.
- 5) To assess day hikers level of satisfaction with their Grand Canyon experience.
- 6) To suggest management actions that best meets the social needs of day hikers.

The first section of the report discusses the methods and results of the counts of backcountry day hikers. The second section discusses the methods for interviewing backcountry day hikers and subsequent sections are organized around objectives two through six (above).

**ESTIMATING THE NUMBER AND DISTRIBUTION OF
BACKCOUNTRY DAY HIKERS**

There are several methods to estimate the number of backcountry day hikers. The method used by Stewart and Cole (1997) stationed a person at a given position on the trail and used a hand counter to tally the number of hikers exiting the trail. They counted across four-hour time blocks during the summer and fall, and their estimate of an average daily count of day hikers was based on a composite. The techniques of trail counting have improved since the 1990s. For this study, the use of infrared counters calibrated by hand counts was considered the best at being both cost effective and accurate. The volume of day hiker traffic was measured at the seven following trailheads:

<u>Corridor Trails</u>	<u>South Rim Threshold</u>	<u>North Rim</u>
Bright Angel	Grandview	Widforss
South Kaibab	Hermit	Ken Patrick
North Kaibab		

During the study period between May and October 2004, infrared counters were placed in consistent locations on each of these trails for the duration of time interviews were scheduled for that trail head. The counter locations varied by trailhead but were generally 500 yards to one mile below the trailhead. Placement was dictated by several considerations including but not limited to 1) an estimation of how far a hiker needed to travel to be called a day hiker and 2) the ability to set up and camouflage the counter units. Counts and the onsite interviews were being conducted simultaneously (see Appendix C for schedule of interviews). Events recorded included people and mules entering and exiting the trail. Table 2.1 shows the dates traffic was measured using the infrared counters. In addition, interviewers who were placed near the infrared counters, used hand counters to record the number of day hikers exiting the trail in various time blocks. Table 2.2 lists the dates and time blocks when exit traffic was hand recorded.

The hand count data was used to calibrate the infrared counter data by estimating the proportion of infrared events that represented day hikers exiting the trail. Exit counts are an imperfect estimate of the total number of day hikers using a particular trail on any one day and any time period because not all visitors hike into the canyon on the trail they hike out on. Thus hikers who hike into the canyon on the trail being counted but hike out on a different trail would not be counted in the hiker number estimate. Exits counts capture those who hiked into the canyon on a trail other than the trail being counted as well as day hikers who may have entered the canyon by other means (like those hiking out from a river trip). Counting exits was also consistent with the interview procedure discussed in the next chapter. So, despite the imperfection of counting exits, it is the most accurate way to estimate the number of day hikers. Appendix A provides details about the method used to estimate use figures based on the two counting methods of infra red and hand counters.

Table 2.1. Data collection for infrared counts.

Trail	May	June	July	August	September	October
Bright Angel	13-21	11-19	Lost	20-31	1, 17-30	10-16
South Kaibab		11-19	9-17	28-31	1, 17-30	8-16
North Kaibab		25-30	28-31	1-3		
Hermit		11-19	10-17	20-31	1, 17-25	8-16
Grandview		11-19		20-31	1, 17-25	8-15
Widforss		25-30	28-31	1-3		
Ken Patrick		27-29	28-31	1-3		

Destinations within trails and routes were estimated using the information collected in the interviews with day hikers. Respondents were asked to report their hike start location and destination. Hikers who could not name their destination were asked to point to their destination on a map or approximate the distance they hiked into the canyon. Distances were coded into destinations based on the reported distances to destinations that appear in the Grand Canyon Trip Planning/Visitor Information website for day hiking (<http://www.nps.gov/grca/grandcanyon/dayhike/index.htm>). Routes like rim-to-rim hikes could be identified because the hiker(s) reported starting their hike at the opposite rim from where they were intercepted. In some instances hikers consistently reported hiking a distance where a landmark could not be identified by consulting maps of the area, Grand Canyon Hiking guidebooks or the trip planning website. In these cases, the distance is reported.

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 2.2. Data collection for exit counts.

Date	Bright Angel		South Kaibab		Grandview		Hermit		North Kaibab		Ken Patrick		Widforss	
	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
6/12/2004						13:00	19:00	11:00	17:00					
6/13/2004	9:00	15:00	9:00	15:00										
6/14/2004					9:00	15:00	9:00	15:00						
6/15/2004	13:00	19:07												
6/16/2004					11:00	17:00	9:00	15:00						
6/17/2004	12:00	18:30	13:00	19:00										
6/18/2004					11:00	17:00	11:00	17:00						
6/19/2004	8:35	14:54	8:45	15:40										
6/25/2004									13:00	19:00	13:00	18:00		
6/26/2004									9:00	15:00	11:00	17:00		
6/27/2004											11:00	17:00	8:45	15:10
6/28/2004									13:00	18:00	10:50	17:00		
6/29/2004											11:30	17:30	12:45	18:00
6/30/2004									8:40	15:15			9:00	15:00
7/10/2004					13:00	19:00	9:00	15:00						
7/11/2004	10:00	16:00												
7/12/2004					9:00	15:40	9:00	15:00						
7/13/2004	12:00	19:00												
7/14/2004							11:00	17:10						
7/15/2004	10:05	14:35	13:00	19:00			11:00	15:00						
7/16/2004	10:00	15:00			9:00	14:00								
7/17/2004	8:30	15:00												
7/29/2004									9:00	15:00	9:00	15:00		
7/30/2004											12:45	19:00	9:00	15:00
7/31/2004									13:00	19:00			12:30	18:10
8/1/2004											13:00	19:00		
8/2/2004									9:00	15:00	12:00	18:30	9:00	15:00
8/3/2004									9:00	15:00				
8/21/2004					11:00	17:00	11:00	17:16						
8/22/2004	9:00	15:00	9:00	15:00										
8/23/2004					11:00	17:00	11:00	17:00						
8/24/2004	13:00	19:00	13:00	19:00										
8/25/2004					11:00	17:00	11:00	17:00						
8/26/2004	13:00	19:00	13:00	19:00										
8/27/2004					11:00	17:00	11:30	17:30						
8/28/2004	9:00	15:00	8:30	15:00										
9/3/2004									13:00	19:00				
9/4/2004									8:30	15:20	11:00	17:25		
9/5/2004											11:00	17:00	12:30	19:00
9/6/2004									13:00	17:00			9:00	15:00
9/7/2004											11:00	17:00		
9/8/2004									9:00	15:00				
9/9/2004									13:00	19:00				
9/10/2004													11:00	17:00
9/11/2004									9:00	15:00				
9/17/2004			13:00	18:30										
9/18/2004	8:43	15:00			11:00	17:00	9:00	15:00						
9/19/2004	13:00	19:00	9:00	15:00										
9/20/2004														
9/21/2004			13:00	19:00			11:00	17:00						
9/22/2004					9:00	15:00								
9/23/2004	9:00	15:00												
9/24/2004			12:00	18:00			11:00	17:00						
9/25/2004	12:00	18:00			11:00	17:00	11:00	17:00						
9/26/2004			9:00	15:00										
8/28/2004			8:30	15:00										
10/9/2004	9:00	15:00			12:40	17:00								
10/8/2004			13:00	18:00										
10/10/2004	11:50	18:00	13:00	19:00										
10/11/2004			9:00	15:00	11:00	17:00								
10/13/2004					11:00	14:30								
10/15/2004						11:00	17:00							
10/16/2004	9:00	15:00	9:00	15:00										

Results of Trail Counts

The three corridor trails seem to attract the vast majority of day hikers. As demonstrated in Figure 2.1, the daily averages (calculated over the period of May – October) for these three trails are considerably larger than the other trails. The busiest trail is Bright Angel with the number of day hikers averaging between 464 and 787. Note that these numbers are the estimated exit figures, that is, the number of day hikers that exited the trail. Average daily traffic on the South Kaibab ranged from 302 to 567 day hikers exiting and on the North Kaibab from 146 to 208 day hikers exiting.

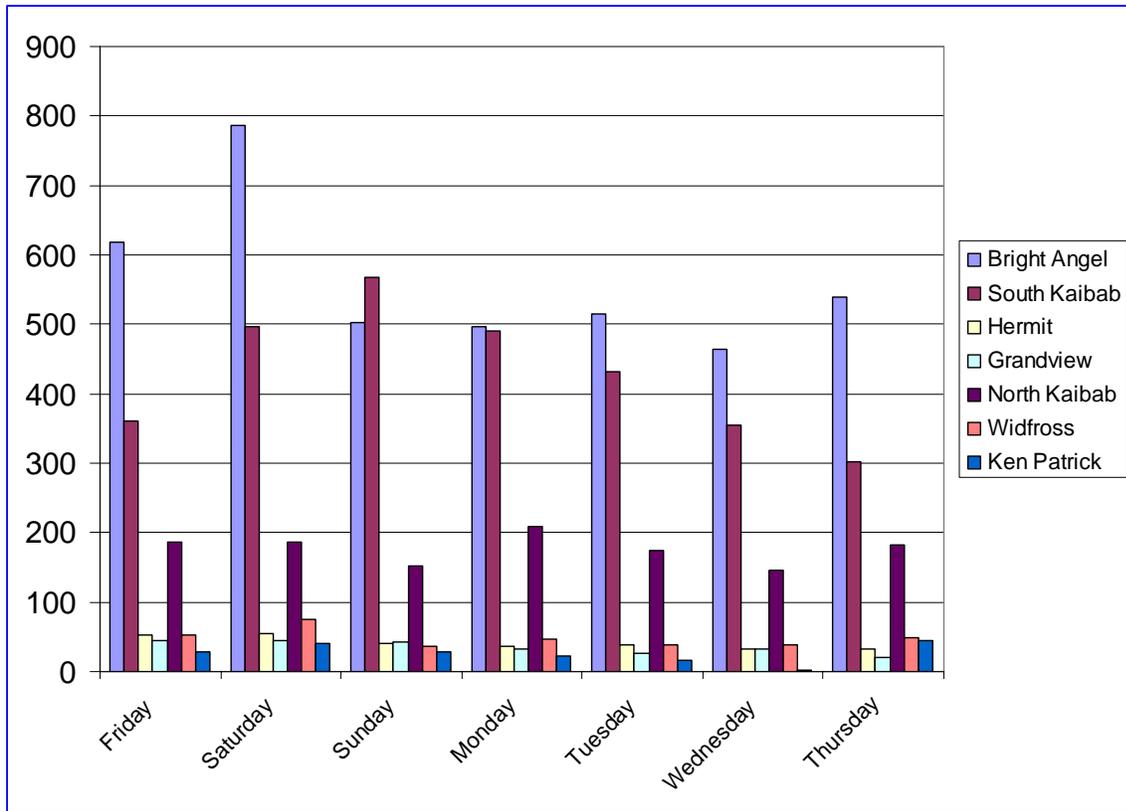


Figure 2.1. Day user exit traffic by day of the week.

The Bright Angel is most busy on Saturdays and Friday while Wednesdays are the least busy days. On the South Kaibab the busiest day is Sunday followed by Saturday. The least busy day is Thursday. North Kaibab was most busy on Mondays and the least busy on Wednesdays.

The figures above are averages across the period of May – October. A month by month analysis yields a similar daily pattern for the Bright Angel trail but a slightly different one for the South and North Kaibab trails. In June the highest number of day user on the two Kaibab trails are found on Monday. In July, the highest number on the South Kaibab trail was on Saturday (there are not enough observations on the North Kaibab to provide a reliable estimate). During August, Sunday was the busiest day on the South Kaibab trail and Monday on the North Kaibab. In September, Wednesday was the busiest day on the South Kaibab trail and there are not enough

observations for the North Kaibab. Saturday was the busiest day in October on the South Kaibab and there was no October traffic information during the sampling on the North Kaibab.

Hour-by-hour Distribution

The hand count figures were used in conjunction with the infrared counts to estimate hour-by-hour distribution of the day hikers’ traffic (see appendix B for details). More specifically, for each trail (and for every hour of the day) we estimated the proportion of recorded infrared events that represented hikers exiting the trail. These proportions (Table 2.3) were then used to construct the hourly pattern of use: both the number of day hikers exiting the trail each hour, and the number of day hikers on the trail by hour.

Table 2.3. Proportion of day hikers exiting the trail by hour.

Time	Bright Angel	South Kaibab	North Kaibab	Hermit	Grandview	Widforss
am						
Midnight -12:59	0%	0%	0%	0%	0%	0%
1:00 – 1:59	1%	1%	1%	1%	1%	1%
2:00 – 2:59	3%	3%	3%	3%	3%	3%
3:00 – 3:59	6%	5%	5%	5%	5%	5%
4:00 – 4:59	9%	8%	7%	8%	8%	8%
5:00 – 5:59	12%	12%	10%	11%	11%	11%
6:00 – 6:59	16%	16%	13%	15%	15%	15%
7:00 – 7:59	21%	20%	17%	18%	18%	18%
8:00 – 8:59	25%	24%	20%	22%	22%	22%
9:00 – 9:59	30%	29%	24%	27%	27%	27%
10:00 – 10:59	36%	34%	28%	31%	31%	31%
11:00 – 11:59	41%	40%	32%	36%	36%	36%
pm						
noon – 12:59	47%	46%	36%	41%	41%	41%
1:00 – 1:59	54%	52%	41%	46%	46%	47%
2:00 – 2:59	60%	58%	45%	52%	52%	52%
3:00 – 3:59	67%	64%	50%	57%	57%	58%
4:00 – 4:59	74%	71%	55%	63%	63%	63%
5:00 – 5:59	81%	78%	60%	69%	69%	69%
6:00 – 6:59	89%	85%	65%	75%	75%	76%
7:00 – 7:59	97%	92%	70%	82%	81%	82%
8:00 – 8:59	100%	100%	76%	88%	88%	89%
9:00 – 9:59	100%	100%	81%	95%	94%	95%
10:00 - 10:59	100%	100%	87%	100%	100%	100%
11:00 - 11:59	100%	100%	93%	100%	100%	100%

The following Figures 2.3 and 2.4 indicate that the busiest time on the Bright Angel Trail was around 11:00 am and 12:00 noon. The peak exit traffic was during the early afternoon hours. The South and North Kaibab trails had similar patterns with one exception. On

Saturdays, the South Kaibab on-the-trail figures peaked at 6:00 am, considerably earlier than the 11:00 – 12:00 time slot on the Bright Angel Trail.

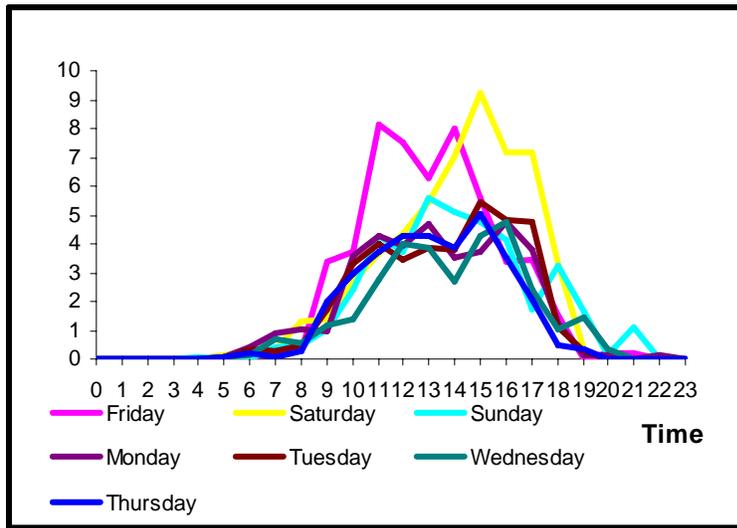


Figure 2.2. Bright Angel hourly day hikers exiting trail by weekday and time (May – October).

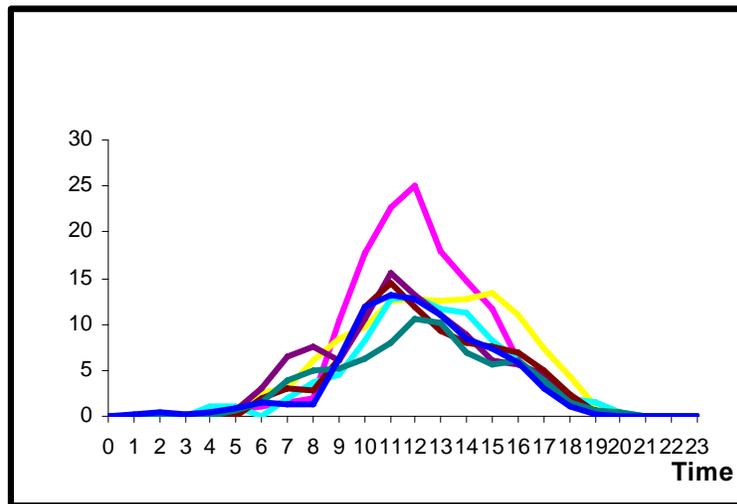


Figure 2.3. Bright Angel hourly trail use by week day and time (May – October)¹.

While the other four trails show similar hourly patterns, the hourly numbers are probably too small for reliable analysis.

¹ This estimated by subtracting the cumulative exit events from the cumulative infrared events.

Destinations or Routes within Trails

Thirty-one percent (31%) of the day hikers on the Bright Angel Trail make their destination the Mile-and-a-half Rest House, 14% hike to the Three Mile Rest House, 13% to Plateau Point, 11% hike to the second Tunnel, and 9% to Indian Gardens. Compared to the summer, a smaller percentage of fall day hikers end their trip at the Mile-and-a-half Rest House, the Three Mile Rest House and Plateau Point, while a slightly larger proportion end their trip at the 2nd Tunnel, the 1st Switchbacks, the second mile switchbacks, and Indian Gardens. Figure 2.2 illustrates the proportion of hikers hiking to each destination or route.

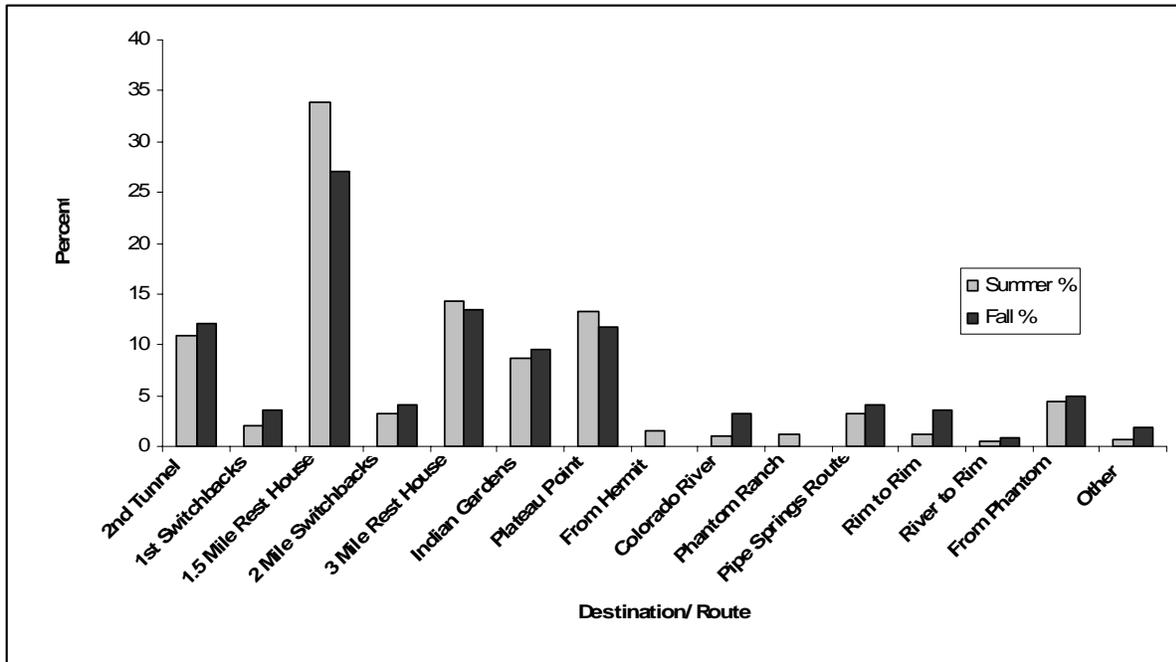


Figure 2.4. Destinations or routes of Bright Angel day hikers by season.

On the South Kaibab Trail, 23% of the day hikers reach Ooh Ah Point, 45% reach Cedar Ridge and 15% reach Skeleton Point. Compared to summer hikers, a higher proportion of fall hikers go to Skeleton point; the same percentage go to Cedar Ridge and a smaller percentage end their trip at Ooh Ah Point (Figure 2.3). On the North Kaibab Trail, 16% of day hikers end their trip at the Overlook, 35% at the Supai Tunnel, 9% at the Redwall Bridge, 13 % at Roaring Springs, and 5% at Ribbon Falls. Compared to the summer, a slightly higher percentage of fall hikers reach the Supai Tunnel and Roaring Springs, and a lower percentage reach Ribbon Falls (Figure 2.4)

The two threshold trails and the two North Rim trails attract a considerably smaller number of day hikers with daily averages (June through October) that range from 1 to 76. Fridays and Saturdays were the busiest and Wednesdays and Thursdays the least busy. Forty-six percent of Grandview day hikers go to Coconino Saddle, 27% to the saddle at Horseshoe Mesa and 11% turn around after hiking half a mile (Figure 2.5). On the Hermit, 18% go to Waldron Basin, 16% to Santa Maria Springs and 23% to Dripping Springs (Figure 2.6). Widforss day

hikers go mainly to Widforss overlook (47%). Eighteen percent turn around after 2.5 miles (Figure 2.7). On the Ken Patrick, 67% reach Uncle Jim’s point (Figure 2.8).

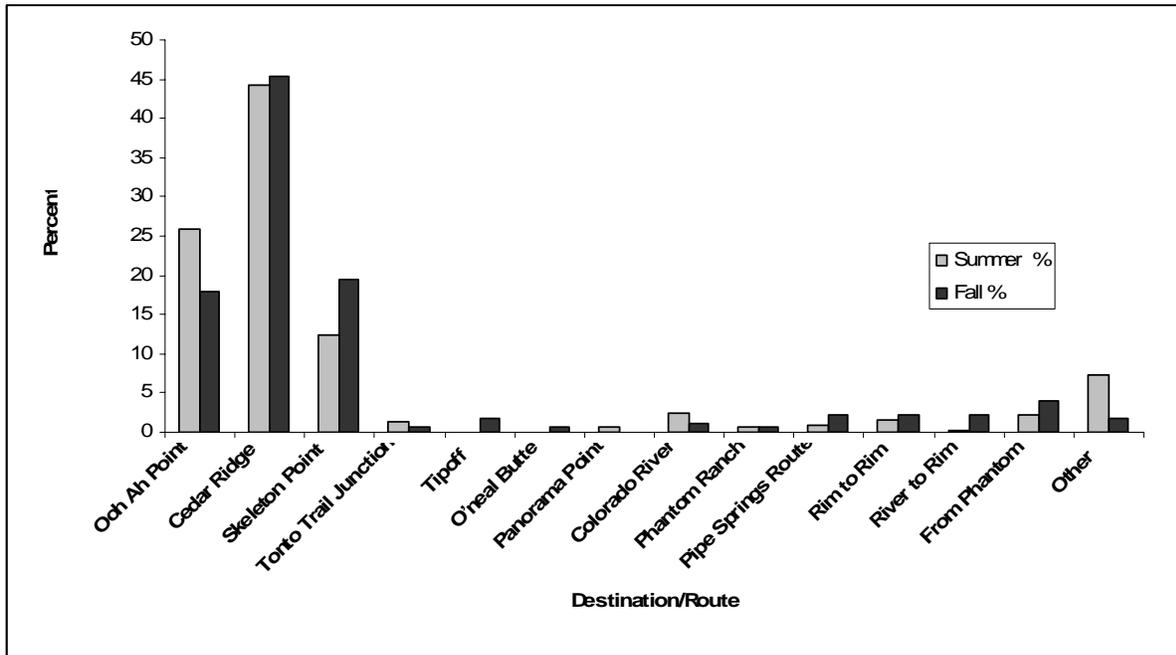


Figure 2.5. Destinations or routes of South Kaibab day hikers by season.

