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Title: Climbers' Preferred Management Actions: Addressing Resource and Crowding Impacts in Yosemite Valley

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Joanne F. Tynon

As more people become interested in rock climbing, the need to understand climbers and their preferences and how their activities impact the resource are more vital than ever. With increased use, and with little empirical data about the Yosemite climbing community, park managers cannot adequately develop a comprehensive climbing management plan. The objectives of this research are to use a theoretically based survey instrument to measure Yosemite NP climbers' level of support for different management strategies. I used chi-square analysis to evaluate the relationship between my independent variables, climbers' self identified skill level and dependent variables, climbers' perceived crowding and support for different resource and social based management actions. I found a relationship between climbers' experience level and their support for resource based management actions. This suggests to managers that managing climbing impacts, either resource based or social impacts, should focus on managing the resource by using restoration techniques, or providing signs or maps to direct climbers to climbing areas.

Climbers' Preferred Management Actions: Addressing Resource and Crowding Impacts in Yosemite Valley

by
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APPROVED:

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Molly T. Burns, Author

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (CONTINUED)

LIST OF TABLES

Chapter 1: Introduction

Recreational rock climbing is practically ubiquitous with Yosemite National Park. Many climbers consider Yosemite a destination for the elite and accomplished in their sport. Jim Opedyck, an expert climber and the "mayor" of climbing at Beacon Rock near Portland, Oregon, claims "the only other place I would want to be is in Yosemite" (Bendixen, 2012). Climbers are drawn to Yosemite National Park for challenge, growth, and reflection. They push themselves to their limits on granite giants like El Capitan, Half Dome, Royal Arches, and Leaning Tower.

Climbing draws people who are fit and adventurous. There are over 500,000 climbers in North America (Ung, 2011). And, although climbing in Yosemite National Park requires a specialized skill set and expensive technical gear, more and more climbers see many of the park routes as attainable goals.

Background

The National Park Service's twofold mission is to provide recreation opportunities as well as resource protection. This requires park managers to understand both the physical impacts on the resource as well as the social impacts. In Yosemite National Park (NP) researchers have examined physical resource impacts due to the repetitive use of climbers' approach trails to popular climbing sites. Past research took a descriptive approach, utilizing Global Positioning Systems (GPS) to track use patterns and identify the routes climbers use (NPS, 2011). Results helped inform resource restoration efforts and climbing management plans. The purpose of this study is to uncover climbers' preferences for proposed management actions aimed at resource

protection. In addition, the study will examine crowding, a social issue that Yosemite NP managers have been dealing with since the 1950s (Eng, 2011; Yager, 2013), preferences and past experiences, and trust in management.

National Park Service (NPS) planning processes have been shaped by several iterations of planning designs. Currently, the NPS uses a modified Visitor Experience and Resource Protection (VERP) approach. The NPS defines VERP as:

> *"…a planning and management framework that focuses on visitor use impacts on the visitor experience and the park resources. These impacts are primarily attributable to visitor behavior, use levels, types of use, timing of use, and location of use" (NPS, 1997).*

VERP was developed to help mangers be transparent and methodical in their planning process and to address National Environmental Policy Act (NEPA) requirements. VERP does not address the range of different management actions that should be considered in the NEPA process.

Many agencies utilize a type of VERP planning which is based on a Limits of Acceptable Change (LAC) framework. LAC is a process in which one identifies two goals in conflict, with the understanding that one of the goals must be compromised, one goal will constrain the other, and that establishing indicators and standards will help manage for the minimally acceptable conditions for both the resource and visitor (Manning, 2011). This basic framework using indicators and standards can be seen in many of Yosemite's plans, including the Merced River Plan (MRP).

The Merced River planning process included understanding the role of the Wild and Scenic Designation. Planners crafted multiple Outstandingly Remarkable Values (ORVs) to guide the development of indicators and standards. Any Yosemite NP climbing management plan will likewise need an empirical understanding of who climbs in Yosemite; it will likely require baseline indicators and social standards.

Problem statement

As more people become interested in rock climbing, the need to understand climbers and their preferences and how their activities impact the resource are more vital than ever (Ewert, Attarian, Hollenhorst, Russell, & Voight, 2006).Park managers cannot adequately develop a comprehensive climbing management plan without empirical understanding of the climbing community, (Cole, Watson, Hall, &Spildie, 1997).

Research Question

My research question is:

> How do Yosemite climbers view different management actions proposed for resource protection in Yosemite NP?

The objectives of this research are to use a theoretically based survey instrument to measure Yosemite NP climbers' level of support for different management strategies. The different management strategies are based on Heberlein's (1977) concept of carrying capacity, discussed in chapter two.

Hypotheses

My study tests the following hypotheses:

H1: There is a relationship between climbers' experience levels and their support for management actions.

H2: There is a relationship between perceived crowding and climbers' experience level.

Basic Assumptions

Scope of the Study

The scope of this study is limited to Yosemite NP climbers camping in the designated climbers' camp, Camp 4, and day users at three sites: the Churchbowl, El Capitan, and the Manure Pile climbing areas. The objectives of this study limit the scope of concern to the opinions of Yosemite NP climbers, specifically climbers who were located in the described Yosemite NP climbing areas.