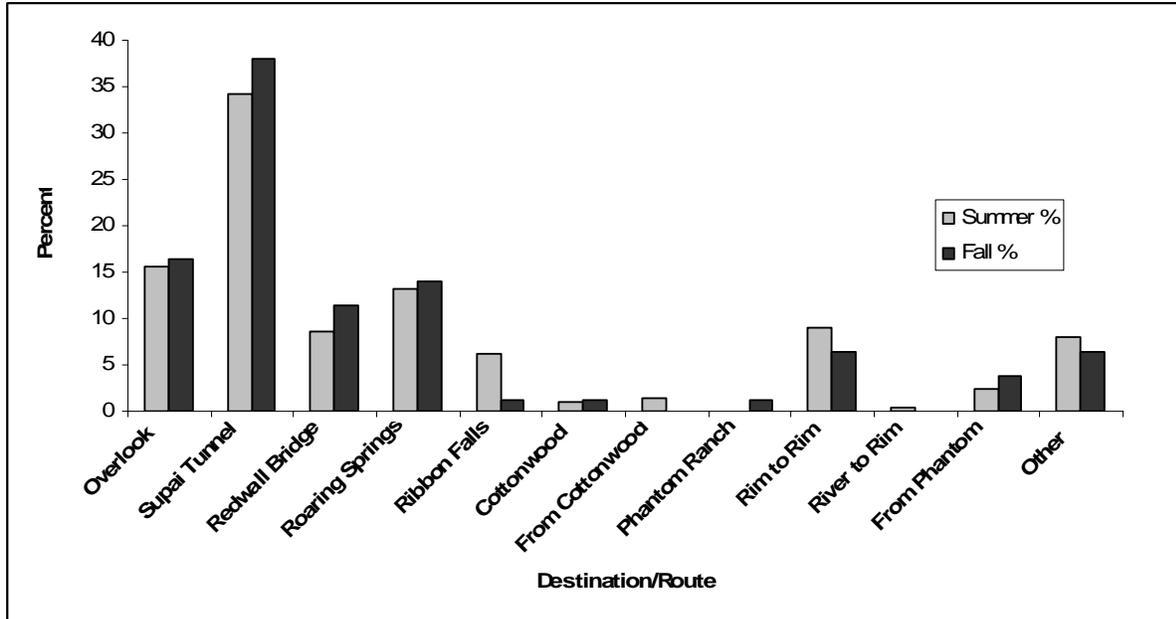


Figure 2.6. Destinations or routes of North Kaibab day hikers by season.

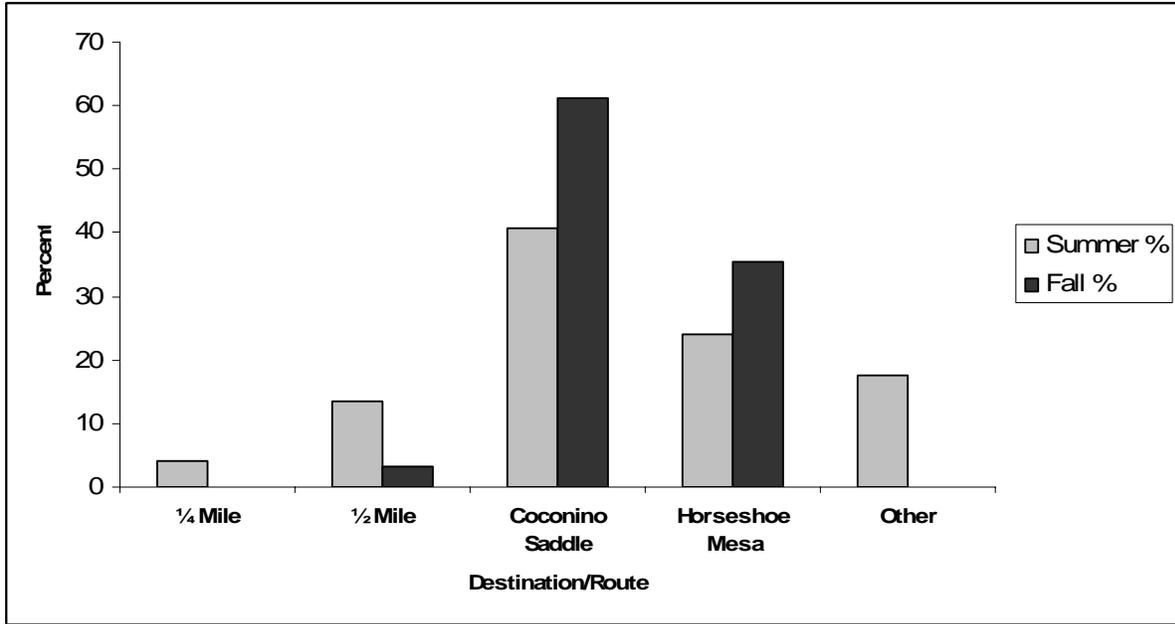


Figure 2.7. Destinations or routes of Grandview day hikers by season.

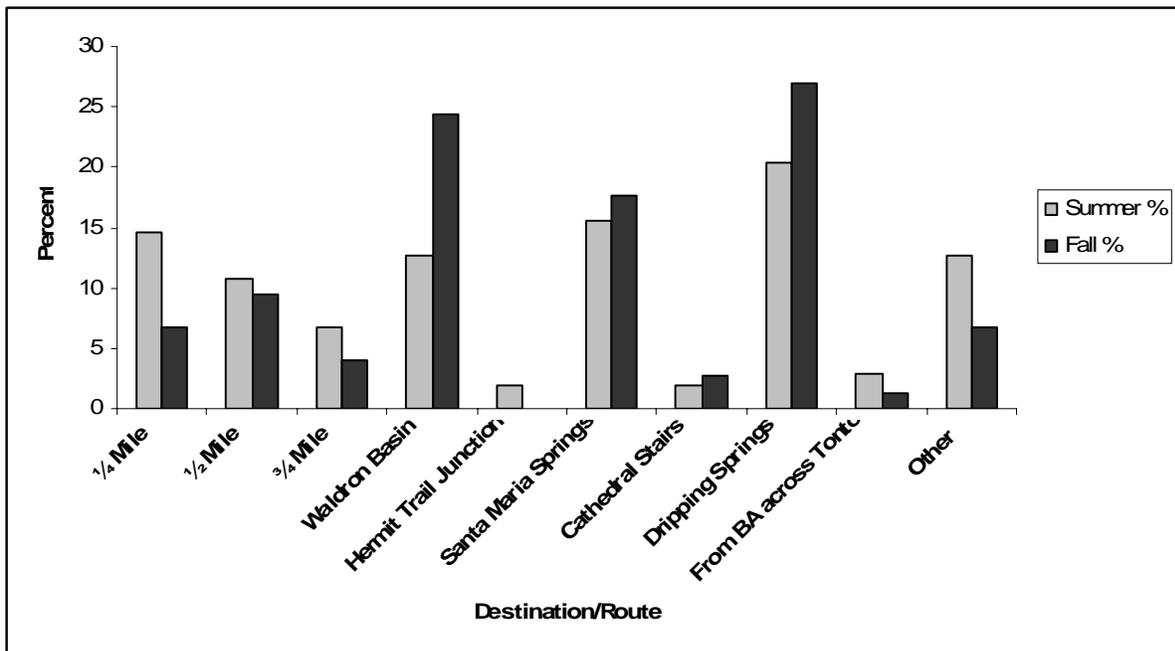


Figure 2.8. Destination or routes of Hermit day hikers by season.

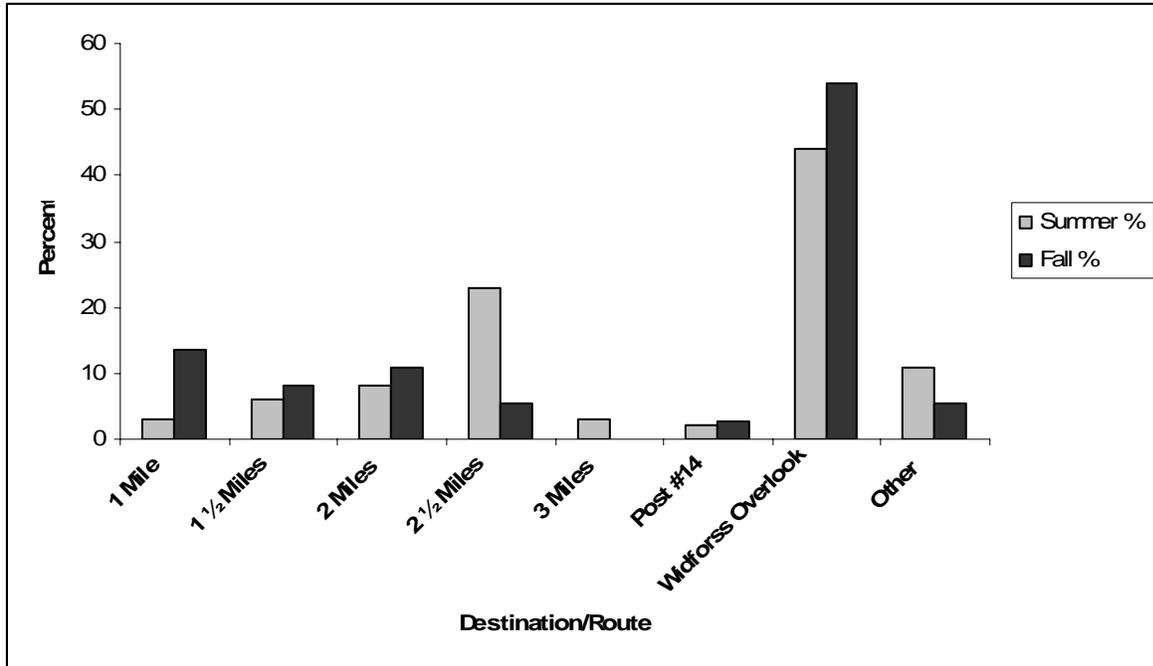


Figure 2.9. Destination or routes of Widforss day hikers by season.

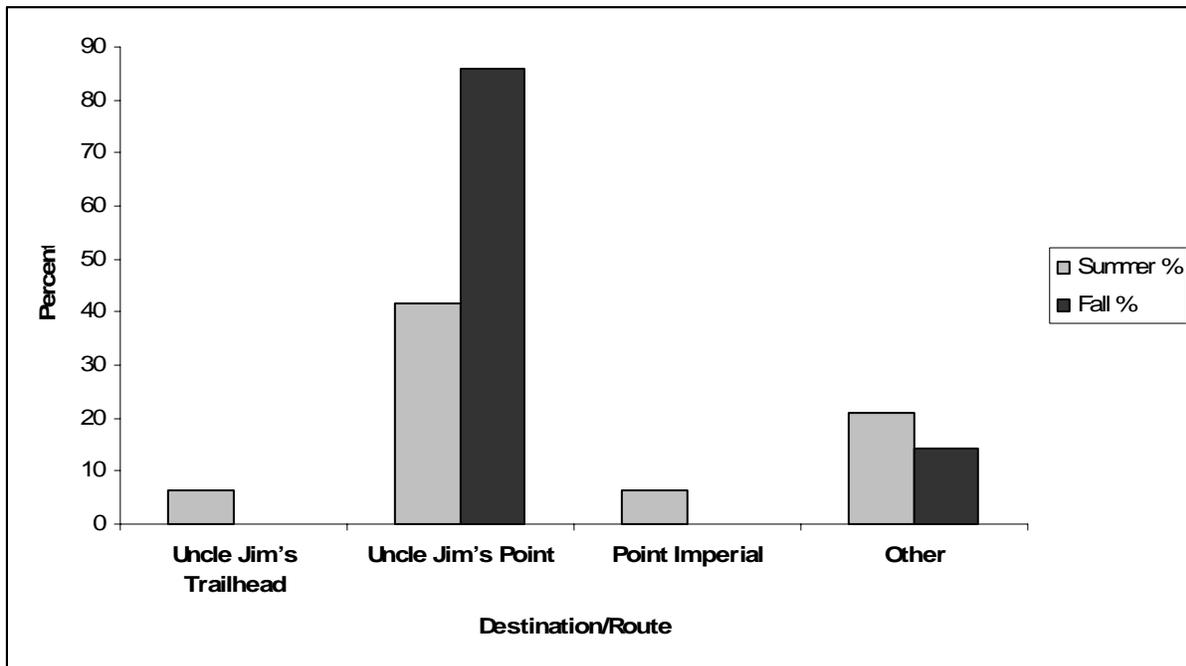


Figure 2.10. Destination or routes of Ken Patrick day hikers by season.

Conclusion

The daily averages ranged from 464-787 day hikers for the Bright Angel, 302-567 day hikers for the South Kaibab, and 146-208 day hikers for the North Kaibab. The counts on the other trails were too small to provide reliable daily averages, however the counts ranged from 1 to 76 day hikers on the days sampled. For the Bright Angel Trail, Saturday was the peak day for visitation with Friday as the second highest volume of day hikers. In general, there was a steady flow of visitors hiking uphill across the hours of the day, with daily peaks of uphill hikers between noon and 3:00 p.m.

METHODS OF DAY HIKER INTERVIEWS

Procedures

The procedures used by Manning et al. (1999) employed a combination of onsite interviews coupled with a mailback questionnaire. A strength of this combination is that respondents are usually able to complete more items in a mailback questionnaire compared to an onsite interview. However, when a significant portion of the user population is foreign, the mailback questionnaire process may over-represent domestic users, and in such cases, the capacity to generalize the results may be weakened. In light of this issue, an interview-only technique was developed to insure representation of all users. To address the issue of respondents being burdened with a lengthy interview in the middle of their hike, four versions of the interview questionnaire were developed. The questionnaires contained three pages of “core” items that did not vary across the four versions; and four thematic “modules” were developed and each asked of a systematic random sample of respondents. All four questionnaires had a consistent set of core items plus items designed to address specific themes identified in the study objectives. The core set of items identified group and individual characteristics including but not limited to group size, age distribution, length of the groups’ hike, length of stay at Grand Canyon, previous hiking experience, and socio-demographic characteristics. The core items also addressed where hikers received information about hikes at Grand Canyon, how that information might change their plans, and hiker preparedness.

The thematic sections of the interviews were designed to elicit responses related to study objectives. The “PSAR” interview module addressed day hikers’ attitudes toward hiking preparedness and safety as well as support for a range of management actions that could be applied to day hiking. The “Impacts” module specifically addressed day hikers’ attitudes toward resource protection and assessed the interviewees’ knowledge of low impact hiking behaviors. The “Satisfaction” module included items that assessed overall satisfaction, perceptions of impacts, and satisfaction with setting attributes. Finally, the “Motivations” module included items to assess day hiker preferences for various recreational experiences. The interview questionnaires along with frequency distributions of the results are presented in Appendix B.

An interview schedule was developed (see Appendix C) to represent day hikers on the South Rim corridor trails (Bright Angel and South Kaibab), South Rim threshold trails (Hermit and Grandview), and North Rim trails (North Kaibab, Widforss, and Ken Patrick) from May to October, 2004. The interview schedule included representative portions of weekend/weekday day hikers, and various time blocks of the day from 6:00 am to 8:00 pm, on each trail. Visitors were sampled on a systematic random basis as they were hiking uphill. A sampling interval of n was identified, and each n th hiker (who appeared over 18 years) to pass the interviewer was approached and invited to participate in the study. If they were willing, or deferred to another person in their hiking group, then the interview was conducted. Once the interview was complete, the interviewer returned to their position and began counting until the next n th visitor passed.

Analysis

To analyze the data, respondents on various trails were collapsed into three groups, based upon the location of their hike. Day hikers of the South Kaibab and Bright Angel trails were collapsed into a category labeled South Rim corridor trails. Day hikers on the Hermit and Grandview trails were collapsed into a category and referred to as South Rim threshold trails. Finally, respondents of the three North Rim trails were grouped together. In addition, season of hike is another variable that could explain results. For the analyses, a variable was developed that collapsed responses for May through August (i.e., summer day hikers), and September through November (i.e., fall day hikers). All data has been analyzed by the location of hike (the above three groups), and by season of hike. With such a large dataset, small differences will exhibit statistically significant results. As a general rule for presenting data in this report, only differences with practical significance are shown or discussed.

DAY HIKER AND HIKING GROUP CHARACTERISTICS

An objective of this report is to identify day hiker characteristics. This section will report basic socio-demographic characteristics and hiking behaviors of the respondents and their hiking groups. It will address questions such as: Who are day hikers? How long was their hike? How much hiking experience do they have? And, what kinds of experiences were they seeking? Findings presented will begin with socio-demographic characteristics of respondents followed by the hiking group characteristics and behaviors, and finally the motivations for day hiking are presented. When possible, data are compared to the 2000 U.S. Census and the Rim Visitor Studies conducted in the summer of 2003 (Littlejohn & Hollenhorst, 2004a; Littlejohn & Hollenhorst, 2004b)

Socio-demographic Characteristics

Overall, 40% of the interviewees were female (Table 4.1). The proportion of male and females is consistent between corridor and threshold hikers, and across both summer and fall respondents. Day hikers overwhelmingly described themselves as white, with 92.4% reporting it as their race. As a distant second, Asians comprised 5.5% of respondents. Compared to the general population, females interviewees were underrepresented and people describing themselves as white and Asian were overrepresented (see Table 4.1).

Close to 49% of respondents ranged between 30 and 49 years (Table 4.2). North Rim hikers tended to be older than South Rim hikers. For example, 11.2% of North Rim day hikers were 60 years or over compared to 6.5% of South Rim corridor hikers. There was also some variability of age by season, in that fall day hikers tended to be older than summer hikers. For example, 31.9% of fall hikers were 50 years or over compared to 27.1% of summer hikers. Also, fall hikers were less likely than summer hikers to be in the 40-year age group, compare 21.9% to 28.9%, respectively.

Table 4.1. Day hiker’s demographic characteristics compared to the 2000 Census

Demographic Characteristics	Day Hikers	2000 Census
	%	%
Sex		
Female	40	49
Male	<u>60</u>	<u>51</u>
Total	100	100
Race		
American Indian or Alaska Native	0.4	0.9
Asian	5.5	3.6
Black or African American	0.5	12.3
Native Hawaiian or other Pacific Islander	0.1	0.1
Spanish Hispanic, or Latino	3.3	12.5
White	92.4	77.1
Did Not Wish to Answer	1.1	

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 4.2. Age by location of hike and season and compared to the 2000 Census and Rim Visitors.

Age Group	Location of Hike			Season		Total (n=1945) %	2000 Census %	South Rim Visitor Study %	North Rim Visitor Study %
	South Rim Corridor %	South Rim Threshold %	North Rim %	Summer %	Fall %				
Less than 20	4.4	2.2	1.7	3.7	2.7	3.3	28.6	30.8	24.9
20-24	8.4	12.3	6.2	9.0	7.4	8.5	6.7	3.6	2.5
25-34	24.0	28.4	18.7	21.7	26.5	23.3	14.2	8.5	16.0
35-44	23.5	19.1	23.6	23.7	21.0	22.8	16.0	16.8	16.2
45-54	24.0	23.1	28.2	25.8	23.4	25.0	13.4	19.5	18.2
55-59	9.1	6.8	10.4	8.9	9.4	9.0	4.8	7.0	7.7
60-64	3.7	4.3	7.1	4.3	5.6	4.7	3.8	5.6	6.1
65-74	2.6	3.4	3.5	2.7	3.5	3.0	6.5	6.8	6.6
75+	0.2	0.1	0.6	0.2	0.6	0.3	5.9	1.46	1.7
Total	56.7	16.7	26.6	65.9	34.1	100			

Table 4.3. Day hikers' socio-economic characteristics

Socio-economic Characteristic	Percent of Respondents %	2000 Census Percent of Pop. %
Years of Education		
8 or less	.2	7.5
9-11	.8	12.1
12	8.5	28.6
13-15	16.5	27.3
16	36.1	15.5
17+	<u>37.5</u>	<u>8.9</u>
Total n=1912	100	100
<i>Mean (S.D.)</i>	<i>16.4 (2.4)</i>	
Household Income¹		
<\$10,000	4.8	
\$10,000-19,999	3.2	
\$20,000-34,999	7.5	
\$35,000-49,999	10.9	
\$50,000-64,999	14.9	
\$64,000-79,999	12.4	
\$80,000-94,999	12.6	
\$95,000+	<u>33.6</u>	
Total n=1608	100	

¹Income data not collected in categories comparable to 2000 Census.

About three-fourths of interviewees had four or more years of college (Table 4.3). The range of education levels was greater on the South Rim than on the North Rim and the range of education levels was greater during the summer months as compared to the fall months. That is, there were not any South Rim threshold or North Rim day hikers, nor were there fall day hikers, who completed less than a high school diploma (12 years of education); whereas the range of education attainment for South Rim corridor and summer day hikers included several respondents who completed less than a high school diploma (tables not shown). In general, interviewees tended to be more educated than the population.

A majority of the day hikers interviewed (73.5%) reported a total household income above \$50,000 (Table 4.3). The trail with the highest portion of day hikers in the \$95,000-and-over income category was North Rim day hikers where 40.1% reported this income (Table not shown). The highest income category was reported by 33.4% of South Rim corridor and 23.6% of South Rim threshold respondents.

Table 4.4. Respondents’ geographic region of origin.

Region ¹	Percent of respondents %
Alaska	0.1
Intermountain	22.2
Midwest	12.9
Northeast	16.8
Pacific West	14.5
Southeast	8.0
International	25.5

N=1871

¹ Regions based on NPS administrative subdivisions with Washington D.C. included in the Northeast Region.

Table 4.4 summarizes the respondent’s geographic region of origin; a state by state breakdown can be found in Appendix D. A substantial portion of day hikers interviewed were international visitors (25.5%), with the second largest portion coming from the Intermountain Region (22.2%). The two states of origin of the most day hikers were Arizona (12.6%) and California (10.2%). Foreign countries of origin with the largest proportion of respondents were France (6.7%), Germany (5.8%) and the U.K. (4.6%).

Group Characteristics and Hiking Behavior

Just 6.4% of respondents indicated that they were part of an organized group. Organized groups were about twice as likely to be found on either South Rim corridor or threshold trails (7.1% and 8.3% respectively) rather than North Rim trails (3.6%; table not shown). There were no respondents from organized groups on the North Rim during the fall (table not shown).

Table 4.5 displays the proportion of day hiking groups in a range of group sizes by location of their hike. A large majority of the day hiking groups were composed of four or fewer people (86.5%). A pair of hikers was the most frequent hiking group size (48.2%), and a distant second place for group size were respondents hiking alone (14.2%).

Solo hikers were slightly more like to travel on the Grandview Trail (21.1%) compares to the other trails on the South Rim (South Kaibab, 11.9%; Hermit, 12.3% and Bright Angel, 13.7%). On the North Rim, solo hikers were most likely found on the Ken Patrick Trail (19.8%) compared to either the North Kaibab (16.2%) or the Widforss (12.8%). Group size of two people were most likely found on the Hermit Trail (61.5%) compared to all other trail on which less than 50% of trail hikers were traveling in a group of two people (See table 4.5) The largest reported hiking group was composed of 45 members. Seventy-five percent of groups had two or more adults over the age of 17 in the group. Nineteen percent of day hiking groups included children and teens between the ages of 5 and 17. Among those groups with children and teens, most (80%) included one or two. There were 21 (1.1%) respondents in groups that had children under the age of five. Of the groups that included eight or more members, 53 (60%) were organized groups (tables not shown).

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 4.5. Size of Group by Trailhead

Group Size	Trailhead							Total (n=1978) %
	Bright Angel %	South Kaibab %	Hermit %	Grandview %	North Kaibab %	Widforss %	Ken Patrick %	
Solo Hiker	13.7	11.9	12.3	21.1	16.2	12.8	19.8	14.2
2	47.9	49.1	61.5	45.1	45.5	48.3	45.7	48.9
3	11.5	11.5	9.6	7.7	10.0	10.1	11.1	10.7
4	13.2	14.1	7.5	9.2	13.4	13.4	11.1	12.6
5	4.4	5.3	4.3	7	6.9	5.4	4.9	4.8
6	3.3	2.2	1.6	2.1	2.1	3.4	4.9	2.7
7	1.6	1.2	1.1	5.6	.7	.7	1.2	1.5
8+	4.3	4.6	2.1	8.5	5.2	6.0	1.2	4.6
Total	32.1	25.0	9.5	7.2	14.7	7.5	4.1	100

Table 4.6. Total Days Spent at Grand Canyon During Current Trip by Past Experience Day Hiking at Grand Canyon

Days at Grand Canyon	Number of Day Hikes at Grand Canyon				Total (n=1799) %
	1 %	2 %	3-5 %	6+ %	
Day trip	15.0	5.4	9.3	9.6	12.0
2	32.7	29.6	24.4	20.9	29.5
3	33.4	36.8	30.6	30.9	33.2
4	11.9	13.7	18.2	16.1	13.6
5	3.9	6.1	6.6	8.3	5.2
6	1.4	3.6	5.0	3.0	2.4
7	1.2	2.9	3.5	6.1	2.4
8+	0.7	1.8	2.3	5.2	1.7
Total	57.5	15.4	14.3	12.8	100.0

$\chi^2 = 109.9$, $df = 21$, $p=0.0$, $n=1799$

Table 4.7. Day of visit that hiker was interviewed.

Day of visit	Percent of Respondents %
1	36.0
2	45.8
3	11.3
4	3.4
5	1.8
6+	1.7
Total n=1846	<u>100</u>
Mean (S.D.)	2 (3)

Most respondents were visiting Grand Canyon for two or three days (combined from Table 4.6 to comprise 62.7%). The general pattern of Table 4.6 indicates that hikers with higher number of day hikes at Grand Canyon were more likely spend a longer time visiting park. For example, 5.2% of visitors who have been to the park “six or more” times were at the park “eight or more” day compared to 0.7% of hikers show were on their first trip to Grand Canyon. More than one-third of respondents were interviewed on the first day of their trip to Grand Canyon (Table 4.7). Most (58.3%) were

staying inside the park and of those staying inside the park, 42% were camping. Of the 26.8% who stayed outside of the park, 20% were staying at local campgrounds (table not shown).

Table 4.8. Duration of day hikes.¹

Time in hours:min	Percent of respondents %
1:15 and less	15.7
1:16 - 2:29	24.3
2:30 - 6:30	47.9
6:31 and over	<u>12.1</u>
Total n=1922	100

The length of hike was assessed two ways: distance hiked and length of time (Tables 4.8 and 4.9). Distance was measured by asking hikers where they began their hike and how far they hiked. The interviewer held up a map to facilitate the respondent’s ability to report how far they hiked. The length of hike was measured by asking respondents the time they began their hike and then calculated the length of time elapsed between the start of their hike and the interview

time (recorded on each questionnaire by the interviewer). Thus, the length of time is not their total time hiking, but the length of time hiking until the start of the interview. The longest distance reported was over 26 miles. The longest time reported took 18 hours. The most frequent hike distance was 3 miles (25%) and 50.2% of respondents went on hikes 3 miles or less. However there was substantial variability on distance hiked based upon location of hike (Table 4.8). Threshold day hikers were more than twice as likely to go less than a mile-and-a-half compared to either South Rim corridor or North Rim hikers (42.0% vs. either 14.9% or 17.1%, respectively). In addition, there were not any South Rim threshold hikers interviewed who reported traveling more than 10 miles for their day hike (see Table 4.8). The distance hiked did not vary significantly by season; in other words, on average, summer day hikers hiked as far as fall day hikers.

¹ From start of hike to time of interview.

Table 4.9. Distance hiked by location of hike.

Distance Category	Location of Hike			Total (N=1945) %
	South Rim Corridor %	South Rim Threshold %	North Rim %	
1.5 miles or less	14.9	42.0	17.1	19.7
1.0 to 3.0 miles	43.2	22.0	7.4	30.5
3.1 to 6.0 miles	15.5	20.7	45.0	24.0
6.1 to 10.0 miles	11.3	15.4	22.3	14.8
10.1 to 14.0 miles	11.0	0	3.0	7.2
Over 14.0 miles	4.2	0	5.2	3.8

Most day hikers (52.9%) have made at least one trip to Grand Canyon previously (Table 4.10). While more than half have visited previously, most (57.2%) report that their current day hike has been their first hike in Grand Canyon (Table 4.11). There were 25.9% of respondents who reported more than one day hike at Grand Canyon in the past twelve months while (Table 4.11), 84.0% reported hiking at other parks or wilderness areas in the past twelve months (Table 4.10).

Table 4.10. Past hiking experience

Past Experience Variable	Percent of respondents %
Total number of visits to Grand Canyon	
1	47.1
2	25.0
3	8.6
4-6	9.6
7+	9.7
Total n=1953	100
<i>Mean (S.D.)</i>	3 (10)
Day hikes at other wilderness areas in the past 12 months.	
0	16.0
1	9.1
2	10.2
3-5	18.6
6-10	17.1
10+	29.0
Total n=1982	100
<i>Mean (S.D.)</i>	12 (23)

Table 4.11. Past day hiking experience at Grand Canyon by location.

	Location			Total
	South Rim Corridor	South Rim Threshold	North Rim	
	%	%	%	
Total day hikes at Grand Canyon.				
1	66.3	56.0	37.8	57.2
2	14.4	15.1	18.2	15.5
3-5	10.3	12.9	23.0	14.0
6+	9.0	16.0	21.0	13.3
$\chi^2=132.8$ df=6, p<.05, n=1942				
Hikes in past 12 months at Grand Canyon.				
1	81.2	68.6	62.2	74.2
2	11.4	16.5	20.0	14.5
3-5	5.2	9.9	13.7	8.2
6+	2.2	5.0	4.1	3.2
$\chi^2=78.5$ df=6, p<.05, n=1955				

South Rim threshold and North Rim trails attract more experienced hikers compared to South Rim corridor hikers. For example, 28.9% of the day hikers at South Rim threshold and 44.0% of the day hikers at the North Rim had day hiked 3 or more times at Grand Canyon. Hikers with this level of experience at Grand Canyon compose 19.3% of South Rim corridor hikers. A similar pattern is evident regarding the numbers of hikes in the past 12 months at Grand Canyon. A greater proportion of South Rim threshold and North Rim day hikers have hiked at Grand Canyon more than once in the previous 12 months compared to South Rim corridor day hikers. There were 18.8% of respondents from the South Rim corridor trails who hiked more than once at Grand Canyon in the past year, whereas 31.4% of South Rim threshold and 37.8% of North Rim respondents had hiked more than once in the past year (Table 4.11). Among day hikers who hike Grand Canyon three or more times total, 60% were respondents from either the South Rim threshold or North Rim trails. Similarly, among those who hiked Grand Canyon two or more times in the previous 12 months, 54% were respondents from either South Rim threshold trails or the North Rim. However, an important point to remember is that although the South Rim threshold and North Rim trails attract the bulk of experienced hikers, respondents from these locations are still predominantly first time hikers.

Hiker Motivations

To assess preferred recreational experiences of day hikers, a module of the questionnaire was developed to understand their motivations (Appendix B). Respondents rated the importance of twenty items that indicate the importance of various kinds of experiences in motivating a day hike at Grand Canyon. These items have been widely tested on visitors to other park areas, and

have a long history of characterizing the quality of outdoor recreational experiences (e.g., Manfreda, Driver, & Brown, 1983; Driver, Tinsley, & Manfreda, 1991). These items were expected to group into “domains” of preferred experiences, and were analyzed in ways that resulted in such groupings (see Appendix D). The following five domains emerged from the analysis: testing skills, solitude, being with others, nature appreciation, and family togetherness.

Table 4.12 displays the proportion of day hikers whose ratings of the motivation domains indicated that that domain was either unimportant, neutral or important. Nature appreciation and solitude were important to most day hikers, 94.2% and 87.1%, respectively. Being with others and family togetherness were also important to a majority of the day hikers, 53.4% and 61.2%, respectively. While solitude and being with others may seem contradictory, there is a long history of research that suggest solitude is not necessarily experienced as an individual alone in the wilderness, but as individual who is part of an intimate group of family and friends (e.g., Lee, 1977; Loeffler, 2004). Finally, testing skills was both unimportant and important to fairly equal proportions of respondents.

Table 4.12. Importance of motivation domains.

Domain	Level of Importance		
	Unimportant %	Neutral %	Important %
Nature Appreciation	2.5	3.3	94.2
Solitude	10.2	2.8	87.1
Family Togetherness	22.7	16.1	61.2
Testing Skills	40.6	12.9	46.5
Being With Others	30.0	16.7	53.4

n = 474

The importance of solitude varied by trailhead. Table 4.13 displays the mean solitude ratings by trailhead in descending order. Figure 4.1 displays box plots for each trailhead. The table and figure show that day hikers on the Ken Patrick and Widforss trails are more focused on solitude seeking than hikers of other trails. The mean rating was both high and the distribution of ratings was narrow. The mean solitude ratings on the corridor trails (North Kaibab included) were the lowest among the seven trailheads yet, had the widest distribution of solitude importance ratings. This indicates that there was a diversity of importance placed on seeking solitude among day hikers at each trailhead. For example, some day hikers on the Bright Angel indicated that solitude was very important while others indicated that it was less so or even unimportant. Alternatively, day hikers on the Ken Patrick mostly indicated that seeking solitude was important to the quality of their recreational experience.

Table 4.13. Day hikers' mean solitude ratings by trailhead.

Ken Patrick n=20		Widforss n=38		Hermit n=42		Grandview N=32		North Kaibab n=73		South Kaibab N=115		Bright Angel N=.78	
<i>M</i>	SD	<i>M</i>	SD	<i>M</i>	SD	<i>M</i>	SD	<i>M</i>	SD	<i>M</i>	SD	<i>M</i>	SD
1.50 ^a	.41	1.28 ^{ab}	.66	1.07 ^b	.83	1.04 ^{bc}	.83	.96 ^{bc}	.62	.87 ^{bc}	.72	.78 ^c	.79

-2=Very Unimportant, -1=Unimportant, 0=Neutral, 1=Important, 2=Very Important

$F=5.22$ $df=6,465$; $p<.05$

^{a,b,c} means identified with different letters are significantly different at the $p<.05$ level base on Least Significant Differences.

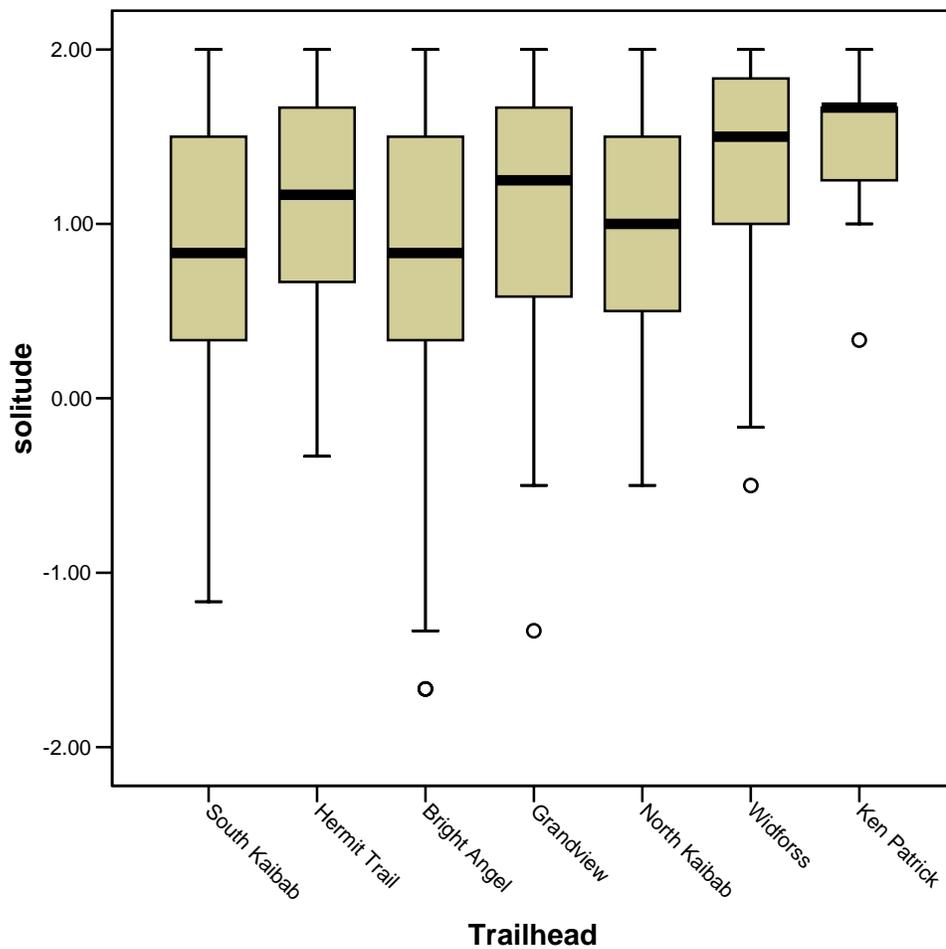


Figure 4.1. Boxplot of Solitude ratings by trailhead.

The proportion of day hikers who indicated that “Family Togetherness” was important differed between hikers of summer and fall (Table 4.14). A significantly larger proportion of day hikers indicated that family togetherness was important to the quality of their experience during the summer than fall, compare 64.9% to 53.3%.

Table 4.14. “Family Togetherness” by season.

Season	Level of Importance		
	Unimportant %	Neutral %	Important %
Summer	19.0	16.1	64.9
Fall	30.7	16.0	53.3

n=466
 $\chi^2 = 8.32, df=2, p<.05$

Characteristics of long-distance hikers

Over the past decade, there has been a growth in the number of hikers inquiring about long-distance day hikes, such as traveling from the rim-to-river and back or rim-to-rim. For the purposes of this analysis, long-distance day hikers are those who travel 10 or more miles on a day hike. Such hikers comprise 11% of respondents from this study, with 64% found on the Bright Angel Trail, 17% on the South Kaibab, 18% on the North Kaibab, and less than 1% each on the Widforss and Ken Patrick Trails. For this study, we did not interview any long-distance hikers on either the Hermit or Grandview Trails.

Long-distance hikers, compared to non-long-distance hikers, were equally likely to hold the same level of education, household income, age, and hike as part of an organized group. However there were several differences between long-distance and non-long-distance day hikers. Table 4.15 indicates that long-distance hikers brought significantly more water along with them than other hikers. For example, 46.6% of long-distance hikers brought 2.2 or more quarts of water per person compared to 21.2% of non-long-distance hikers who brought along a similar amount. In addition, 21.0% of long-distance hikers were traveling alone compared to 12.8% of non-long-distance hikers going solo. Table 4.15 also indicates that long-distance hikers were less likely to be female – compare 27.7% of long-distance hikers vs. 41.3% of non-long-distance hikers who were female.

Table 4.15. Distance Hiked by Amount of Water Taken, Hiking Alone, and Gender

	Distance Day Hiked		Total (N=1888) %
	10 miles or greater %	Less than 10 miles %	
Quarts of Water Per Person			
0 – 0.5	3.8	7.6	7.2
0.6 – 1.0	14.9	41.2	38.3
1.1 – 1.5	11.1	16.8	16.2
1.6 – 2.1	23.6	16.4	17.2
2.2 and more	46.6	18.0	21.2
Hiking Alone?			
Yes	21.8	12.8	13.8
No	78.2	87.2	86.2
Gender			
Male	72.3	58.7	60.2
Female	27.7	41.3	39.8
Total	11.0	89.0	100.0

In terms of physical fitness level, Table 4.16 indicates that 42.3% of long-distance hikers reported getting at least 20 minutes of continuous exercise per day compared to 30.7% of non-long-distance hikers. In addition, across all categories of items taken on the day hike, long-distance hikers were more likely to bring along the item compared to non-long-distance hikers. For example, 45.0% of long-distance hikers took electrolyte replacement on their trip compared to 20.4% of non-long-distance hikers. The likelihood of long-distance hikers to take useful gear on their hike is probably due to their longer planning horizon. Table 4.16 also indicates that 72.7% of long-distance hikers decided to hike prior to arriving at the park compared to 30.9% of non-long-distance hikers who planned their trip prior to arrival.

Table 4.16. Distance Hiked by Daily Exercise Level, Items Taken on Hike, and Timing of Decision to Day Hike

	Distance Day Hiked		Total (N=1888) %
	10 miles or greater %	Less than 10 miles %	
At least 20 minutes of continuous exercise per day			
Nearly every day	42.3	30.7	32.0
About every other day	46.2	48.8	48.5
About once per week	6.7	15.1	14.2
About once every two weeks or longer	4.8	5.5	5.3
Items taken on day hike			
Electrolyte replacement	45.0	20.4	23.2
First aid kit	56.0	31.3	34.1
Topographic map	11.5	6.6	7.1
Jacket	52.6	40.3	41.7
Signal mirror	11.5	7.3	7.8
Food	93.8	77.0	78.9
Toilet paper	51.7	41.0	42.2
Brought enough water	96.6	93.5	93.9
When did you decide to day hike?			
Before arriving at the park	72.7	30.9	35.5
After arriving	20.1	30.6	29.5
Today	7.2	38.4	35.0

Conclusion

The purpose of this chapter was to identify day hiker characteristics in terms of socio-demographics, hiking behaviors, and motivations. These findings highlight that there is a broad diversity to day hikers, ranging from novices to seasoned backcountry enthusiasts. Yet despite their differences, many are seeking and finding similar experiences under different environment and social conditions. For many day hikers, finding solitude on corridor trails is just as important as findings solitude on Threshold or North Rim trails. What makes this possible is the spectrum of hiking opportunities presented to hikers that allow them to find trails that fit with their preferences and abilities. Future management should seek to further define and refine the spectrum of day hiking opportunities. Developments envisioned in the 1995 General Management Plan like the Greenway Project on the South Rim should seek to provide rim hiking opportunities like that provided by the Widforss trail where hikers can experience rim destinations in a backcountry setting.

HIKER PREPAREDNESS

An objective of this research was to assess the preparedness of day hikers, and their support for management actions designed to increase day hiker safety. This section will discuss information sources used by day hikers, the effects of the information on their hiking behavior, attitudes toward safety and preparedness, and their support for management alternatives designed to reduce search and rescue efforts.

Information Sources

Although 76.3% of all respondents received information about hiking Grand Canyon prior to their hike, the proportion receiving information varied by their location of hike (table not shown). North Rim day hikers were most likely to receive information (80.0%) followed by South Rim corridor hikers (76.5%), and South Rim threshold day hikers were the least likely to have received information about hiking the backcountry in Grand Canyon (69.4%). Of those that received information prior to their hike (n=1520; see Table 5.1), the most commonly reported source of information across all locations was “book or magazine” (54.2%), and the second most common was the Grand Canyon website (37.3%). In contrast, the Canyon View Information Plaza was used by 7.0% who reported receiving information prior to their hike. Across the three locations, South Rim threshold day hikers were most likely to receive information prior to their hike through a “book or magazine” (62.8%) and least likely to use the Grand Canyon website (28.3%).

Table 5.1. Information sources used by day hikers.

Information Source	Location of Hike			Total (n=1520) %
	South Rim Corridor %	South Rim Threshold %	North Rim %	
Book or Magazine	51.7	62.8	54.8	54.2
Grand Canyon Website	36.5	28.3	43.9	37.3
Other Information Sources	26.3	28.8	29.6	27.6
Park Ranger	19.4	15.0	11.3	16.5
Friends/Word of Mouth	14.8	13.3	18.8	15.7
Ranger Program	15.7	13.3	6.5	12.8
Other Website	6.8	6.7	11.2	8.0
Canyon View Information Plaza	9.2	7.5	1.9	7.0
Poster on Hiking Safety	5.4	8.4	4.3	5.5
North Rim Visitor Center	2.1	2.7	12.7	5.1
Backcountry Information Center - South Rim	3.3	4.9	3.8	3.7
Store or Lodge Employee	3.8	3.1	2.2	3.2
Desert View Information Center	2.5	6.2	0.2	2.4
Backcountry Information Center - North Rim	0.1	0.4	3.1	1.0

Ninety-three percent of respondents who received information prior to hiking indicated that safe hiking tips were included in the information – regardless of the source of information (see Table 5.2). In addition, the information received by South Rim threshold day hikers was most likely to include information about low impact hiking techniques (73.1%) compared to either South Rim corridor day hikers (66.4%) or North Rim day hikers (60.0%).

Table 5.2. Content of information received.

Did the information include...?	Reporting “Yes” by Location of Hike			Total (n=1520) %
	South Rim Corridor %	South Rim Threshold %	North Rim %	
Safe hiking tips	95.1	95.0	87.7	93.0
Low impact hiking techniques	66.4	73.1	60.0	65.6

Close to one-fifth of respondents (n=257, or 18.1% of the sample) reported changing their hiking plans due to the information received prior to their hike, and this proportion did not vary by location of hike nor season (summer vs. fall). However the way in which plans were changed varied by location (Table 5.3). Compared to South Rim corridor day hikers, South Rim threshold hikers were more than twice as likely to change their route due to the information they received prior to hiking (compare 18.2% to 42.9%, respectively), but were more than half as likely to bring more food with them (28.3% to 14.3%).

Table 5.3. Influence of information received on hiking behavior.

How were plans changed?	Location of Hike			Total (n=257) %
	South Rim Corridor %	South Rim Threshold %	North Rim %	
Started earlier	11.0	17.9	12.1	12.1
Started later	3.1	3.6	0	2.4
Changed route	18.2	42.9	39.4	26.5
Lengthened hike	1.9	3.6	3.0	2.4
Shortened hike	37.7	32.1	31.8	35.6
Carried more water	40.3	39.3	36.4	39.1
Brought electrolyte replacement	8.8	10.7	10.6	9.5
Brought more food	28.3	14.3	15.2	23.3
Wore different clothes	7.5	3.6	7.6	7.1
Hiked without children/child	0.6	0	0	.4
Hiked without unfit adult	1.3	0	0	.8
Other	7.5	7.1	16.7	9.9

The most common item taken on a day hike was water, with 95.5% of respondents reporting bringing water regardless of season (table not shown). Taking water along varied by

location. South Rim threshold hikers were least likely to carry water along with them (91.7%) compared to either South Rim corridor (96.2%) or North Rim (96.5%) hikers (see Table 5.4). Compared to day hikers of other locations, North Rim day hikers carried the most items along on their day hike, and were most likely to carry a first aid kit, sun screen, jacket, trail map, flashlight, and toilet paper. In terms of seasonal variation (table not shown), fall, compared to summer, respondents were more likely to carry a first aid kit (39.4% vs. 31.2%), a topographic map (9.7% vs. 6.0%), a jacket (66.4% vs. 28.9%), a cell phone (20.6% vs. 15.3%), food (83.1% vs. 75.9%), a flashlight (25.3% vs. 15.6%), and toilet paper (47.1% vs. 39.0%), and least likely to carry sunscreen (49.7% vs. 61.5%).

Table 5.4. Items taken on hike.

Items	Location of Hike			Total (n=1931) %
	South Rim Corridor %	South Rim Threshold %	North Rim %	
Water	96.2	91.7	96.5	95.5
Electrolyte Replacement	23.6	18.3	24.8	23.0
First aid kit	32.0	33.3	38.7	34.0
GPS receiver	2.3	4.2	5.7	3.5
Topographic map	6.7	4.8	10.0	7.3
Sunscreen	55.8	47.1	67.6	57.5
Jacket	39.9	41.0	45.4	41.5
Cellular phone	19.2	11.9	15.7	17.1
Signal mirror	7.7	9.9	7.1	7.9
Food	79.5	72.4	79.4	78.4
Trail map	33.5	29.8	44.2	35.7
Sunglasses	82.6	78.5	81.7	81.7
Flashlight	17.7	18.3	21.7	18.9
Toilet Paper	38.9	37.8	50.2	41.7
Hat	84.1	81.1	87.0	84.4

When asked whether the amount of water brought on their hike was sufficient, 95.3% of both South Rim corridor and North Rim day hikers reported that their water was sufficient. This proportion dropped to 87.4% with South Rim threshold hikers who reported the same (table not shown).

On average, hikers on the Hermit and Grandview trails carried the most water per person per mile hiked (Table 5.5). However the variability, or standard deviation, was also highest on these trails indicating that compared to hikers on the other trails, these day hikers also were likely to carry either not enough or too much. Table 5.5 also indicates that day hikers generally carried less water in the fall compared to the summer.

Table 5.5. Mean water (quarts) per person per mile hiked by season and trailhead.

Season	South Kaibab n=490	Bright Angel n=626	Hermit's Rest n=176	Grandview n=129	North Kaibab n=288	Widforss n=131	Ken Patrick n=71
	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>
	<i>S.E.</i>	<i>S.E.</i>	<i>S.E.</i>	<i>S.E.</i>	<i>S.E.</i>	<i>S.E.</i>	<i>S.E.</i>
Summer	1.55	.76	2.32	2.029	.98	.69	.71
	.13	.11	.23	.23	.16	.23	.34
Fall	1.21	.83	1.32	1.82	.78	.72	1.15
	.17	.15	.27	.40	.26	.38	.46

A question asked respondents whether anyone in their group became sick. Out of 1930 respondents, the number who reported “yes” was less than 10 people for each location. With such low cell sizes on this variable, generalizations beyond this sample should be done with caution. There were two similar questions asking whether anyone became injured or lost. The pattern of responses was the same in that cell sizes were low, and hence reliability weak.

Physical Fitness Characteristics

Respondents reported a variety of fitness levels and frequency of exercise patterns. However 94.3% of respondents rated their own fitness level on the high end of the fitness scale, from “somewhat fit” to “extremely fit” (see Table 5.5). Another substantial proportion (80.3%) reported getting at least 20 minutes of exercise either “nearly every day” or “about every other day.” These proportions did not vary by location of hike, but varied slightly by season of hike. Summer day hikers tended to be less physically fit than fall hikers (table not shown); for example, 37.2% of fall hikers reported 20 minutes-or-more of exercise nearly every day compared to 29.3% of summer hikers.

Table 5.6. Fitness of day hikers.

	Total (n=1931) %
Self-perceived fitness level	
1 Not at all	0.7
2	4.9
3 Somewhat fit	35.9
4	48.6
5 Extremely fit	9.8
Frequency of 20 minutes-or-more exercise	
Nearly every day	32.0
About every other day	48.3
About once a week	14.1
About once every two weeks	2.2
About once a month	1.7
Less than once a month	0.9
Don't Know	0.8

Support for PSAR Alternatives

With the potential for life-threatening danger involved in search and rescue (SAR) efforts, expenses of such efforts, and labor intensity of them, the park has increased planning and developed strategies to reduce the need for SAR, referred to as preventative SAR or PSAR. Although there are numerous PSAR management alternatives, and various criteria to evaluate their effectiveness, reactions of visitors to PSAR alternatives provides insight to their social acceptability. A questionnaire module was developed that focused on respondents’ support for various PSAR alternatives.

Respondents’ support did not vary substantially by location of their hike or season, except for an item that asked about the necessity of ranger patrols. South Rim corridor respondents, compared to either South Rim threshold or North Rim respondents, were more likely to “strongly agree” with the statement “ranger patrols are necessary and appropriate,” compare 63.1% to either 42.3% or 43.3%, respectively (Table 5.6).

Table 5.7. Agreement on necessity of ranger patrols.

Ranger patrols are necessary and appropriate	Location of Hike			Total (n=492) %
	South Rim Corridor %	South Rim Threshold %	North Rim %	
Strongly disagree	0	1.3	1.6	0.6
Disagree	2.8	7.7	15.0	6.7
Neutral	4.5	16.7	3.9	6.3
Agree	29.6	32.1	36.2	31.7
Strongly agree	63.1	42.3	43.3	54.7

There were two items that asked respondents whether park rangers exaggerate the dangers of hiking the Canyon. Although there was variation across the response categories on these items, most respondents felt that park rangers did not distort the dangers of hiking. For example, in response to the statement “most park rangers depict Grand Canyon hiking as being more dangerous than it really is,” 73.8% of respondents disagreed and 10.3% agreed (Table 5.7).

Although 84.1% agreed that most risks faced in Grand Canyon are beyond the control of the NPS (Table 5.7), most respondents felt that park rangers would rescue them if need be. For example, in response to the statement “park rangers will rescue me if I get into trouble,” 70.3% agreed and 11.2% disagreed. In response to a similar statement, “park rangers will help me back to safety if I have problems hiking,” 66.8% agreed and 15.0% disagreed. It is clear that more than two-thirds of day hikers in Grand Canyon’s backcountry have some degree of reliance on park rangers for their own safety. Fortunately 84.9% indicated being well-prepared for their hike, and 5.7% indicated they were not well-prepared (Table 5.7).

Table 5.8. Agreement on hiking safety items.

	Agreement Level				
	Strongly Disagree %	Disagree %	Neutral %	Agree %	Strongly Agree %
Park rangers exaggerate the dangers of hiking.	29.9	46.6	10.4	11.8	1.2
Park rangers will rescue me if I get into trouble.	1.4	9.8	18.4	57.0	13.3
I was well-prepared for my hike.	1.4	4.3	9.4	49.0	35.9
Day hiking at Grand Canyon requires special physical conditioning.	0.8	14.5	13.7	51.6	19.3
Park rangers will help me back to safety if I have problems hiking.	1.5	13.5	18.2	53.9	12.9
Most park rangers depict Grand Canyon hiking as being more dangerous than it really is.	21.1	52.7	15.9	9.6	0.7
Most of the risks visitors face in Grand Canyon are beyond the control of the National Park Service.	1.0	6.7	8.2	53.6	30.5

n=492

When asked about preferences for PSAR management alternatives, the alternative that captured the most support was for rangers to check the adequacy of supplies and equipment (Table 5.8). There was just one alternative that received a majority of support; 58.0% of respondents supported the statement “require all hikers on this trail to have minimum supplies and equipment (e.g., adequate water, appropriate shoes or boots).” The second most favorably rated PSAR alternative was to restrict the start time of hikes on hot days; 39.2% of respondents supported the statement “restrict the time of starting a hike to before 7:00 a.m. or after 4:00 p.m. on days when the temperature is predicted to be extremely hot.”

There were two alternatives that garnered a substantial amount of opposition. The most unpopular alternative was to eliminate SARs. To the statement “eliminate search and rescue activity by park personnel – Hikers are responsible for their own health and safety,” 78.7% opposed this alternative. Another unpopular alternative was to restrict the number of day hikers by a permit process. To the statement “limit the number of hikers allowed to use this trail by means of a daily permit system,” 72.8% opposed this alternative (Table 5.8).

Table 5.9. Support for management alternatives.

Management alternative	Oppose %	Neutral %	Support %	Mean %	Standard Deviation %
Provide more signs along this trail concerning appropriate use and safety.	45.7	19.6	34.7	2.8	1.1
Require orientation about appropriate use and safety for all first time hikers on this trail.	51.1	12.4	36.4	2.8	1.2
Limit the number of hikers allowed to use this trail by means of a daily permit system.	72.8	13.6	13.2	2.2	1.0
Require all hikers on this trail to have minimum supplies and equipment (e.g., adequate water, appropriate shoes or boots).	30.1	11.9	58.0	3.4	1.2
Charge a day hiking fee for this trail to help pay for hiker education and safety.	67.6	13.4	19.0	2.2	1.1
Provide more park rangers along this trail to enforce rules and regulations.	52.2	23.0	24.8	2.7	1.0
Restrict the <u>time</u> of starting a hike to before 7:00 a.m. or after 4:00 p.m. on days when the temperature is predicted to be extremely hot.	47.5	13.3	39.2	2.9	1.2
Restrict the <u>time</u> of starting a hike to before 7:00 a.m. or after 4:00 p.m. on all days from Memorial Day to Labor Day.	64.8	14.5	20.8	2.4	1.1
Restrict the <u>length</u> of hikes when the temperature is predicted to be extremely hot.	58.0	14.1	27.9	2.6	1.2
Eliminate search and rescue activity for park personnel – Hikers are responsible for their own health and safety.	78.7	11.4	9.9	1.9	1.0

n=492

Note: Response categories were coded as 1=strongly oppose, 2=oppose, 3=neutral, 4=support, and 5=strongly support. For this table, “Oppose” represents responses of either 1 or 2, and “Support” represents responses of either 4 or 5. Means and standard deviations calculated on a 1 to 5 scale.

Unprepared Hikers

The 5.7% who self-identified as not being well prepared for their day hike merit further investigation. Understanding the location of their hikes and their hiking behavior provide insight to developing PSAR strategies. Compared to the rest of the day hikers, those who said they were unprepared were most like to have hiked on the Bright Angel and the Grandview Trails (Table 5.9).

Table 5.10. Proportion of Prepared and Unprepared Hikers by Trailhead.

	Bright Angel	South Kaibab	Hermit	Grandview	North Kaibab	Widforss	Ken Patrick
% of Prepared	32.7	24.9	9.3	6.1	14.5	8.4	4.1
% of Unprepared	46.4	28.6	0.0	21.4	0.0	0.0	3.6
% Total	33.5	25.1	8.8	6.9	13.7	4.1	4.1

$\chi^2 = 19.67, df=6, n=490, p<.05$

Most were indicated that they were hiking on their first day in the park (65.4%) where only a third (34.5%) of all hikers indicated that they were hiking on the their first day in the Park (Table 5.10).

Table 5.11. Proportion of Prepared and Unprepared by Number of Days at the Park

	Number of Days at the Park (to the point of the hike)				
	1	2	3	4	5+
% of Prepared	32.6	47.4	11.5	4.6	3.9
% of Unprepared	65.4	26.9	3.8	3.8	0.0
% Total	34.5	46.2	11.1	4.6	3.7

$\chi^2 = 12.17, df=4, n=490, p=.02$

The unprepared hikers tended to report that they were less physically fit in terms of their frequency of getting at least 20 minutes of exercise over the past year. Only 22.4% indicated that they got 20 minutes of continuous exercise everyday compared to 33.5% of the total; 10% also indicated that they did not know how often they got 20 minutes of exercise, as compared to 0.8% of the total sample. In strange twist, hikers who said that they were unprepared were more likely to indicate that they were “Extremely Fit” or “Somewhat Fit” than the entire sample. Fourteen percent of unprepared hikes indicated that they were extremely fit compared to only 9% of prepared hikers. Similarly, 43% of unprepared hikers said they were “Somewhat fit” compared to 35% of prepared hikers. On average, hiking groups where the respondent reported being unprepared carried .21 liters of water per person per mile hiked less than those who reported being prepared and were far more likely to report that they did not carry a sufficient amount of water, 39% of the unprepared compared to 7.9% of the total (Table 5.11). Those groups that were unprepared were also less likely to carry food than those who were prepared. Most telling, unprepared hikers were more likely to report that their hike took longer than they had expected than those that indicated that they were prepared for their hike, 18% of the unprepared hikers

said their hike took longer than expected and 6% of prepared hikers indicated that their hike took longer than expected.

Table 5.12. Prepared and Unprepared hikers with water carried on hike.

	Prepared Hikers	Unprepared Hikers	Total
Liters H₂O/Person/Mile Hiked			
Mean	0.45	0.25	0.44
Standard Deviation	0.42	0.25	0.42
$t=3.69, df = 33.46, p=.001^1$			
Was amount of reported water carried sufficient for hike?			
% indicating "YES"	94.1	60.7	92.1
% indicating "NO"	5.9	39.3	7.9
$\chi^2 = 40.27, df=1, p<.001$			

¹Does not assume equal variances

Conclusion

This section was concerned with day hiker preparedness. It sought to describe the information sources used, the effects of the information on hiking behavior, hikers’ preparedness for their hike, their attitudes toward safety, and their support for management alternatives concerned with hiker safety. The findings show that the PSAR campaign is effective in changing the behavior of hikers so that they have safer experiences. The findings also suggest there is some room to further improve PSAR activities. Future efforts should concentrate on the 5% to 6% of hikers that reported being unprepared for their hike. Threshold trail hikers may require different PSAR approaches than corridor trail hikers. In sum, PSAR efforts are effective at reaching a large proportion of day hikers, and further refinement of the program could target the unprepared hikers.

RESOURCE PROTECTION ATTITUDES AND KNOWLEDGE

Objective four of this research project was to assess day hikers' attitudes toward resource protection and their knowledge of appropriate low-impact hiking behaviors. This section addresses day hikers' attitudes toward resources protection, their knowledge of backcountry regulations, including attitudes and behavior connected to human waste and appropriate sanitation. To assess attitudes and backcountry regulation knowledge, a questionnaire module was developed and directed at attitudes toward low-impact hiking behavior. In addition, respondents were asked to complete a "test" of their knowledge of low-impact backcountry regulations.

Resource Protection Attitudes

The majority of day hikers believe that, as a day hiker, they have potential to significantly impact the park's resources. They feel it is important to minimize those impacts, and are willing to learn more about low-impact hiking (Table 6.1). For example, 96.3% of respondents disagreed with the statement "a single hiker cannot damage park resources because he or she is just one of many hikers." There were 60.3% of respondents who agreed with "I want to learn more about low-impact hiking to avoid damaging park resources."

While most are willing to learn more about low-impact hiking and are willing to change their behavior, a significant proportion was neutral or disagreed with taking action to minimize their own impacts. When asked if they agreed that "I would change my behavior to avoid damaging park resources," 21.4% said they disagreed and 15.2% indicated that they felt neutral. Fifteen percent disagreed with the statement "I want to learn more about low-impact hiking to avoid damaging park resources" and another 23.2% indicated they were neutral to the same statement (Table 6.1).

Knowledge of Backcountry Regulations

To assess the day hikers' knowledge of low impact hiking behaviors, respondents were asked to respond whether they believe eleven statements to be true or false (Table 6.2). Of those that completed all 11 questions, the lowest score was five correct (0.4% received this score) and the highest score was 11 correct (28.0% received this score). Most respondents (86%) reported nine to eleven answers correctly. The distribution of scores did not vary with either trailhead or season.

"When disposing of human wastes in places where toilets are not available, park rangers recommend that visitors bury their toilet paper" stands out for the high rate of incorrect answers. Fifty-eight percent of the respondents indicated that this statement was "True" when the correct answer is "False." Fall and Summer day hikers were equally likely to incorrectly answer the question. North Rim day hikers were more likely to correctly (50% correct) answer the question than either South Rim Corridor hikers (38% correct) or South Rim Threshold hikers (38% correct). Among the 175 respondents who correctly answered ten of the eleven questions, 127 (73%) answered this question

Table 6.1. Day hikers' attitudes toward low-impact behavior.

Statement	Level of Agreement				
	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
Ranger patrols are necessary and appropriate.	.4	7.5	7.8	29.5	54.7
I was well informed about appropriate behavior to protect park resources.	.6	1.8	6.1	45.5	45.9
I would change my behavior to avoid damaging park resources.	4.3	17.2	15.2	24.2	39.1
I want to learn more about low-impact hiking to avoid damaging park resources.	2.5	13.9	23.2	42.7	17.6
It is important for day hikers to minimize their impact on the resource.	0	.6	1.9	26.6	70.9
A single hiker <u>cannot</u> damage park resources because he or she is just one of many hikers.	69.8	26.5	1.2	2.1	.4

n=492

Table 6.2. Proportion true or false to questions about backcountry regulations.

Backcountry Regulation Item	% True	% False
	Hikers are not allowed to collect plants and rocks along the trails at Grand Canyon.	98.4*
The air temperature at the bottom of Grand Canyon is usually 5 degree Fahrenheit warmer than the air temperature at the rim.	25.2	74.8*
Most of the trails going down into the Grand Canyon have water sources along the way.	17.7	82.3*
Food scraps (from snacks and lunches) should be scattered widely to avoid attracting and concentrating wild animals.	7.1	92.9*
Park rangers discourage visitors from hiking rim-to-river-to-rim in one day.	98.0*	2.0
When hiking Grand Canyon during the summer, park rangers recommend that visitors take one quart of water per person per day of hiking.	16.4	83.6*
All day hikers should be prepared to carry out their own trash and litter.	99.8*	.2
Off-trail hiking to mark a short cut is appropriate at Grand Canyon.	2.9	97.1*
Hunting wild animals is not allowed in Grand Canyon.	99.4*	.6
Park rangers recommend that you drink water regularly, even before you become thirsty.	99.8*	.2
When disposing of human wastes in places where toilets are not available, park rangers recommend that visitors bury their toilet paper.	58.2	41.8*

n = 492, * indicates correct response

incorrectly (table not shown). Of those who answered five or six correctly, none answered this question correctly.

The high rate of incorrect answers on proper sanitary behavior suggests at least two possible explanations. First, the statement could be difficult to understand. It is a long-winded statement, and some respondents may have a difficult time imagining a trail where toilets are not available. If the statement was difficult to understand one might expect there to be a statistical relationship between education level and getting the answer correct. This was not true within respondents to this question; visitors with high education levels were just as likely to answer incorrectly as visitors with lower education levels (table not shown). But given that there is fairly little variation in the education, this is a weak test and we cannot conclude that the item is problematic due to difficulty in understanding the statement.

A second explanation is that many day hikers were misinformed and thought they should bury their toilet paper. A significant proportion of the sampled day hikers were inexperienced hikers, did not receive information before their hike, and therefore may not know what to do with toilet paper in the backcountry. If this were so, we would expect the more experienced hikers to answer the question correctly, and hikers who received information on low-impact hiking techniques to answer the question correctly. Analysis of three past experience variables show that experienced hikers were more likely to know how to dispose of toilet paper than the less experienced hikers (Tables 6.3 and 6.4).

Table 6.3. Test scores on knowledge of low impact by hiking experience.

	Number of hikes in the past 12 months at Grand Canyon.				Total
	1	2	3-5	6+	
% Incorrect	61%	56%	50%	21%	58%
% Correct	39%	44%	50%	79%	42%
Total n	356	68	40	14	478

$\chi^2 = 10.1, df=3, p<.05$

Table 6.4. Test scores on knowledge of low impact by day hiking experience.

	Total number of day hikes at Grand Canyon.				Total
	1	2	3-5	6+	
% Incorrect	63%	61%	47%	41%	58%
% Correct	37%	39%	53%	59%	42%
Total n	280	77	65	51	476

$\chi^2 = 12.7, df=3, p<.05$

Receiving information on low-impact hiking techniques improved hikers knowledge about human waste and appropriate sanitation. Of those hikers whose information did not include information on low-impact hiking techniques, 31% knew that they should not bury their toilet paper. Of the hikers whose information included information on low-impact hiking techniques, 46% knew not to bury their toilet paper (Table 6.5). The inclusion of information on

low-impact hiking techniques increased the proportion of correct answers to the quiz question by approximately 48%. Yet despite this great increase, most day hikers do not know how to properly dispose of their toilet paper. The next step examines if some information sources were better than others.

Table 6.5. Test score by response to “Did the information you received include low impact hiking techniques?”

Correct response to burying toilet paper?	Did the information you received include low impact hiking techniques?			Total
	Yes	No	Don't Know	
No	54%	69%	68%	59%
Yes	46%	31%	32%	41%
n	240	54	76	370

$\chi^2 = 7.54, df=2, p<.05$

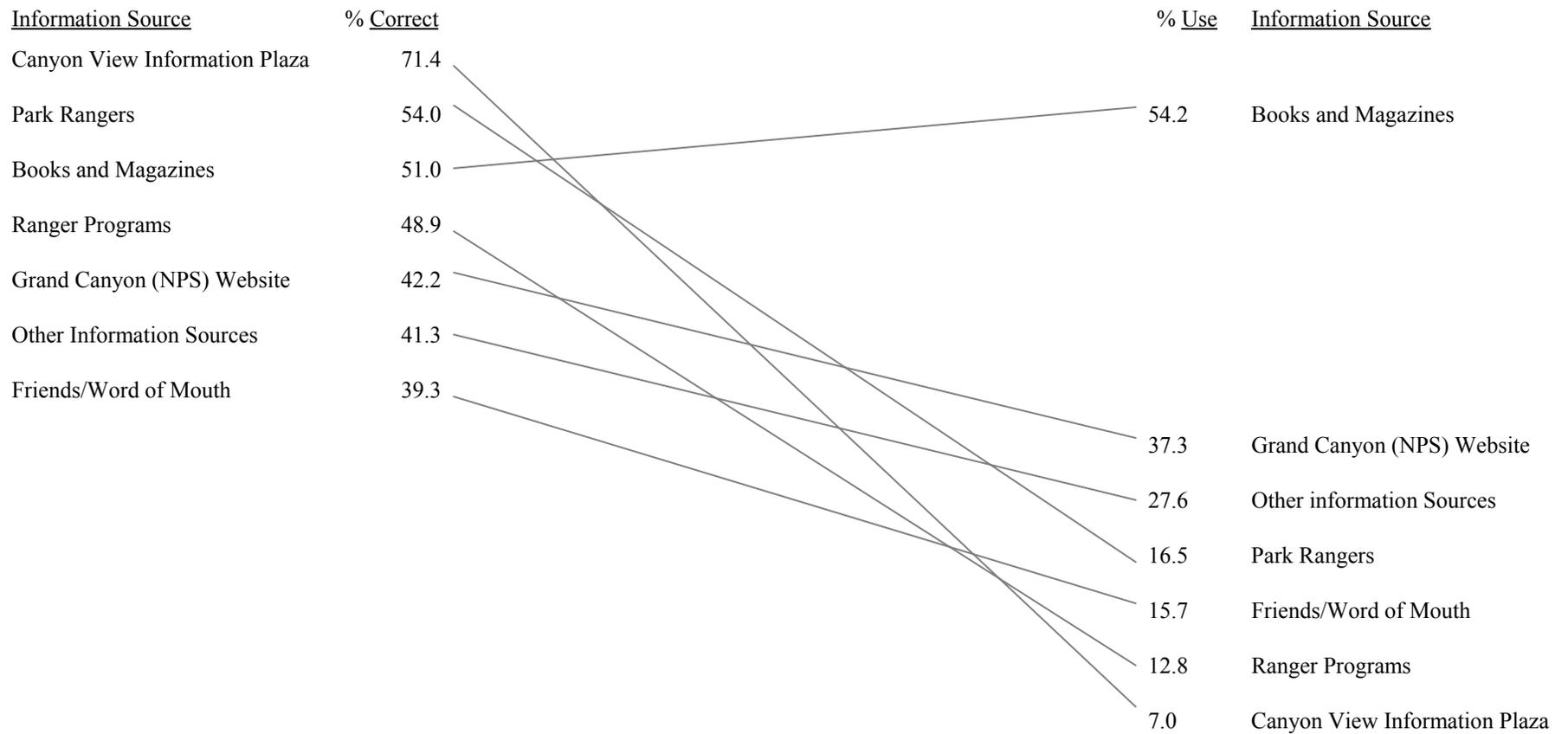
For an information source to be effective, it needs to both reach a significant portion of visitors and influence behavior. When examining respondents’ knowledge about burying toilet paper with the information source that they reported using, the effectiveness of the information source could be assessed. In this case, the following sources of information were reported with the percent correct in parentheses: Canyon View Information Plaza (71%), park rangers (54%), and books/magazines (51%). When taking into consideration the proportion of respondents who indicated they used an information source, books/magazines were the most effective at increasing respondents’ knowledge of backcountry regulations because 55% of day hikers utilized them when seeking information for their hike, followed by park rangers who reached approximately 17% of the day hikers and Canyon View Information Plaza which was utilized by 7% of day hikers (Table 6.6).

Conclusion

The purpose of this section was to examine hikers’ attitudes toward resources protection and their knowledge of both backcountry regulations and low impact hiking techniques. These findings show that day hikers are concerned about their impact on the canyon and that they largely are knowledgeable about backcountry regulations and low-impact hiking techniques. How to dispose of toilet paper is a source of confusion among day hikers. Most respondents indicated they believed that toilet paper should be buried. Further analysis indicated that those hikers who received information on low impact hiking techniques especially from a visit to the Canyon View Information Plaza and from personal contacts with park rangers were most likely to know how to dispose of their toilet paper. These findings suggest that in the future, minimum impact hiking education should attempt to make clear how all hikers should dispose of their toilet paper in the backcountry.

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 6.6. Difference between proportion of correct responses by information sources and proportion that use that information source.



DAY HIKER SATISFACTION

The fifth objective of this study was to assess day hiker satisfaction with their Grand Canyon hiking experience. Respondents’ overall satisfaction with their day hiking experience, day hikers’ perceptions of resource impacts, and the impacts’ effects on experience satisfaction, as well as hikers’ satisfaction with social and managerial condition are addressed in this section. A questionnaire module was designed to measure overall satisfaction with their day hiking experience, the extent to which impacts were apparent and were found to be disturbing and finally, the importance of their satisfaction with a variety of social and managerial conditions.

Overall Satisfaction

To assess overall satisfaction, respondents were asked to indicate the degree to which they agreed or disagreed with five statements (Table 7.1). Based on the responses, an index score was calculated for each individual. The index had a potential range of 20 with the lowest possible score being -10 and the highest possible score being 10. A score of zero would indicate a person who was neither dissatisfied nor satisfied. The index scores and their distribution suggest that, on the whole respondents were generally satisfied with their day hike. However there was variation in the degree to which they were satisfied. In this sample, the lowest satisfaction score that emerged was a -8 and the highest was a 10.

Table 7.1 Proportion of respondents indicating their level of agreement with five satisfaction statements.

	Level of Agreement				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I thoroughly enjoyed my day hike today.	0.8	0.4	1.0	17.2	80.5
I was disappointed with some aspects of my hike today.	47.1	35.6	4.7	11.7	0.8
I cannot imagine a better day hike than the one I took at Grand Canyon.	0.2	11.5	24.8	45.4	18.0
My hike was well worth the cost.	0.4	0.8	4.8	31.3	62.9
I do not want to have any more hikes like the one today.	66.4	28.3	2.1	1.9	1.3

n=488

Very few respondents could be characterized as dissatisfied. Just 1.8% of respondents had index scores of zero or less. While 98% of the respondents can be characterized as satisfied, there is variation among those who are satisfied. Approximately one quarter of the respondents had index scores between one and five, 42% had index scores of six to eight, and 29% had index scores of nine or ten (Table 7.2). There were no differences in overall satisfaction levels among the trailheads or between summer and fall (Tables not shown).

Table 7.2. Distribution of satisfaction index scores.

Satisfaction Index Score	% of respondents
-8 – 0	1.7
1 – 5	27.9
6 – 8	41.9
9 – 10	28.5

n=456

Resource Impacts

Respondents were asked to rate the extent each impact was apparent and the extent they felt those impacts were disturbing. Table 7.3 summarizes the degree to which respondents perceived each of the eight impacts to be apparent. The most apparent resource impacts were “mule waste” and “trail erosion,” the least apparent were “human waste along trail” and “toilet paper along trail.”

Table 7.3. Apparentness of resource impacts.

Resource Impact	Apparent				
	Not at all	Slightly	Moderately	Very	Extremely
	%	%	%	%	%
Litter along trail	68.4	25.6	5.3	0.8	0
Human waste along trail	97.1	1.8	0.4	0.4	0.2
Toilet paper along trail	91.9	5.8	1.7	0.4	0.2
Mule waste	26.0	7.2	26.7	21.9	18.2
Aircraft overhead	65.3	23.7	7.4	3.2	0.4
Trail erosion	48.0	32.0	16.6	2.9	0.4
Vegetation damage from trampling or cutting	84.9	12.4	2.1	.4	.2
Vandalism/Graffiti on rocks	74.0	17.8	6.8	1.4	0

n=484

The degree to which respondents indicated that resource impacts were apparent varied across trailheads for litter along the trail, mule waste, aircraft overhead, and vandalism/graffiti on rocks. Table 7.4 displays the mean “apparent” ratings of the above mentioned impacts by trailhead. Based on a rating scale of 1 to 5, with five being the most apparent, litter along the trail was most apparent on the Grandview and the Bright Angel trails and least apparent on the Ken Patrick and Widforss trails compare the mean rating of 1.67 and 1.47 compared to 1.10 and 1.11 respectively. Mule waste was most apparent to respondents on corridor and Ken Patrick trails with mean ratings all above

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 7.4. Mean “Apparent” scores for resource impacts by trailhead.

Resource Impact	South Rim				North Rim			Total	F
	South Kaibab n=122	Bright Angel n=144	Hermit n=49	Grandview n=34	North Kaibab n=72	Widforss n=33	Ken Patrick n=19		
	<i>M</i> <i>S.D.</i>								
Litter along trail	1.38 ^a .58	1.47 ^a .68	1.30 ^{ab} .54	1.67 ^a .86	1.34 ^{ab} .60	1.11 ^b .32	1.10 ^b .31	1.39 .63	3.83*
Human waste along trail	1.03 .28	1.11 .49	1.02 .14	1.03 .17	1.01 .11	1.00 .00	1.00 .00	1.05 .32	1.32
Toilet paper along trail	1.11 .52	1.14 .46	1.06 .24	1.15 .36	1.10 .42	1.09 .28	1.05 .22	1.11 .43	.36
Mule waste	3.46 ^b 1.01	3.44 ^b 1.00	1.02 ^c .14	1.00 ^c .00	4.28 ^a .88	1.03 ^c .17	3.45 ^{ab} 1.10	2.99 1.44	143.44*
Aircraft overhead	1.27 ^b .52	1.25 ^b .60	3.00 ^a .98	1.44 ^b .62	1.25 ^b .50	1.51 ^b .78	1.32 ^b .48	1.50 ^b .80	51.50*
Trail erosion ¹	1.91 ^a .97	1.81 ^a .88	1.66 ^{ab} .75	1.81 ^{ab} .79	1.57 ^b .81	1.43 ^b .66	1.70 ^{ab} .71	1.76 ^{ab} .86	2.38*
Vegetation damage from trampling or cutting	1.14 .39	1.20 .57	1.06 .24	1.23 .49	1.21 .55	1.37 .60	1.20 .41	1.19 .49	1.65
Vandalism/Graffiti on rocks	1.43 ^{ab} .71	1.23 ^{ab} .57	1.39 ^{ab} .70	1.75 ^a .87	1.28 ^{ab} .56	1.46 ^{ab} .70	1.20 ^b .70	1.36 ^{ab} .67	3.82*

1=Not at All Apparent, 2=Slightly Apparent, 3=Moderately Apparent, 4=Very Apparent, 5=Extremely Apparent

* p-values <.05

^{a,b,c} Means identified with different letters are significantly different at the $p > .05$ level based on Tamhane's T2 when variances were not assumed equal based on Levene's test for homogeneity of variance or least significant differences when equal variances assumed.

¹ Equal variances assumed.

3.4. “Aircraft overhead” was more apparent at the Hermit Trail than the other trailheads, compare the mean of 3.00 with the second highest mean for apparentness from respondents of the Widforss trail of 1.51, respectively. Finally, vandalism and/or graffiti were most apparent hikers on the Grandview, compare the mean of 1.75 with the second highest mean for apparentness from respondents of the Widforss trail of 1.46, respectively (see Table 7.4). The total column of table 7.3 should be interpreted cautiously because resource impacts are often trail specific. For example, mules are not allowed on trails outside of the corridor therefore the mean mule wastes is problematic to apply across all trailheads.

Table 7.5 presents the degree to which respondents felt various impacts were disturbing. Patterns among the “disturbing” ratings are similar to the “apparent” ratings. For example, the impact that the most respondents indicated were disturbing included “mule waste” and “trail erosion” just as these were the impacts that the largest proportion of respondents indicated that were the most apparent. Likewise the impacts the fewest respondents indicated were disturbing included “toilet paper along trail” and “human waste along trail.” When the relationship between the degree to which an impact was apparent and the degree to which the impact was disturbing is examined, two distinct groups of impacts are revealed.

Table 7.5. Resource impacts and level of feeling disturbed.

Resource Impact	Disturbing				
	Not at all	Slightly	Moderately	Very	Extremely
	%	%	%	%	%
Litter along trail	70.2	10.4	10.4	7.4	1.5
Human waste along trail	96.7	0.8	0.6	1.1	0.8
Toilet paper along trail	91.5	2.6	2.8	2.6	.6
Mule waste	54.5	20.7	13.3	7.2	4.2
Aircraft overhead	83.2	7.9	3.7	3.4	1.8
Trail erosion	66.8	21.2	9.4	2.4	0.3
Vegetation damage from trampling or cutting	86.9	9.4	1.9	1.4	0.3
Vandalism/Graffiti on rocks	74.7	10.7	8.3	4.7	1.6

n=393

“Apparent” ratings and “disturbing” ratings were positively correlated indicating the more apparent the impacts were to the respondents, the more disturbing they were in general (Table 7.6). Closer examination of the correlations suggests there is some sensitivity to different types of impacts. The comparatively high correlations for toilet paper, litter, human waste, and vandalism/graffiti indicate that respondents have lower tolerance for these impacts. The lower correlations for mule wastes, aircraft overhead, and trail erosion suggest that respondents may become tolerant of them at low levels of appearance and increases in these impacts do not increase the level of disturbance. As an example of differences in tolerance across types of

impacts, compare the results exhibited in Tables 7.7 and 7.8. The organization of the tables presents the degree of feeling disturbed in the columns and the apparentness of the impact in the rows. A perfectly correlated relationship would exhibit responses following the diagonal in a positive slope. In the case of “litter along the trail” (Table 7.7), as apparentness increases from “not at all” to “extremely” (from the bottom row to the top row), it is associated with equal or disproportionate increases in feeling disturbed; note the cells above the diagonal tend to be void of responses. In contrast, “trail erosion” (Table 7.8), exhibits dispersion on both sides of the diagonal as apparentness increases. The relationship suggests that respondents do not get as disturbed by this impact, and are tolerant of trail erosion compared to litter.

Differences in tolerance across impacts could be explained in several ways. Hikers may expect some impacts and not others, and tolerate the impacts that they expect. For example, when hiking the Hermit, many hikers know it is an over-flight corridor and thus are more tolerant of aircraft. Or likewise, when hiking the corridor, hikers may expect to share the trail with mules and thus, when they encounter mule wastes, such hikers would not be disturbed by it. Impacts such as litter, present a different case. These impacts are directly attributable to actions of others and can be seen as less natural than say trail erosion, thus, hikers are less tolerant of this category of impact.

Table 7.6. “Apparent” and “Disturbing” correlations for resource impacts.

Resource Impact	N	Spearman's <i>r</i>
Litter along trail	393	.87
Human waste along trail	362	.85
Toilet paper along trail	350	.94
Mule waste	428	.60
Aircraft overhead	376	.61
Trail erosion	382	.65
Vegetation damage from trampling or cutting	360	.79
Vandalism/Graffiti on rocks	384	.86

Table 7.7. Apparentness and feeling disturbed by litter along trail.

	Level of Feeling Disturbed				
	Not at all	Slightly	Moderately	Very	Extremely
Apparentness	%	%	%	%	%
Extremely	0	0	0	0	0
Very	0	0	0	10.3	16.7
Moderately	0	4.9	31.7	24.1	33.3
Slightly	8.0	92.7	68.3	65.5	33.3
Not at all	99.2	2.4	0	0	16.7
n	276	41	41	29	6

Table 7.8. Apparentness and feeling disturbed by trail erosion.

	Level of Feeling Disturbed				
	Not at all	Slightly	Moderately	Very	Extremely
Apparentness	%	%	%	%	%
Extremely	0	0	0	11.1	0
Very	0.8	4.9	11.1	33.3	100.0
Moderately	7.1	32.1	61.1	44.4	0
Slightly	31.0	60.5	27.8	11.1	0
Not at all	61.2	2.5	0	0	0
n	255	81	36	9	1

Social and Managerial Conditions

Respondents were asked to rate the importance and satisfaction with social and managerial conditions. Social conditions included number of people met on the trail, socializing with companions, and considerate behavior of other groups. Managerial conditions included availability of water, availability of toilets, cleanliness of toilets, and number of rangers in the backcountry. Each was rated on a five point importance scale that ranged from “very unimportant” to “very important” and on a satisfaction scale from “very unsatisfied” to “very satisfied.”

The most important social condition was considerate behavior of other groups, with 96.8% of the respondents reporting it as such. The least important was number of other people met on the trail, rated by 58.9% as being an important condition. The most important managerial condition was availability of water with 58.9% reporting it as such. The least important was the

cleanliness of toilets and was rated by 39.8% of respondents as being an important condition (Table 7.9).

Table 7.9. Importance of social and managerial conditions.

Condition	Level of Importance		
	Unimportant %	Neutral %	Important %
Social			
Considerate behavior of other groups	1.3	1.8	96.8
Socializing with companions	10.4	11.0	78.6
Number of other people you met on the trail	23.6	17.5	58.9
Managerial			
Availability of water	23.6	17.5	58.9
Number of rangers in the backcountry	28.0	21.9	50.1
Availability of toilets	38.6	17.2	44.2
Cleanliness of toilets	19.6	40.7	39.8

n=476

Across all of trailheads and across all conditions assessed, considerate behavior of other groups was clearly the most important condition with a small range of variability (Table 7.10). All of the social conditions have means in the “Important” ranges indicating that social conditions are important to the quality of all day hikers experiences. Across all trailheads except for Grandview, “number of other people you met on the trail” was the least important social condition. These findings suggest that while the number of contacts with other people is important to most day hikers, how others behave is more important. The implications of this finding is that promoting good hiking etiquette among day hikers could do more to maintain or increase the quality of the day hiking experience than limiting the number of day hikers allowed to enter the backcountry.

In contrast to the social conditions, the managerial conditions exhibited variability in importance across trailheads. These conditions were generally important to hikers on corridor trails and generally unimportant to hikers on threshold trails. For example, the mean importance level for respondents on the Bright Angel Trail for availability of toilets was 0.70 (on a -2 to +2 scale), compared to respondents of the Hermit Trail who are related to an average of -0.74 level of importance. The differences between these means could be interpreted in several ways, including that toilets on the Hermit Trail, compared to the Bright Angel, are not expected, not used, or not necessary for a satisfactory day hike. Whereas for Bright Angel hikers, more than half may believe that they contribute to a satisfactory day hike. Thus, infrastructure like bathrooms and the availability of water are important to maintain along corridor trails because of the types of hikers attracted to the corridor. These facilities are essential because it allows less experience hikers and families to have backcountry experiences that they may otherwise eschew

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 7.10. Managerial and social conditions: Mean importance ratings by trailhead.

Conditions	South Rim				North Rim			Total	F
	South Kaibab n=120	Bright Angel n=140	Hermit n=50	Grandview n=35	North Kaibab n=70	Widforss n=35	Ken Patrick n=20		
	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	<i>M</i>	
	<i>S.D.</i>	<i>S.D.</i>	<i>S.D.</i>	<i>S.D.</i>	<i>S.D.</i>	<i>S.D.</i>	<i>S.D.</i>	<i>S.D.</i>	
Social									
Considerate behavior of other groups. ¹	1.20 ^b .65	1.28 ^b .51	1.36 ^{ab} .53	1.25 ^b .55	1.34 ^b .63	1.59 ^a .50	1.40 ^a .82	1.30 .59	2.19*
Socializing with companions.	.80 ^{ab} .91	.95 ^{ab} .77	.85 ^{ab} .91	.34 ^b 1.11	1.06 ^a .88	.74 ^{ab} .99	.90 ^{ab} .97	.85 .91	2.94*
Number of other people you met on the trail.	.47 .84	.25 1.03	.54 .97	.72 1.00	.27 1.01	.43 1.07	.35 1.09	.39 .98	1.65
Managerial									
Availability of water	.11 ^b 1.10	.80 ^a .97	-.65 ^c 1.09	-.74 ^c 1.12	.43 ^{ab} 1.17	-.69 ^c .80	-.85 ^c .59	.12 1.19	26.04*
Number of rangers in the backcountry	.25 ^b .91	.62 ^a .90	.06 ^{ab} 1.14	-.51 ^c 1.07	.23 ^{ab} .99	.11 ^{ab} 1.02	-.25 ^{bc} .85	.25 1.01	8.52*
Availability of toilets	.30 ^b 1.03	.70 ^a .94	-.74 ^c .96	-.80 ^c 1.13	.20 ^b .97	-.63 ^c .91	-.90 ^c .45	.09 1.13	28.10*
Cleanliness of toilets	.39 ^a .84	.66 ^a .86	-.45 ^b .88	-.73 ^b 1.01	.33 ^a .96	-.06 ^b .73	-.37 ^b .68	.24 .97	19.53*

-2=Very Unimportant, -1=Unimportant, 0=Neutral, 1=Important, 2=Very Important

* p-values < .05

^{a,b,c} means identified with different letters are significantly different at the $p > .05$ level based on Tamhane's T2 when variances were not assumed equal based on Levene's test for homogeneity of variance or least significant differences when equal variances assumed.

¹ equal variances assumed.

because of a lack of skill or the challenges of hiking with children and other family members of varying age and fitness levels.

Respondents indicated that they were generally satisfied with social conditions they encountered. Although there were substantial proportions satisfied with the managerial conditions, large proportions indicated that they felt “neutral” toward many of the managerial conditions (Table 7.11). The neutral responses could be interpreted that the respondent did not encounter these conditions in the backcountry, and therefore are neither satisfied nor unsatisfied with them. In other words, they do not have a basis to judge their satisfaction.

Table 7.11. Satisfaction with social and managerial conditions.

Condition	Level of Satisfaction		
	Unsatisfied %	Neutral %	Satisfied %
Social			
Considerate behavior of other groups	3.0	2.6	94.4
Socializing with companions	.5	13.7	85.8
Number of other people you met on the trail	2.9	12.3	84.8
Managerial			
Availability of water	11.5	30.6	57.9
Number of rangers in the backcountry	6.9	36.8	56.3
Availability of toilets	5.2	29.5	65.3
Cleanliness of toilets	3.7	53.7	42.6

n=448

When assessed across trailheads, the level of satisfaction is not associated with trailheads for social conditions but is associated with trailheads for the managerial conditions. Table 7.12 displays the proportion of respondents indicating their level of satisfaction for the managerial conditions by trailhead. Availability of water was the managerial condition that the largest proportion of hikers indicated that they were unsatisfied with. This was particularly so for hikers on the South Kaibab. About thirty five percent indicated that they were unsatisfied with the availability of water. In general, these results also show that most threshold hikers are neutral toward the number of rangers in the backcountry whereas most corridor and North Rim hikers are satisfied with the number of rangers in the backcountry. A similar pattern occurs for the availability of toilets. Most corridor and North Rim hikers are satisfied with their availability. Threshold hikers are split between being satisfied or neutral. When it comes to the cleanliness of toilets, most hikers are neutral, except in the corridor where 66% said that they were satisfied.

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Table 7.12. Proportion of respondents indicating level of satisfaction with managerial conditions by trailhead.

Condition		South Rim				North Rim			Total	χ^2	n
		South Kaibab	Bright Angel	Grandview	Hermit	North Kaibab	Widforss	Ken Patrick			
Availability of water	% Satisfied	38.4	77.8	29.0	48.9	70.8	65.6	68.4	57.9	71.43	444
	% Neutral	43.5	19.3	54.8	31.9	23.1	25.0	26.3	30.6		
	% Unsatisfied	34.8	3.0	16.1	19.1	6.2	9.4	5.3	11.5		
Number of rangers in the Backcountry	% Satisfied	60.9	70.4	24.2	41.3	48.5	52.9	52.6	56.3	35.39	448
	% Neutral	35.7	22.2	43.9	50.0	43.9	41.2	36.8	36.8		
	% Unsatisfied	3.5	7.4	7.6	8.7	7.6	5.9	10.5	6.9		
Availability of toilets	% Satisfied	69.3	75.6	48.4	44.9	54.8	71.9	72.2	65.3	26.97	441
	% Neutral	26.3	22.2	45.2	46.9	37.1	18.8	22.2	29.5		
	% Unsatisfied	4.4	2.2	6.5	8.2	8.1	9.4	5.6	5.2		
Cleanliness of toilets	% Satisfied	45.2	65.7	15.4	8.7	38.7	20.0	31.6	42.6	79.12	432
	% Neutral	52.2	32.1	80.8	89.1	51.6	80.0	57.9	53.7		
	% Unsatisfied	2.6	2.2	3.8	2.2	9.7	0.0	10.5	3.7		

All df=12, p<.05

The preceding findings show that managerial conditions were generally less important to hikers than social conditions and a high proportion of hikers consistently indicated that they were satisfied with the social conditions they encountered on their backcountry hike across all trailheads. The one managerial condition that is similarly important to social conditions, the availability of water, was also the managerial condition with which that the largest proportions of hikers were unsatisfied. The one place this seems to be a real issue for hikers is on the South Kaibab trail where almost 35% of the respondents indicated that they were unsatisfied. This large proportion suggests that day hiker expectations for water access at the South Kaibab needs to be addressed in some way. Lowering visitor's expectations for access to water in *The Guide* or in other informational materials may influence day-hiker behavior and ultimately their satisfaction. Overall, the findings suggest that the large majority of day hikers are satisfied with the social and managerial conditions they encountered, and if not satisfied, most were neutral toward the conditions they encountered.

Conclusion

In this section, day hikers' satisfaction with their experience and their perceptions of resource impacts were addressed. Two points stand out in these results. First, the vast majority of day hikers are satisfied with most of their experiences. Second, at current use levels and managerial operations, the behavior of others is the most important factor influencing hikers' satisfaction with their experiences. This is evidenced by the findings that resource impacts that are attributable to the behavior of others were the impacts to which day hikers were most sensitive to and considerate behavior of others was reported to be the most important backcountry condition.

CONCLUSIONS AND RECOMMENDATIONS

This research covered a wide-breadth of issues connected to day use hiking in the backcountry at Grand Canyon National Park. The primary issues covered were: (1) estimation of the number and distribution of day hikers, (2) identification of day hiker characteristics, including socio-demographic characteristics, hiking behaviors, and motivations, (3) assessment of hiking preparedness and support for management actions, (4) low impact behavior and attitudes toward resource protection, and (5) satisfaction with their Grand Canyon day hike experience. The research methods were developed in a working relationship with park staff at important junctures in the research process, including the development of issues addressed and the draft of the research instruments. The data were collected, for both the count estimates and day hiker interviews during the summer of 2004.

As the majority of day hikers reported satisfaction with most aspects of their trip, suggestions that could be made as a result of this study are designed to improve on policies that already affect most day hikers in positive ways. These recommendations were developed in discussion with the NPS staff during a workshop of the results of this study in fall, 2005. The recommendations include:

Recommendation 1: Maintain and further define the spectrum of day hiking opportunities.

Managing for a spectrum of day hiking opportunities in the backcountry has been an important priority for Grand Canyon, and should continue to be a top priority for the NPS. The park currently characterizes unique opportunities of each trail for day visitation, as reflected in *The Guide*, park pamphlets, and interpretive displays. The park should continue managing unique aspects of each trail through maintaining variation on managerial presence (e.g., water availability, ranger encounters, trail maintenance standards, signage, human waste disposal facilities, and so forth) across the trails; accessibilities of trailheads through private vehicles, buses, and walking; and depicting specific destinations and vistas unique to each trail within the park's interpretative information.

Unlike the management of overnight backcountry use where the four use zones are generally portrayed in a linear fashion from most-to-least developed (e.g., Corridor, Threshold, Primitive, and Wild), the management of backcountry day-hiking opportunities has been sensitive to nominal distinctions across the trails that do not follow linear paths of development. For example, both the Bright Angel Trail and the Grandview Trail are easily accessible trailheads in that a person could park their private vehicle within a few steps of the trailheads. However, the Bright Angel is well-maintained, easy to follow its path, and has an obvious managerial presence (e.g., water availability, number of ranger encounters, rest houses, signage). In contrast, the Grandview Trail is generally managed to be unmaintained (although the extensive cribbing on the upper part is an exception), low presence of ranger encounters, no rest houses, yet represented in ways that include the historic mining activity at Grand Canyon and appealing stories of the Last Chance Mine on Horseshoe Mesa. These two trails are not easily comparable along a linear continuum from more-to-less of something – they are categorically different from one another. Each of the trails at Grand Canyon offers unique day hiking opportunities that differ from one another in ways that day hikers find meaningful. Along several parameters of visitor satisfaction, motivations, and importance of conditions, these data indicate

that day hikers of each of the trails distinguish the varying characteristics of each trail in making their choice of day hikes. The park should continue managing each trail as a unique day hiking opportunity, and where possible, insure that these distinctions are protected within management guidelines and operations.

The vision of the 1995 General Management Plan (GMP) states that “*the unique qualities of each area of the park and its immediate surroundings should be preserved and enhanced to heighten the distinctly different visitor opportunities*” (p. 3). As part of implementing this vision, specific objectives reflecting desired social conditions and visitor experiences should be developed for each trail and day use access point. These objectives should be developed in the context of providing a diverse array of backcountry day hiking opportunities at Grand Canyon, and also should account for regional opportunities within the Colorado Plateau. Expanding the array of day use recreational opportunities within Grand Canyon is to broaden the diversity of opportunities within a regional context and within the mission of the NPS, and should not necessarily repeat opportunities already provided elsewhere. For example, there are several areas of public land in the region that already provide off-road vehicle (ORV) opportunities. Allowing ORV use in the park would not be viewed as expanding recreational options nor would it extend the diversity of day use opportunities. The basic question to ask when developing objectives for each trail and day use access point is “What is unique about Grand Canyon and about this trail that needs protection and management?” Responses to this question in the form of measurable conditions and experiences could fit into a Limits of Acceptable Change (LAC) managerial framework and support a monitoring program.

The spectrum of day hiking opportunities offered at Grand Canyon could be further enhanced. With the initiation of the Grand Canyon Greenway project, the possibility exists to develop an on-the-rim day-hiking experience, much like the Ken Patrick Trail on the North Rim. Besides the paved Rim Trail, there currently is not a formalized on-the-rim trail at the South Rim. This type of day-hiking, particularly if it were to connect various destinations on the rim (i.e., Hermit’s Rest, South Rim Village Marketplace, CVIP, Yaki Point, and overlook points along the East Rim Drive to Desert View), would be desirable for many visitors who currently do not venture down into the canyon yet would take advantage of a greenway trail on the South Rim offering extensive opportunities to hike within the natural environments of the rim, and access to various destinations along the South Rim but distinct from the current Rim Trail. As part of diversifying the spectrum of recreational opportunities, the current Greenway project includes plans for bicycle trails, bicycle rental, and so forth. If the Greenway project extends beyond the confines of the South Rim Village, it should plan to *develop separate trails for pedestrian and bicycle use*. If there is anything learned from five decades of outdoor recreation research (see Manning, 1999 for an excellent summary), differing user types are not compatible with each other particularly if one type is mechanized (faster pace of travel, need for paved trails, and distinct safety issues) and the other type is not mechanized (slower movement of travel encourages frequent opportunities to stop while observing nature).

As part of the Greenway project, an additional kind of backcountry day hiking opportunity could be an experience like the Widforss Trail in which the trailhead is behind the rim and requires hiking a brief distance to a rim destination in order to view the Canyon free

from sights and sounds of vehicular traffic. Within the vision statements of the 1995 GMP, the values for future NPS development of the South Rim are characterized as the following:

Of utmost importance is direct access to the rim, where panoramas of the canyon provide the park's aesthetic, inspirational, and emotional appeal, some of the main reasons people visit the park. The South Rim should remain the focus for most park visitors, with diverse opportunities to view the canyon. It should also provide access to areas that allow people to have solitary experiences. (p. 6).

Currently the Hermit Trailhead allows day hikers to travel from Hermit's Rest to the trailhead along a short pedestrian trail, however because the trail is so brief and follows close to the gravel road that leads to the trailhead, the recreational opportunities provided on this trail do not emphasize awe or inspiration. Shoshone Point on the South Rim provides visitor experiences consistent with the above vision statement, but the park may be understandably hesitant to promote use of this point and further develop it as an official part of the spectrum of day hiking opportunities due to the unique opportunities for privacy and solitude at Shoshone Point. If the Greenway extends toward Desert View, there may be potential to develop such a day hiking experience to a "point" located between Grandview and Moran Points.

Recommendation 2: Continue to maintain and care for facilities and conditions along the Bright Angel Trail in order to benefit day hikers. On any given day, about 40-50% of all backcountry day hikes occur on the Bright Angel Trail. The Bright Angel Trail is one of the most famous trails in the National Park system, and considered a destination within Grand Canyon by many visitors. Most day hikers who travel on the Bright Angel Trail are satisfied with their experience, felt a positive sense of solitude and appreciated nature at various points along the trail, were able to test their hiking skills, and reported caring about protecting resources at Grand Canyon. Those hiking with family generally reported that the Bright Angel Trail provided a positive experience of bringing their family together.

The forthcoming re-development of the Bright Angel Trailhead will further assert the importance of this trail for visitors to Grand Canyon, and will entice visitors already predisposed to day hiking to select the Bright Angel Trail as their choice of trails to travel. Among other characteristics planned for re-development, the Bright Angel Trailhead will be framed as the gateway to Grand Canyon's backcountry and through its design will communicate a sense of place appropriate to the grandeur and history of the Bright Angel Trail. The park has a long history of focusing managerial operations and attention to facilities and services along the Bright Angel Trail in order to benefit day hikers. With the re-development of the trailhead, it is imperative to continue these efforts and to maintain the appeal of the Bright Angel Trail for day hikers.

This study indicated that day hikers were more sensitive to social conditions than managerial conditions. In particular, the considerate behavior of other groups encountered were the most important conditions reported by respondents. Such behavior includes hiking etiquette (e.g., observing low impact policy), behavior while encountering others on the trail (e.g., passing behavior, manners while greeting others), and inappropriate activities viewed by others (e.g., throwing rocks or objects). At the current use levels, respondents reported being the most

sensitive to these kinds of social conditions on trails. It is important to note that *although respondents were sensitive to the number of other people encountered on the trail, the quality of the encounter was a more important factor to their experience compared to the number of people they encountered* (from Table 7.9 compare 96.8% reporting considerate behavior as important vs. 58.9% reporting number of encounters as important). In addition, various kinds of users travel on the Bright Angel Trail – overnight backcountry visitors, Xanterra mule rides, private stock rides, and most of the park’s long-distance day hikers choose the Bright Angel Trail. With day hiking popularity on the Bright Angel Trail expected to grow, coupled with it functioning as a trail with multiple user types, the current needs for the park to educate visitors on proper hiking behavior will only increase. In short, to address the social needs of day hikers, evidence from this study suggests that planning for the future management of the Bright Angel Trail should emphasize strategies to teach considerate hiking behavior, with less concern for limiting the number of day hikers.

Recommendation 3: Maintain and improve PSAR activities. The park’s PSAR campaign to prepare day hikers for safe trips was effective in reaching the majority of respondents. More than three-quarters of respondents received information about day hiking Grand Canyon prior to their trip, and of those receiving planning information, most (93%) indicated that safe hiking tips were included in the information (see Tables 5.1 and 5.2 for more detail). Close to one-fifth of respondents reported changing their behavior due to hiking safety information, with carrying more water or hiking shorter distances being the most commonly reported behavioral changes. In addition, the majority of respondents carried several items on their trip to insure their own safety, including water (96% reported bringing), hats (84%), sunglasses (82%), food (78%), and sunscreen (58%). Most respondents (95%) reported that the amount of water brought on their hike was sufficient. The general level of physical fitness of day hikers was excellent with 94% of respondents identifying that they considered themselves “somewhat” to “extremely” fit, and 80% reporting 20 minutes of exercise at least every other day. Whether or not the fitness level of day hikers was due to the park’s PSAR campaign (i.e., unfit hikers decided not to hike, or decided to get into shape prior to their hike) is an open question, however it suggests that most day hikers recognize the need to be in good health and physical shape for Grand Canyon backcountry travel.

Even though the principles of the PSAR campaign with its coverage of “hike smart” techniques are well recognized amongst most day hikers, there is still room for improvement and need for vigilance to further extend the PSAR reach. In particular, day hikers of the South Rim threshold trails, such as the Hermit and Grandview, may require distinct PSAR strategies. More than one-fifth of respondents did not receive any information about hiking safety prior to their trip, and when examining by trailhead, close to one-third of day hikers of the Grandview and Hermit Trails did not receive information prior to their trip. In addition, about 8% of respondents on the Grandview and Hermit Trails did not carry water with them and 12% reported that the amount of water they brought on their hike was not sufficient. Whereas 4% of respondents on Corridor trails did not carry water, and 5% reported that the amount of water they brought on their hike was not sufficient. Of the day hikers of various trails sampled, those of the Grandview and Hermit Trails were most likely to deviate from “hike smart” principles.

There were 5.7% of respondents who self-identified that they were not prepared for their day hike (i.e., they disagreed with the statement “I was well prepared for my hike”). Of these unprepared hikers, 46.4% hiked on the Bright Angel Trail, 28.6% on the South Kaibab, and 21.4% hiked on the Grandview (Table 5.9). In addition, two-thirds of these unprepared hikers are venturing into the backcountry on their first day in the park (Table 5.10). Targeting visitors who enter the park and make early stops at the Bright Angel, South Kaibab, and Grandview trailheads may educate otherwise unprepared day hikers, and reduce the number of unprepared hikers venturing into the backcountry. While unprepared hikers are a small portion of day hikers, such hikers are most likely to become a burden on backcountry rangers and emergency services personnel. One can imagine a situation where a group drives in from Desert View and stops at Grandview, sees the readily accessible trail and decides to head down, not considering the difficulty presented by hiking the Grandview’s steep switchbacks. Similarly, imagine a group pulling up to the Bright Angel Trailhead. The large numbers of people on the Bright Angel trail make it rightfully appealing, so they head down the trail without food, water, or proper gear. In both cases, the excitement of being at Grand Canyon and need to hike “just a short way down” overwhelm any caution about hiking safety.

There are a number of ways to reach unprepared hikers, and several are already being explored at Grand Canyon. Replicating the hike grading system (sandwiches and water bottles as presented at CVIP) in *The Guide* and at trailheads could potentially be an effective way to convince some of these visitors to reassess their preparedness before they head down the trail. This is especially important because the results indicate that unprepared hikers carry almost half the volume of water prepared hikers carry (Table 5.11). The best way to influence people is a personal contact with a Park Ranger. At the Bright Angel and South Kaibab trailheads, the presence of PSAR rangers and other park personnel currently provide this type of visitor contact. At Grandview, increasing the presence of park personnel who contact visitors could reduce the number of unprepared hikers venturing down the trail. Reducing the number of unprepared hikers, even a small amount, may have substantial benefits.

The park’s PSAR campaign has taken on a life of its own, and exists beyond the direct control of Grand Canyon staff. Books and magazines were the most widely reported source of trip planning information, with 54% of day hikers reporting using them prior to their trip (see Table 5.1), and the Grand Canyon website was second most popular (37%). A variety of other information sources also were used including Park Rangers (17%), friends and word of mouth (16%), and Ranger programs (13%). Although effective at educating those who found their way to Canyon View Information Plaza, just 7% of day hikers used the CVIP as an information source.

As a recommendation, continue to update the Grand Canyon website and provide “hike smart” messages in visible places on this website. As the planned transportation system becomes further implemented on the South Rim, more day hikers will find their way to the CVIP and will be educated by its displays on hiking safety. However until the CVIP becomes more widely used, a transition strategy to promote “hike smart” principles may need consideration for PSAR to extend its reach.

Recommendation 4: Minimum impact education should emphasize behavior related to human wastes, hiking etiquette, and littering. A common concern with Corridor trails is the presence and appearance of toilet paper. The findings indicate that the presence of toilet paper may be partially due to the fact that most day hikers do not know the “pack it out” rule, and think they should bury their toilet paper (or leave it under a rock). Assuming if day hikers know the “pack it out” rule they indeed will do so, one solution is to explore strategies to further educate users on proper disposal of toilet paper. The findings presented suggest that current information about low-impact hiking techniques is an improvement over no information whatsoever. The problem is that most respondents indicated that their information sources covered low impact hiking techniques, yet most could not answer the question about toilet paper disposal correctly. This suggests that messages concerning low-impact hiking techniques do not clearly communicate that toilet paper should be packed out of the Canyon and/or that this message does not reach the majority of day hikers.

The results show that some day hikers have learned that they should not bury their toilet paper. Those day hikers correctly responding to the question received their trip planning information from a variety of sources. More than half of the hikers receiving information from Canyon View Information Plaza, books/magazines, and Park Rangers could correctly answer the question about toilet paper disposal (Table 6.6). Books/magazines was probably the most effective message source because it reached more day hikers than Canyon View Information Plaza and Park Rangers.

If a goal of the NPS interpretation is to improve day hikers’ knowledge of proper disposal techniques, messages promoting low impact hiking could be improved. One information source that could more effectively carry the message is the Grand Canyon website. Thirty-nine percent of respondents indicated this was their source of information used for trip planning. Of those, 40% reported that it included information on low impact hiking techniques and 15% of the total users of the Grand Canyon website knew they should not bury their toilet paper. However, the appropriate handling of toilet paper was not easily found on this website, and existed in just one place on the web page “Hiking Tips” within the section heading “Be Lightweight.” Perhaps including low impact hiking techniques as a sidebar on the pages that give individual trail descriptions could effectively increase day hikers’ knowledge as to how they should handle toilet paper in the backcountry.

The littering issue is similar to proper toilet paper disposal in that day hikers are leaving something behind in the backcountry that may influence ecological conditions and, if viewed by others, be a source of disturbance for their Grand Canyon experience. However a commonly accepted cultural norm is “don’t be a litterbug.” Day hikers are probably aware of rules to pack out all litter, food scraps, and packaging material, even if they did not read such anti-littering messages regarding their Grand Canyon day hike. Decreasing the proportion of day hikers who litter may ultimately be a larger challenge than decreasing the proportion who bury their toilet paper, since it involves more than just getting-out the message. It may also involve changing visitors’ routine pattern of behavior, i.e., if they litter in their daily lives they will probably litter in the backcountry too. However with litter along backcountry trails being a source of bother and concern for a majority of day hikers, it would be important for the NPS to continue to explore strategies to educate hikers about litter and to reduce the amount of litter along trails.

Recommendation 5: Develop a monitoring program. A monitoring program should be established to assess experiences, satisfactions, and social conditions perceived by day hikers, and to compare the assessment to management objectives (or standards). The purpose of the monitoring program is to periodically evaluate the extent to which objectives are being met. Monitoring should occur periodically, about every five years, or more frequently if there is concern that conditions and experiences are changing and may not meet objectives for the day use opportunity. If there are particular opportunities that appear vulnerable to change, then monitoring could be directed at a specific area or group of trails.

There are several parameters that are meaningful to monitor that could be connected with managerial objectives for social conditions, experiences, and satisfactions. The number of users is a common parameter to monitor due to its relative ease for measurement and potential to be manageable. This study provides some baseline information for user numbers on several trails, and it would be important to employ similar techniques for counting in future study – specifically regarding the trail location of the counts and based upon day hikers who are traveling uphill. In addition to user number, the park may want to consider managerial standards connected to mean solitude ratings (see Table 4.13), percent of day hikers receiving information prior to their hike and monitoring the information source used (Table 5.1), ways in which information influenced hiking behavior (Table 5.3), and amount of water per person taken on hike (Table 5.5). Assessing day hiker knowledge of minimum impact hiking techniques (Table 6.2) and importance/satisfaction with conditions (Tables 7.9 and 7.10) are helpful to review the direction of managerial efforts.

Not each of these variables are given to direct managerial control. However each variable is connected – directly or indirectly – to managerial efforts that could be implemented within a monitoring program and ultimately lead to compliance with managerial standards. For example, it would be both expected and desirable that the portion of day hikers using CVIP as an information source should increase from its current 7% usage. The NPS target may be, say 40%, of day hikers should use CVIP as an information source and a monitoring program would provide evidence to evaluate whether the target usage percent is reached. If the target is not met after further implementation of the transportation plan and subsequent monitoring, then reviewing the connections between the transportation system and strategies for the interpretation programming for day hikers would be necessary to affect change in the direction of meeting the target.

The methods for monitoring should be consistent across time to enable comparison across data sets. If the methods change, then this could be a source of bias that casts differences with previous monitoring efforts (i.e., like comparison to a baseline) as being due to the change in methods rather than a change in conditions or experiences. For future monitoring of day hikers, on site interviews should be conducted in a similar fashion to this study (same place on trail, inviting uphill hikers, insuring equal balance between weekend and weekdays). For this study, the sampling distribution was not even across location, with 56.7% from the South Rim Corridor Trails, 16.7% from South Rim Threshold Trails (Grandview and Hermit), and 26.6% from North Rim Trails (North Kaibab, Widforss, Ken Patrick Trails). There was a fairly even distribution across the six months of data collection with a total sample size of 1,981 respondents. With the exception of amount of water taken, other items taken on hike, age, and number of children in

the group, there were few seasonal differences within this study. If these seasonally-related items are not important, collecting data for six months across two seasons may not be necessary. For future monitoring programs, sampling during three summer months would allow for a point of comparison with most of the results of this study. A total sample size of 600 respondents would provide reliable results for monitoring the three summer months. This would allow a standard confidence level (within 5% plus or minus) of cross-tabulations for the three locations with a 5-point scale (such as the Likert-type agree/disagree items) and result in an expected cell size for the Threshold Trails (the location with the smallest number of respondents) of about 20 respondents per cell.

REFERENCES

- Cole, D.N. (2001). *Day users in wilderness: How different are they?* Research paper RMRS-RP-31. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station.
- Driver, B., Tinsley, H., & Manfredi, M. (1991). The paragraphs about leisure and recreation experience preference scales: Results from two inventories designed to assess the breadth of the perceived psychological benefits of leisure. In B. Driver, P. Brown, & G. Peterson (Eds.), *Benefits of Leisure* (pp. 263-286). State College, PA: Venture Publishing.
- Lee, R. (1977). Alone with others: The paradox of privacy in the wilderness. *Leisure Sciences*, 1, 3-19.
- Littlejohn, M.A. & Hollenhorst, S.J. (2004a). Grand Canyon National Park North Rim Visitor Study: Summer 2003. USDI National Park Service, Visitor Services Project Report 143.
- Littlejohn, M.A. & Hollenhorst, S.J. (2004b). Grand Canyon National Park South Rim Visitor Study: Summer 2003. USDI National Park Service, Visitor Services Project Report 144.
- Loeffler, T. (2004). A photo elicitation study of meanings of outdoor adventure experiences. *Journal of Leisure Research*, 36 (4), 536-556.
- Manfredo, M., Driver, B., & Brown, P. (1983). A test of concepts inherent in experience-based setting management for outdoor recreation areas. *Journal of Leisure Research*, 15, 263-283.
- Manning, R., Cole, D.N., Stewart, W.P., Taylor, J., & Lee, M. (1999). Day Use Hiking in Grand Canyon National Park. Submitted to Grand Canyon National Park.
- Roggenbuck, J., & Lucas, R. (1987). Wilderness use and user characteristics: A state-of-knowledge review. *Proceedings of the National Wilderness Research Conference: Issues, State-of-Knowledge, Future Directions*. USDA Forest Service, General Technical Report INT-220, pp. 204-245.
- Roggenbuck, J., Marion, J., & Manning, R. (1994). Day users of the backcountry: The neglected park visitor. *Trends*, 31(3), 19-24.
- Stewart, W. & Cole, J. (1997). Bright Angel Trail Day-Hiker Study: A preliminary investigation. Report submitted to Grand Canyon National Park. 21p.

Appendix A

Methodology to Calibrate the Infrared Count Data

This section describes the methodology used to combine the hand counts with the infra red counter data to create daily and hourly traffic estimates for the surveyed trails. The first part of this section outlines the methodology using the Bright Angel trail data. The second part of this section outlines the calibration results for the rest of the surveyed trails and shows the inverse relation between the accuracy of the calibrated exit proportion model and the number of infra red counts.

1. Calibration of Bright Angel Trail counter data

1.1 Data

An infra red counter placed near the Bright Angel trail head (Grand Canyon National Park) recorded traffic on the trail in various time blocks during the period between May and October 2004 (see Table 1). Recorded events include people and live stock entering and exiting the trail.

Table 1

First day	Last day	Events recorded
Thursday, May 13, 2004	Friday, May 21, 2004	10127
Friday, June 11, 2004	Saturday, June 19, 2004	11101
Friday, August 20, 2004	Wednesday, September 01, 2004	13137
Friday, September 17, 2004	Saturday, September 25, 2004	8430
Friday, October 08, 2004	Saturday, October 16, 2004	9375

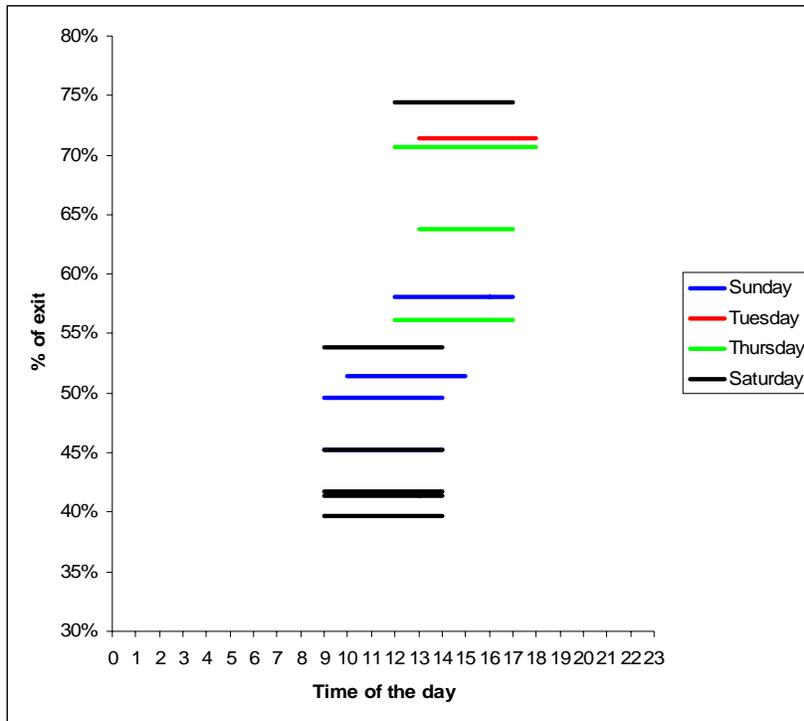
In addition, 22 times during that period of May – October, surveyors, placed near the infra red counters, used hand counters to record the number of day hikers exiting the trail in various time blocks. Table 2 lists the hand recoded exit traffic along with the numbers recorded by the IR counters during the same time. Data from 8 days had to be discarded because it was either incomplete or the conditions on the trail were such that the reported exit proportion, REP, was clearly an outlier (e.g., trail closed, a storm). Hence the final analysis of exit proportion patterns is based on 14 days.

Table 2.

Date	Time start	Time end	IR counter at start	IR counter at end	IR counter events	Hand count events	Proportion of hand count events	Day of the week
6/13/2004	9:00	15:00	2121	2916	795	394	50%	Sunday
7/11/2004	10:00	16:00	2054	2635	581	299	51%	Sunday
8/22/2004	9:00	15:00	2054	2817	763	345	45%	Sunday
10/10/2004	11:50	18:00	2317	2994	677	393	58%	Sunday
6/15/2004	13:00	19:07	5311	5724	413	295	71%	Tuesday
6/17/2004	12:00	18:30	7748	8352	604	427	71%	Thursday
8/26/2004	13:00	19:00	7231	7664	433	276	64%	Thursday
10/14/2004	12:00	18:00	6607	7168	561	315	56%	Thursday
6/19/2004	8:35	14:54	10127	11101	974	525	54%	Saturday
8/28/2004	9:00	15:00	8870	9450	580	230	40%	Saturday
9/18/2004	8:43	15:00	413	1296	883	400	45%	Saturday
9/25/2004	12:00	18:00	7618	8430	812	604	74%	Saturday
10/9/2004	9:00	15:00	423	1357	934	390	42%	Saturday
10/16/2004	9:00	15:00	8558	9370	812	336	41%	Saturday

Figure 1 outlines the pattern of the recorded hand counts where as expected the later it is in the day the higher the proportion of day hikers exit (hand count) events.

Figure 1.



1.2 Hourly EP fitting a non-linear model

Figure 1 indicates that the REP increases with time and that the increase pattern is non-linear. It also seems to indicate that the day of the week has no impact on the REP. Accordingly a non linear model fitted to the daily data (n=1,2,...,14) of hand counts where the hourly exit proportion is given by T^x and T denotes the time of the day, i.e., a one hour unit. For each hand count day, n, T ranges from $T_{start(n)}$ to $T_{end(n)}$. For example, on Sunday, June 13, 2004, $T_{start} = 09:00$ and $T_{end} = 15:00$ and the exit proportion at 12:00 noon is $(12^X)\%$.

The REP was measured over a block of several hours (and not every hour). In the following calculations this REP is assumed to represent a simple average of the hours in that block of time. For example, a daily REP measured between 9 and 12 supposedly equals:

$$[(REP\ 9:00-10:00) + (REP\ 10:00-11:00) + (REP\ 11:00 - 12:00)]/3$$

This assumption holds if the denominator of the hourly REP ratio (hand count event)/(IR events) is relatively stable over that period. All REPs were measured sometime between 9:00-18:00. Visual inspection of the IR events chart reveals that on an average the traffic is relatively flat between 11:00 – 15:00 and that increases before 11:00 are balanced out by decreases after 15:00.

The fitted equation is:

$$\sum_{n=1}^{14} REP_n = \sum_{n=1}^{14} \frac{\sum_{T=T_{start(n)}}^{T_{end(n)}} EP_T}{T_{end(n)} - T_{start(n)} + 1} = \sum_{n=1}^{14} \frac{\sum_{T=T_{start(n)}}^{T_{end(n)}} T^x}{T_{end(n)} - T_{start(n)} + 1} \tag{1}$$

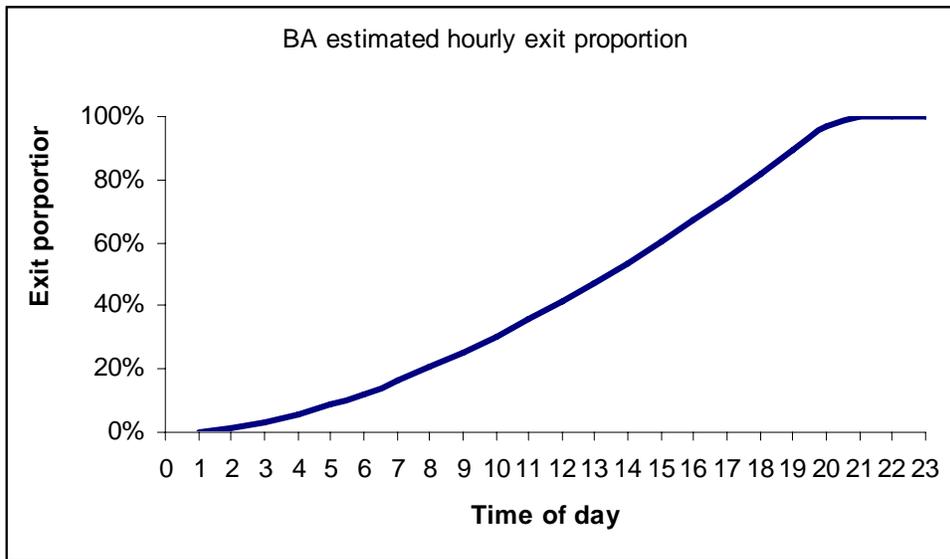
That is, a single value of X is found such that difference between the sum of all 14 EP predictions (14 days, each day is an average of several hourly prediction) and the sum of the 14 REP values (daily hand counts) is minimized.

The fitted value of X (using 14 days) was 1.5531 and it was used to generate an hour-by-hour estimate of EPs. Table 3 and Figure 3 show these predicted hourly proportions where each item is $EP_T = T^{1.5531}$

Table 3

Time of day (T)	Exit Proportion EP	Time of day (T)	Exit Proportion EP
0	0%	12	47%
1	1%	13	54%
2	3%	14	60%
3	6%	15	67%
4	9%	16	74%
5	12%	17	81%
6	16%	18	89%
7	20%	19	97%
8	25%	20	100%
9	30%	21	100%
10	36%	22	100%
11	41%	23	100%

Figure 2



1.3. Testing the model accuracy using all 14 days

The EP figures of table 3 together with the IR counts were used to estimate the number of hourly exit events during the hand count periods. For example, the number of IR events between 9-10 on Friday, June 13, 2004 was 132. The EP for 9 am (Table 3) is 30% and therefore the number of exit between 9 and 10 is $132 \times 30\% = 40$. The exit estimates for the entire hand count period on that day (9:00-15:00) are tallied up and the total exit proportion for that period (sum of hourly

estimates divided by the total number of IR events) is compared to the one reported by the surveyors. The Mean Absolute Deviation (MAD) of all 14 days is .044 or 4.4%.

1.4. A better model “accuracy” test using a hold out sample of 4 days

The non – linear model was refitted using the first 10 days of hand count only. The X value was 1.5613 (compared to 1.5531 fitted on all 14 days). The revised hourly EP values are listed in Table 4. The numbers in parentheses are the difference between the figures in Table 4 (estimated hourly EP based on 10 days of fitted data) and the values in Table 3 (estimated hourly EP based on 10 days of fitted data).

Table 4

Time of day (T)	Exit Proportion EP	Time of day (T)	Exit Proportion EP
0	0%	12	49% (+2%)
1	1%	13	56% (+2%)
2	3%	14	62% (+2%)
3	6%	15	70% (+3%)
4	9%	16	77% (+3%)
5	12%	17	85% (+4%)
6	17% (+1%)	18	92% (+3%)
7	21% (+1%)	19	100% (+3%)
8	26% (+1%)	20	100%
9	31% (+1%)	21	100%
10	37% (+1%)	22	100%
11	43% (+2%)	23	100%

The predictive accuracy of the model is then tested on the 4 days that were not used for model fitting, i.e., the four days in October 2004.

The MAD of the hold out sample is .057 or 5.7%.

1.5. Using the EP estimates to calibrate the IR data

The proportion estimates (Table 3) are then combined with the IR figures to generate an hourly pattern of exit events (by day of the week) at the trail head. Figures 3 and 4 illustrate the results averaged over the entire period of May through October 2004.

Figure 3

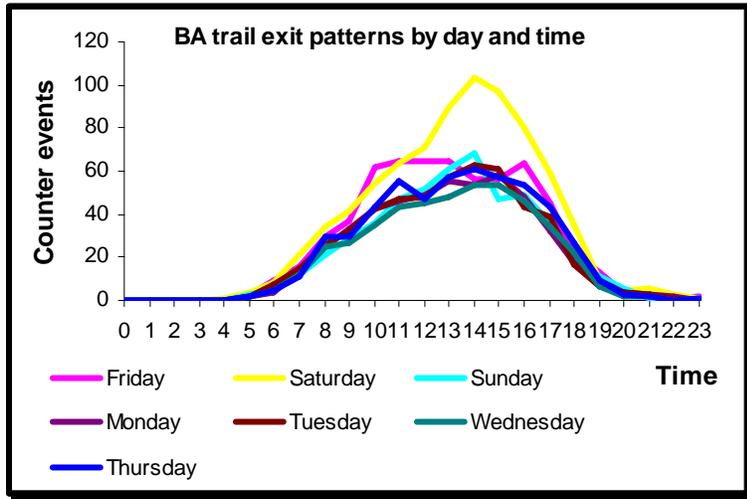


Figure 4

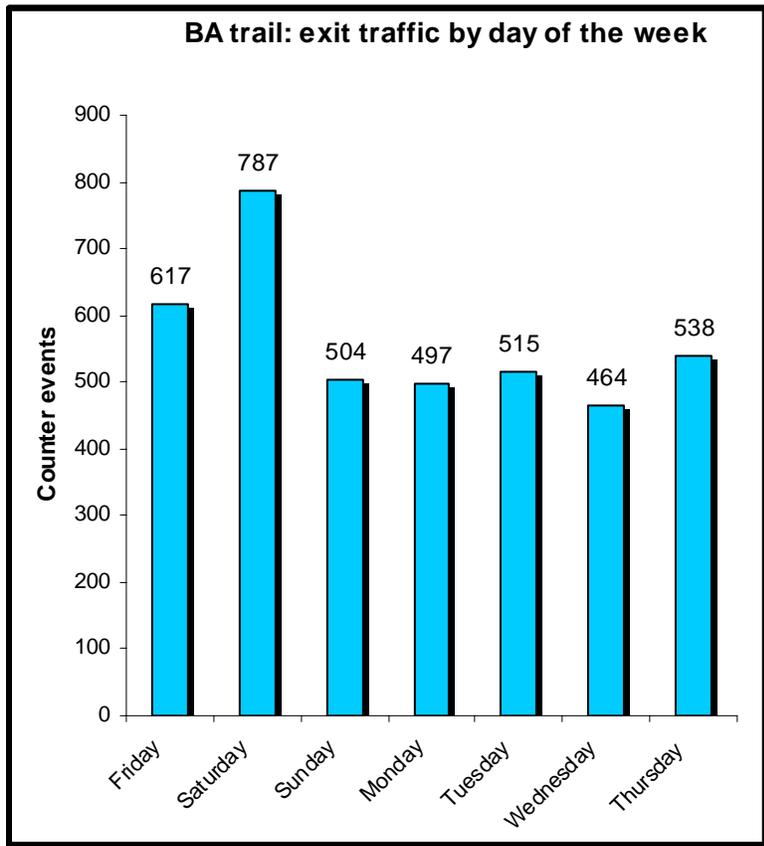
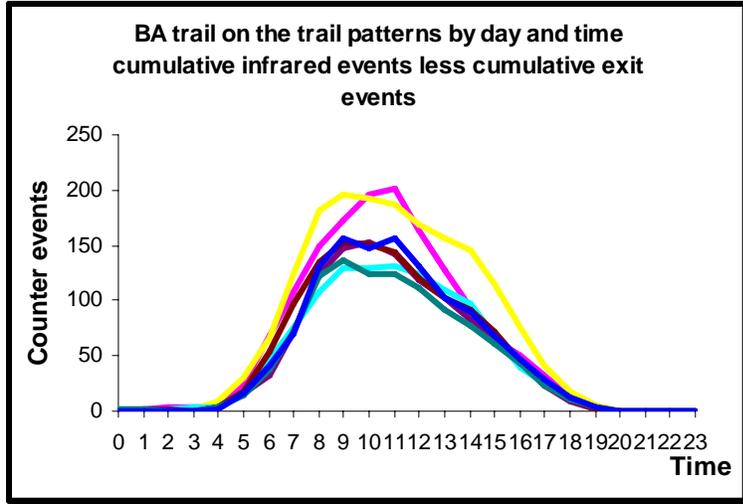


Figure 5 shows the approximated number of people on the trail by day and time. It is estimated to be the difference between the cumulative infrared events and the cumulative exit events each hour of the day.

Figure 5



2. Calibrating the Exit Proportion model for other Grand Canyon trails

The same calibration method was used with all 7 trails:

South Kaibab, Hermit, Grandview, North Kaibab, Widforss and Ken Patrick.

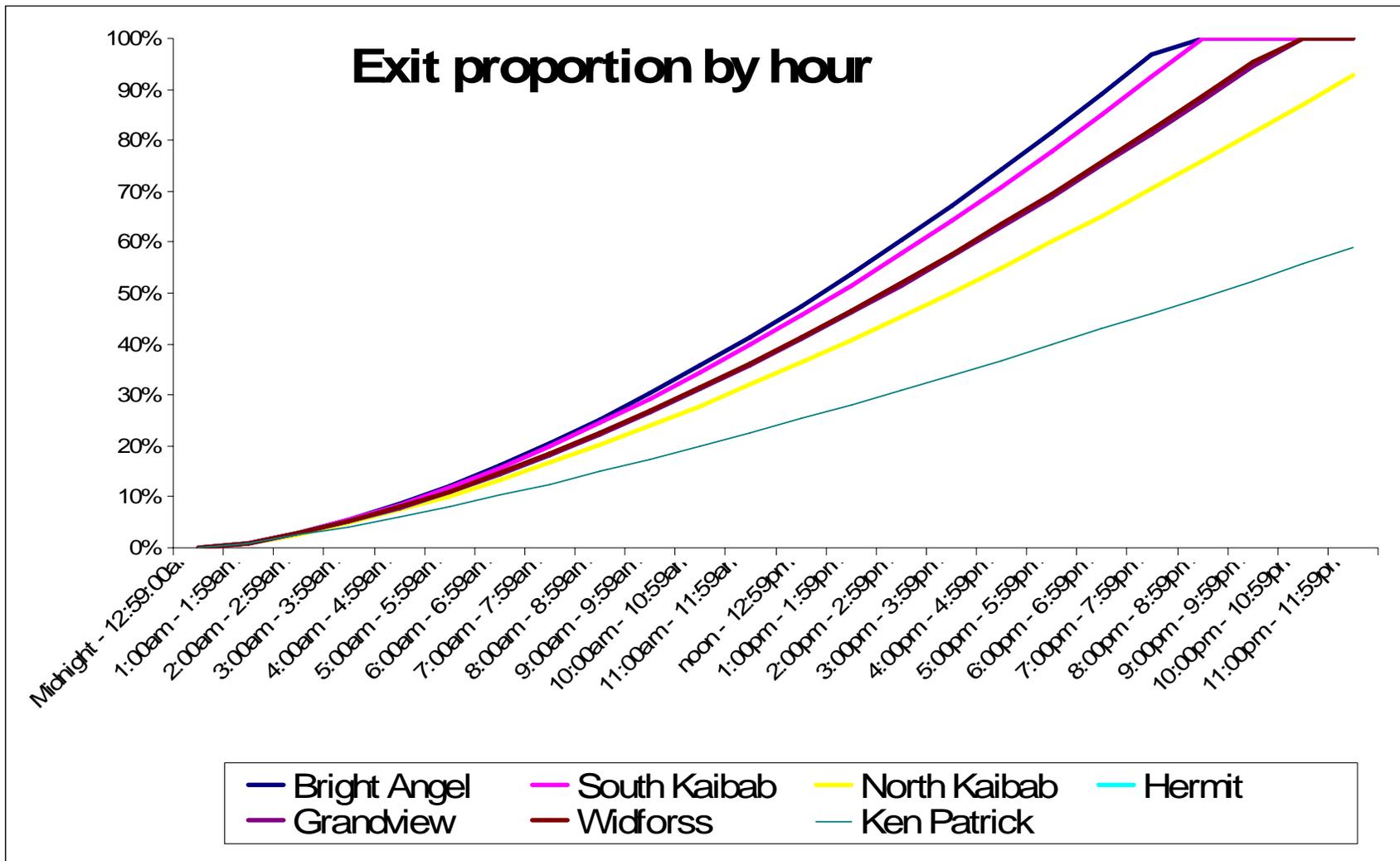
Table 5 shows the calibrated x value for each trail along with the corresponding accuracy measure MAD for both the entire sample and the hold out one.

Table 5

Trail	Entire sample		Hold out sample	
	X	MAD	X	MAD
Bright Angel	1.55	4.4%	1.56	5.7%
South Kaibab	1.53	6.1%	1.55	7.2%
Hermit	1.49	11.23%	1.53	15.37%
Grandview	1.49	13.84%	1.52	23.86%
North Kaibab	1.44	4.95%	1.45	5.55%
Widforss	1.49	12.56%	1.56	23.47%
Ken Patrick	1.30	17.52%	1.37	18.39%

Figure 6 shows the EP pattern for all 7 trails. Note that in terms of practical importance, the time period around midnight is of little significance. This is because the number of people on the trail in late evening hours and at the very early morning hours is really negligible.

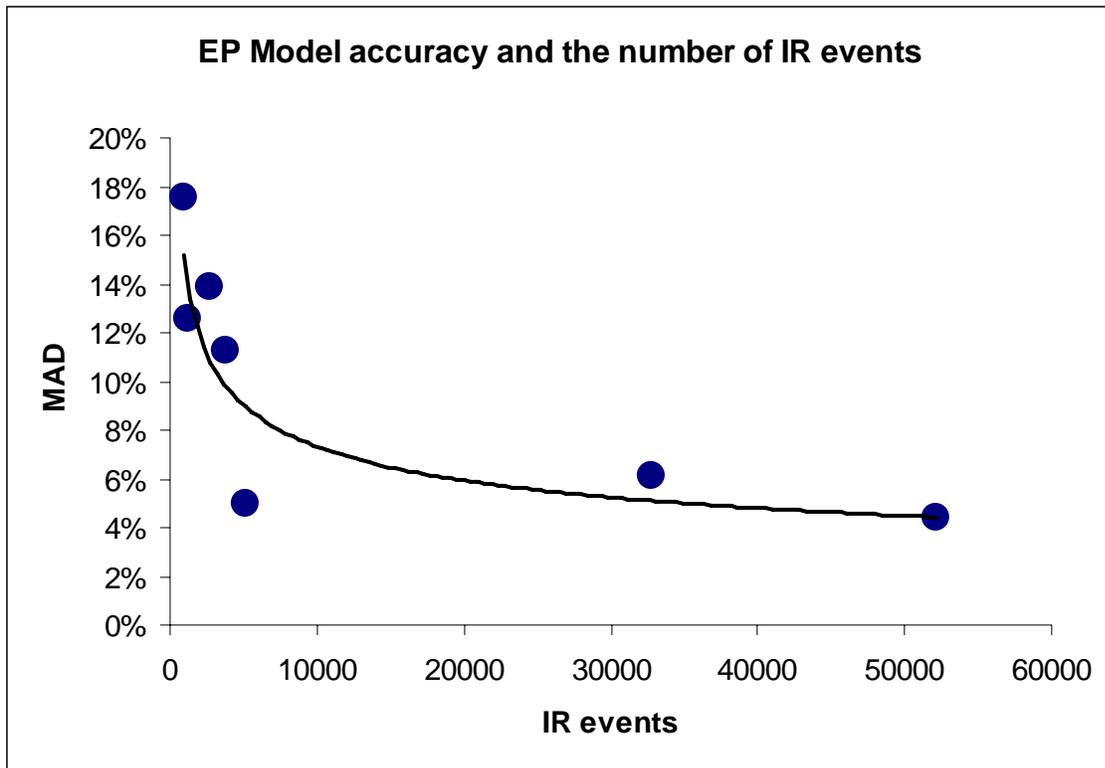
Figure 6



Number of counts and the accuracy of the EP model

Figure 7 indicates that there is an inverse relation between the number of infrared counts and the accuracy of the EP model (Mean Absolute Deviation) as measured using the entire sample. The more infrared data (traffic on the trail) the more accurate the calibrated exit proportion model. A non-linear model, $MAD = 1.2025(IR\ Events)^{-0.3039}$, relating the measured traffic to the accuracy of the EP model was fitted to the data, yielding an R square of 73%.

Figure 7



To summarize, the calibrated Exit Proportion model of the three trails: Bright Angel, South Kaibab and North Kaibab have very low MAD and are likely to be more accurate than the other four trails.

Appendix B

Day Hiker Interview Questionnaire: Frequency Distributions

N=1981 (unless otherwise specified)

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

Hello my name is _____ and I am collecting data for the Park Planning and Policy Laboratory at the University of Illinois. The lab, in collaboration with Grand Canyon National Park is collecting data that will assist the National Park Service to provide quality backcountry experiences for Grand Canyon hikers. The Paperwork Reduction Act requires approval of all federal government surveys by the Office of Management and Budget. This survey has been approved under this Act. The Office of Management and Budget control number and expiration date is available at your request. Additional information about this survey and its approval is available at your request. The questions I would like to ask will only take about **12 minutes to complete**. All of your answers are voluntary and confidential.

Interviewer Number _____ Trailhead Number _____ Interview Start Time _____ Is it raining? <input type="checkbox"/> Yes 5.5% <input type="checkbox"/> No 94.5%	
Is contact willing to be interviewed? <input type="checkbox"/> Yes (Proceed) <input type="checkbox"/> No, Thanks for your time.	6. When did you decide to take a hike on this trail? <input type="checkbox"/> Before arriving at Grand Canyon 35.2% <input type="checkbox"/> After arriving at Grand Canyon but before today 29.5% <input type="checkbox"/> Today 35.4%
1. What time did you begin your hike today? _____	7. Are you staying: (n=1653) <input type="checkbox"/> Inside the park? 58.3% Are you camping? <input type="checkbox"/> Outside the park? 26.8% <input type="checkbox"/> Yes 34.6% <input type="checkbox"/> Just visiting for the day? 12.5% <input type="checkbox"/> No 65.4%
2. a. Where did you begin your hike today? (Begin walking from) Start Code: _____ _____ b. How far did you hike to today? (Interview shows map)	8. On this trip to Grand Canyon: How many days have you been at Grand Canyon including today? 1 day – 36.0%, 2 days – 45.8%, GT2 – 18.2% How many additional days will you spend at Grand Canyon total? 0 days – 32.3%, 1 day – 46.6%, GT1 – 21.0%
3. How many people on your hike today were: Over 17 years old 1 – 17.9%; 2 – 57.0%; GT3 – 25.0% 5-17 years old None – 81.1%; 1 – 7.4%; GT2 – 11.5% less than 5 years old None – 98.9%; 1 – 0.8%; 2-3 – 0.4%	9. Hiking Experience: Including this <i>day</i> hike, how many <i>day</i> hikes have you taken: a) At Grand Canyon in the last 12 months? 1 – 74.2%; 2 – 14.5%; GT2 – 11.4% b) Total at Grand Canyon? 1 – 57.2%; 2 – 15.5%; GT2 – 27.3% c) At other parks or wilderness areas in the last 12 months? None – 16.0%; 1 – 9.1%; 2 – 10.2%; GT2 – 64.7%
4. Were you part of an organized group or club? <input type="checkbox"/> Yes 6.4% <input type="checkbox"/> No 93.6%	
5. Did your trip take: <input type="checkbox"/> More time than you expected 7.4% <input type="checkbox"/> Less time than expected 22.5% <input type="checkbox"/> About what you expected 70.1%	10. How may visits have you made to Grand Canyon prior to this trip? None – 47.1%; 1 – 25.0%; 2 – 8.6%; GT2 – 19.3%

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

11. a) Did you receive any information about hiking Grand Canyon prior to your hike? Yes 76.3% No 23.7%
 (Skip to q. 12)
 b) Where did you get your information about hikes at Grand Canyon? (Check all that apply)

<input type="checkbox"/> Park Ranger 16.5%	<input type="checkbox"/> Poster on Hiking Safety 5.5%	<input type="checkbox"/> Backcountry Info Center - South Rim 3.7%
<input type="checkbox"/> Ranger Program 12.8%	<input type="checkbox"/> Canyon View Information Plaza 7.0%	<input type="checkbox"/> North Rim Visitor Center 5.1%
<input type="checkbox"/> Book or Magazine 54.2%	<input type="checkbox"/> Desert View Information Center 2.4%	<input type="checkbox"/> Grand Canyon Website 37.3%
<input type="checkbox"/> Friends/ Word of Mouth 15.7%	<input type="checkbox"/> Backcountry Info. Center - North Rim 4.0%	<input type="checkbox"/> Other Website 8.0%
<input type="checkbox"/> Store or Lodge employee 3.2%	<input type="checkbox"/> Other 27.6%	

c) Did the information include safe hiking tips?
 Yes 93% No 2.8% Don't Know 4.2%

d) Did the information include low impact hiking techniques?
 Yes 65.6% No 14.5% Don't Know 19.9%

e) Did the information you receive influence you to change plans? Yes 18.1% No 81.9%
 (Skip to 12)
 If yes, how were your plans changed? (Check all that apply)

<input type="checkbox"/> Started earlier 12.1%	<input type="checkbox"/> Shortened hike 35.6%	<input type="checkbox"/> Wore different clothes 7.1%
<input type="checkbox"/> Started later 2.4%	<input type="checkbox"/> Carried more water 39.1%	<input type="checkbox"/> Hiked without children/child 0.4%
<input type="checkbox"/> Changed route 26.5%	<input type="checkbox"/> Brought electrolyte 9.5%	<input type="checkbox"/> Hiked without unfit adult 0.8%
<input type="checkbox"/> Lengthened hike 2.4%	<input type="checkbox"/> Brought more food 76.7%	<input type="checkbox"/> Other: 9.9%

12. a) How much water did you and the rest of your group carry today? Quarts Per Person
 0-0.46 – 7.2%; 0.47-1.06 – 38.5%; 1.07-1.59 – 16.1%; 1.60-2.17 – 17.0% GT2 .17 21.3%

b) Was this amount sufficient? Yes 94.0% No 6.0%

13. Which of the following items did someone in your group take with you on your hike today? (Check all that apply)

<input type="checkbox"/> Water 95.5%	<input type="checkbox"/> Topographic map 7.3%	<input type="checkbox"/> Signal mirror 7.9%	<input type="checkbox"/> Flashlight 18.9%
<input type="checkbox"/> Electrolyte 23.0%	<input type="checkbox"/> Sunscreen 57.5%	<input type="checkbox"/> Food 78.4%	<input type="checkbox"/> Toilet paper 41.7%
<input type="checkbox"/> First aid kit 34.0%	<input type="checkbox"/> Jacket 41.5%	<input type="checkbox"/> Trail map 35.7%	<input type="checkbox"/> Hat 84.4%
<input type="checkbox"/> Global receiver 3.5%	<input type="checkbox"/> Cellular phone 17.1%	<input type="checkbox"/> Sunglasses 81.7%	<input type="checkbox"/> Other: 32.2%

14. a) Did anyone in your group become: Sick 0.6% Injured 0.7% Lost 0% (If not, skip to q. 15)
 n=18

b. Who was responsible for someone in your group being sick, injured, or lost? Please rate your belief on the following scale:

Entirely my/our responsibility	Both equally responsible	Entirely park's responsibility	No one's responsibility
1	4	7	<input type="checkbox"/>
72.2%	0	0	16.7%
2	5	8	
5.6%	0	5.6%	
3			
0			

15. How physically fit do you consider yourself to be?

Not at all Fit	Somewhat Fit	Extremely Fit
1	2	3
0.7%	4.9%	35.9%
	4	5
	48.6%	9.8%

16. Over the past year, how frequently did you get at least 20 minutes of continuous physical exercise?

Nearly every day 32.0%	About once every 2 weeks 2.2%
About every other day 48.3%	About once a month 1.7%
About once a week 14.1%	Less than once a month 0.9%

Frequency Distributions: Impacts Module (n=492)

17. For each statement I read, please indicate your level of agreement from Strongly Disagree to Strongly Agree with the following statements.

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Level of Agreement

SD D N A SA

a. Ranger patrols are necessary and appropriate.	0.4	7.5	7.9	29.5	54.7
b. I was well informed about appropriate behavior to protect park resources.	0.6	1.8	6.1	45.5	45.9
c. I would change my behavior to avoid damaging park resources.	4.3	17.2	15.2	24.2	39.1
d. I want to learn more about low-impact hiking to avoid damaging park resources.	2.5	13.9	23.3	42.7	17.6
e. It is important for day hikers to minimize their impact on the resource.	0	0.6	1.9	26.6	70.9
f. A single hiker cannot damage park resources because he or she is just one of many hikers.	69.8	26.5	1.2	2.1	0.4

18. Please indicate whether you believe the following statements to be true or false.

True False

a. Hikers are not allowed to collect plants and rocks along the trails at Grand Canyon.	98.4	1.6
b. The air temperature at the bottom of Grand Canyon is usually about 5 degrees Fahrenheit warmer than the air temperature at the rim.	25.2	74.8
c. Most of the trails going down into the Grand Canyon have water sources along the way.	17.7	82.3
d. Food scraps (from snacks and lunches) should be scattered widely to avoid attracting and concentrating wild animals.	7.1	92.9
e. Park rangers discourage visitors from hiking rim-to-river-to-rim in one day.	98.0	2.0
f. When hiking at Grand Canyon during the summer, park rangers recommend that visitors take one quart of water per person per day of hiking.	16.4	83.6
g. All day hikers should be prepared to carry out their own trash and litter.	99.8	0.2
h. Off-trail hiking to make a short-cut is appropriate at Grand Canyon.	2.9	97.1
i. Hunting wild animals is not allowed in Grand Canyon.	99.4	0.6
j. Park rangers recommend that you drink water regularly, even before you become thirsty.	99.8	0.2
k. When disposing of human wastes in places where toilets are not available, park rangers recommend that visitors bury their toilet paper.	58.2	41.8

Frequency Distributions: Motivations Module (n=483)

17. People have many reasons for day hiking at Grand Canyon. How important were each of the following experiences for your day hike.

	Importance				
	Very Unimportant	Unimportant	Neutral	Important	Very Important
a. Enjoying nature	0.4	0.2	2.3	20.3	76.8
b. Depending on your skills to deal with wilderness conditions	11.0	22.4	32.7	23.0	11.0
c. Relaxing	3.7	8.5	15.3	37.1	35.4
d. Studying nature	4.1	19.9	28.0	33.1	14.9
e. Experiencing solitude	5.8	13.9	19.3	31.7	29.4
f. Doing something with the family	14.6	8.1	16.6	17.0	43.7
g. Being in a wilderness setting	0.8	1.0	7.9	27.9	62.4
h. Being alone	12.7	18.7	24.7	23.9	20.0
i. Getting away from crowded situations	2.3	5.0	14.3	26.7	51.8
j. Experiencing peace and calm	1.2	2.7	11.6	31.8	52.6
k. Taking risks	27.5	27.1	24.4	15.1	5.8
l. Viewing and/or encountering wildlife	2.1	7.7	16.4	41.2	32.7
m. Testing your abilities	6.7	15.4	29.4	30.8	17.7
n. Being self-sufficient	5.2	15.1	30.1	30.3	19.2
o. Bringing your family closer together	15.4	9.0	20.3	19.9	35.3
p. Knowing others are nearby	14.2	25.8	25.4	27.5	7.1
q. Reflecting on your spiritual values	13.6	17.7	22.1	27.8	18.8
r. Being with others who enjoy the same things you do	5.0	9.6	17.4	39.3	28.7
s. Meeting other people	11.9	22.9	28.5	27.0	9.8
t. Experiencing natural quiet	0.4	1.7	11.5	32.5	54.0

Frequency Distributions: PSAR Module (n=492)

17. For each statement I read, please indicate your level of agreement from Strongly Disagree to Strongly Agree with the following statements.

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Level of Agreement

SD D N A SA

a. Ranger patrols are necessary and appropriate.	0.6	6.7	6.3	31.7	54.7
b. Park rangers exaggerate the dangers of hiking.	29.9	46.6	10.4	11.8	1.2
c. Park rangers will rescue me if I get into trouble.	1.4	9.8	18.4	57.0	13.3
d. I was well prepared for my hike.	1.4	4.3	9.4	49.0	35.9
e. Day hiking at Grand Canyon requires special physical conditioning	0.8	14.5	13.7	51.6	19.3
f. Park rangers will help me back to safety if I have problems hiking.	1.5	13.5	18.2	53.9	12.9
g. Park rangers depict Grand Canyon hiking as being more dangerous than it really is	21.1	52.7	15.9	9.6	0.7
h. Most of the risk visitors face in Grand Canyon are beyond the control of the National Park Service.	1.0	6.7	8.2	53.6	30.5

18. How much do you oppose or support each of the following management actions that might be applied to day hiking at Grand Canyon.

SO = Strongly Oppose, O = Oppose, N = Neutral, S = Support, SS = Strongly Support

Level of Support

SO O N S SS

a. Provide more signs along this trail concerning appropriate use and safety.	11.2	34.5	19.6	28.4	6.3
b. Require orientation about appropriate use and safety for all first time hikers on this trail.	16.5	34.6	12.4	29.5	6.9
c. Limit the number of hikers allowed to use this trail by means of a daily permit system	23.7	49.1	14.0	12.4	0.8
e. Require all hikers on this trail to have minimum supplies and equipment (e.g. adequate water, appropriate shoes or boots).	7.4	22.7	11.9	38.7	19.3
f. Charge a day hiking fee for this trail to help pay for hiker education and safety.	30.1	37.5	13.4	16.3	2.7
g. Provide more park rangers along this trail to enforce rules and regulations.	10.8	41.4	23.0	21.7	3.1
h. Restrict the <i>time</i> of starting a hike to before 7:00a.m. or after 4:00p.m. on days when the temperature is predicted to be extremely hot.	13.3	34.2	13.3	31.1	8.1
i. Restrict the <i>time</i> of starting a hike to before 7:00a.m. or after 4:00p.m. on all days from Memorial Day to Labor Day.	23.1	41.7	14.5	76.8	4.0
j. Restrict the <i>length</i> of hikes when the temperature is predicted to be extremely hot.	17.3	40.7	14.1	21.1	6.8
k. Eliminate search and rescue activity by park personnel – Hikers are responsible for their own health and safety.	39.7	39.0	11.4	9.3	0.6

Frequency Distributions: Satisfaction Module (n=488)

17. For each statement I read, please indicate your level of agreement from Strongly Disagree to Strongly Agree with the following statements.

SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Level of Agreement

SD D N A SA

a. I thoroughly enjoyed my day hike today.	0.8	0.4	1.0	17.2	80.5
b. I was disappointed with some aspects of my hike today.	47.1	35.6	4.7	11.7	0.8
c. I cannot imagine a better day hike than the one I took at Grand Canyon.	0.2	11.5	24.8	45.4	18.0
d. My hike was well worth the cost.	0.4	0.8	4.8	31.3	62.9
e. I do not want to have any more hikes like the one today.	66.4	28.3	2.1	1.9	1.3

18. For each of the following conditions please rate to what extent they were apparent and disturbing to you? Please rate each from “Not at all” to “Extremely” apparent and disturbing.

Apparent

Disturbing

	Apparent					Disturbing				
	Not at All	Slightly	Moderately	Very	Extremely	Not at all	Slightly	Moderately	Very	Extremely
a. Litter along trail	68.4	25.6	5.3	0.8	0	70.2	10.4	10.4	7.4	1.5
b. Human waste along trail	97.1	1.8	0.4	0.4	0.2	96.7	0.8	0.6	1.1	0.8
c. Toilet paper along trail	91.9	5.8	1.7	0.4	0.2	91.5	2.6	2.8	2.6	0.6
d. Mule waste	26.0	7.2	26.7	21.9	18.2	54.5	20.7	13.3	7.2	4.2
e. Aircraft overhead	65.3	23.7	7.4	3.2	0.4	83.2	7.9	3.7	3.4	1.8
f. Trail erosion	48.0	32.0	16.6	2.9	0.4	66.8	21.2	9.4	2.4	0.3
g. Vegetation damage from trampling or cutting	84.9	12.4	2.1	0.4	0.2	86.9	9.4	1.9	1.4	0.3
h. Vandalism/Graffiti on rocks	74.0	17.8	6.8	1.4	0	74.7	10.7	8.3	4.7	1.6

Frequency Distributions: Satisfaction Module (continued) (n=488)

19. How important were each of the following items to your experience and the extent to which you were satisfied with the conditions you may have encountered along the trail.

VU = Very Unimportant U= Unimportant N = Neutral I= Important VI= Very Important
VU = Very unsatisfied U= Unsatisfied N = Neutral S = Satisfied VS= Very Satisfied

	Importance					Satisfaction				
	VU	U	N	I	VI	VU	U	N	S	VS
a. Number of other groups you met on the trail	2.7	20.9	17.5	51.9	7.0	0.4	2.4	12.3	62.1	22.7
b. Size of other groups you met on the trail	4.9	26.1	30.3	35.2	3.5	0.8	8.1	25.0	53.2	12.9
c. Availability of water										
d. Availability of toilets	5.5	33.1	17.2	34.8	9.3	0.5	4.8	29.5	51.7	13.6
e. Cleanliness of toilets										
f. Socializing with companions	4.9	14.6	40.7	31.2	8.5	0.5	3.2	53.7	27.3	15.3
g. Number of rangers in the backcountry	2.4	8.0	11.0	59.1	19.5	0	0.5	13.7	47.7	38.1
h. Considerate behavior of other groups	0.4	0.8	1.9	61.6	35.3	1.3	1.7	2.6	54.2	40.2

Appendix C

Interview Schedule, 2004

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

May

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
am = 8 am - 2 pm Orange = South Rim BA = Bright Angel HT = Hermit GV = Grand View SK = South Kaibab	Pm = 2 pm to 8 pm Green = North Rim NK = North Kaibab R1 = Rim Trail 1 R2 = Rim Trail 2					1
2	3	4	5	6	7	8
9	10	11	12	13 <i>Travel Day Set up Trail Counters</i>	14 David - HT - am Jeremy - GV am	15 David - BA pm <i>Jeremy - SK pm</i>
16 David - GV pm Jeremy - HT pm	17 David - Jeremy -	18 David - Jeremy -	19 David - Jeremy -	20 David - Jeremy -	21 David - Jeremy -	22 David - Jeremy -
			26	27 <i>Travel Day Set up Trail Counters</i>	28 David - Patti -	29 David - Patti -

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

<p style="text-align: right;">30</p> <p>David – Patti –</p>	<p style="text-align: right;">Memorial Day 31</p> <p>David – Patti –</p>					
--	---	--	--	--	--	--

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

June

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		1 David – Patti –	2 David – Patti –	3	4	5
6	7	8	9	10	11 <i>Travel Day Set up Trail Counters</i>	12 David – Jeremy –
13 David – Jeremy –	14 David – Jeremy –	15 David – Jeremy –	16 David – Jeremy –	17 David – Jeremy –	18 David – Jeremy –	19 David – Jeremy –
20	21	22	23	24	25 <i>Travel Day Set up Trail Counters</i>	26 David – Patti –
27 David – Patti –	28 David – Patti –	29 David – Patti –	30 David – Patti –	31 David – Patti –		

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

July

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
				1	2	3
4	5	6	7	8	9 <i>Travel Day Set up Trail Counters</i>	10 Jeremy – Dave –
11 Jeremy – Dave –	12 Jeremy – Dave –	13 Jeremy – Dave –	14 Jeremy – Dave –	15 Jeremy – Dave –	16 Jeremy – Dave –	17 Jeremy – Dave –
18	19	20	21	22	23	24
25	26	27	28 <i>Travel Day Set up Trail Counters</i>	29 Jeremy – Dave –	30 Jeremy – Dave –	31 Jeremy – Dave –

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

August

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1 Jeremy – Dave –	2 Jeremy – Dave –	3 Jeremy – Dave –	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20 David – Jeremy –	21 David – Jeremy –
22 David – Jeremy –	23 David – Jeremy –	24 David – Jeremy –	25 David – Jeremy –	26 David – Jeremy –	27 David – Jeremy –	28 David – Jeremy –
29	30	31				

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

September

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
			1	2	3 <i>Travel Day Set up Trail Counters</i>	4 David – Jeremy –
5 David – Jeremy –	6 David – Jeremy –	7 David – Jeremy –	8 David – Jeremy –	9 David – Jeremy –	10	11
12	13	14	15	16	18 <i>Travel Day Set up Trail Counters</i>	
19 David – Jeremy –	20 David – Jeremy –	21 David – Jeremy –	22 David – Jeremy –	23 David – Jeremy –	24 David – Jeremy –	25 David – Jeremy –
26	27	28	29	30		

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

October

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
					1	2
3	4	5	6	7	8 <i>Travel Day Set up Trail Counters</i>	9 David – Jeremy –
10 David – Jeremy –	11 David – Jeremy –	12 David – Jeremy –	13 David – Jeremy –	14 David – Jeremy –	15 David – Jeremy –	16 David – Jeremy –
17	18	19	20	21	22	23
24	25	26	27	28	29	30

APPENDIX D

State/Country of Origin Frequencies

N = 1871

	% of total
Alaska	.11
Intermountain	22.18
AZ	12.56
CO	1.82
MT	0.16
NM	1.71
OK	0.43
TX	3.31
UT	1.92
WY	0.27
Mid West	12.88
AR	0.37
IL	3.05
IN	0.91
IA	0.32
KS	0.43
MI	1.50
MN	1.55
MO	0.96
NE	0.59
ND	0.00
OH	2.19
SD	0.00

BACKCOUNTRY DAY HIKERS AT GRAND CANYON NATIONAL PARK SUMMER/FALL 2004

	% of total
Northeast	16.78
CT	0.96
DC	0.43
DE	0.32
MD	1.44
MA	1.71
ME	0.16
NH	0.32
NJ	1.87
NY	3.47
PA	3.42
RI	0.32
VA	2.03
VT	0.16
WV	0.16

Pacific West	14.59
AS	0.00
CA	10.15
GU	0.00
HI	0.32
ID	0.16
NV	1.07
OR	0.91
WA	1.98

	% of total n=1871
Southeast	7.96
AL	0.37
FL	2.57
GA	1.60
KY	0.59
LA	0.21
MS	0.11
PR	1.18
NC	0.05
SC	0.69
TN	0.53
USVI	0.05
International	25.49
Australia	1.55
Canada	3.15
France	6.71
Germany	5.83
The Netherlands	1.66
Mexico	0.11
Pacific Rim	0.96
South Africa/Africa	0.32
Other European Union	4.70
South America	0.21
UK	4.60
Israel	0.48
India	0.21

APPENDIX E

Motivation Items Analysis

Domain/Item	Cronbach's Alpha
Skills Testing	.77
Depending on your skills to deal with wilderness conditions	
Taking risks	
Testing your abilities	
Being self sufficient	
Solitude	.79
Relaxing	
Experiencing solitude	
Being Alone	
Getting away from crowded situations	
Experiencing peace and calm	
Experiencing natural quiet	
Being with others	.61
Knowing others are nearby	
Being with others who enjoy the same things as you do	
Meeting other people	
Nature Appreciation	.57
Enjoying nature	
Studying nature	
Being in a wilderness setting	
Viewing and/or encountering wildlife	
Family Togetherness	.93
Doing something with the family	
Bringing your family closer together	