Outline of the Proposal

In the following chapters I will discuss the relevant literature and the proposed methodology.

Chapter 2: Review of Related Literature

Rock Climbing Difficulty Scale: Yosemite Decimal System (YDS)

The Sierra Club developed the Yosemite Decimal System (Eng, 2010) to categorize the different skills required for walks, hikes, and climbs. This is the most prevalent system used in the United States, and it is understood by most visiting climbers. The system includes five class levels. Class one is basic trail hiking. Class two requires the occasional use of hands while scrambling on slopes. Class three climbers use their hands for balance while scrambling and they may also carry ropes. Class four includes scrambling and using a rope for belays; falls can be fatal. Class five is reserved for true rock climbing, when using ropes for belaying and protection, and when falls can result in death. There is a decimal extension beyond the fifth class that ranges from 5.0 to 5.15c (pronounced five-zero to five-fifteen "c"). Eng (2010) describes any climb rated 5.0 to 5.7 as easy for skilled climbers and a place for beginners to gain basic skills. Climbs rated 5.0 to 5.7 generally have two footholds, and two handholds, becoming less obvious as the rating increases to 5.7.

Climbs rated 5.8 to 5.9 are where most weekend climbers are comfortable, using specific rock climbing skills. Routes with these ratings are more strenuous. Foot or handholds are missing, not obvious, or so slick it would be difficult to hold on to. Class 5.10 to 5.11 delineates the line for "committed recreational climbers" (Eng, 2010, p. 55). Climbs at this level have no hand or foot holds. Climber.org (2014) suggests climbers have two options at this level, "pretend there is a hold, pray a lot, or go home". Climbs rated 5.12 to 5.15 require training, agility, and the repeated working of a route or climb. Only expert climbers attempt these routes and climbs.

Routes with this rating are smooth as glass, and at 5.12, the same description applies, but the route is on overhanging rock ("The Yosemite Decimal System", 2014).

Types of Rock Climbing

Traditional climbing, also known as “trad” climbing, is a form of technical rock climbing in which a lead climber places or wedges spring loaded cams (Figure 1) or chocks and nuts (Figure 2) into cracks in the rock formation and attaches themselves to that placed gear for protection (Eng, 2010). The following climber then removes all of the placed gear. Until the 1980s this was considered the only type of acceptable climbing - before bolted or sport climbing became prevalent.

Figure 1. Camming device

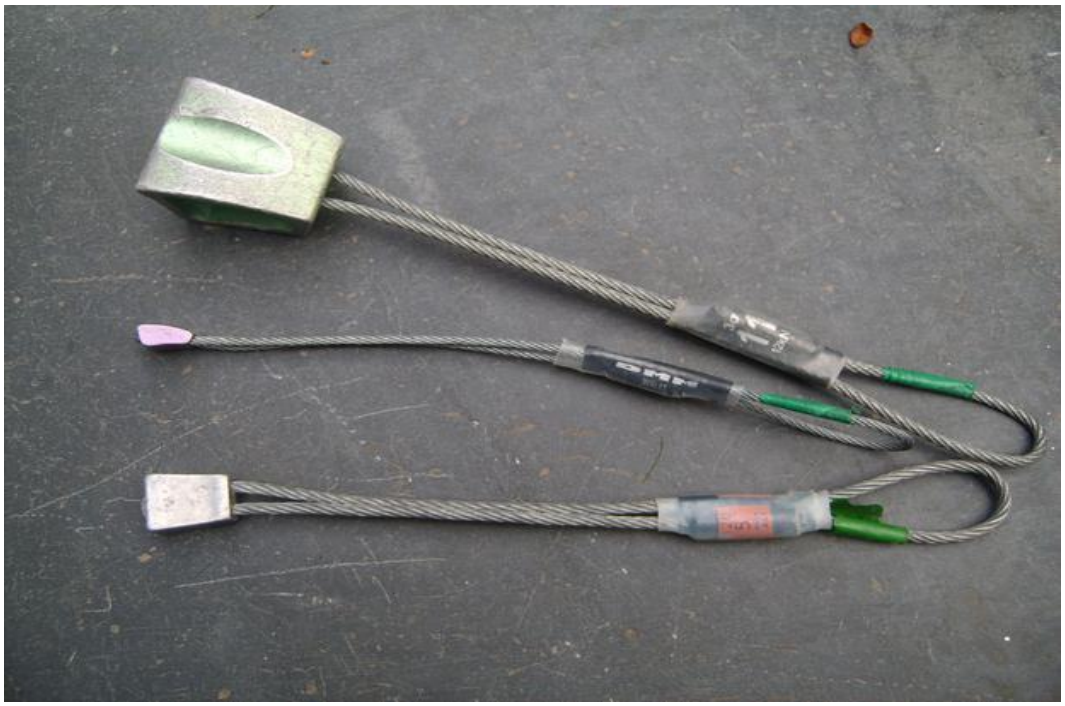

Figure 2. Chocks or nuts of different sizes

Sport Climbing requires less gear than traditional climbing, because the lead climber uses carbineers to connect to bolts already drilled into the rock face (Figure 3).

This type of climbing allows climbers to focus on more difficult climbs. Sport climbing is "technical rock climbing that relies on fixed protection or a top rope and does not require mountaineering skills" (Eng, 2010, p. 176).

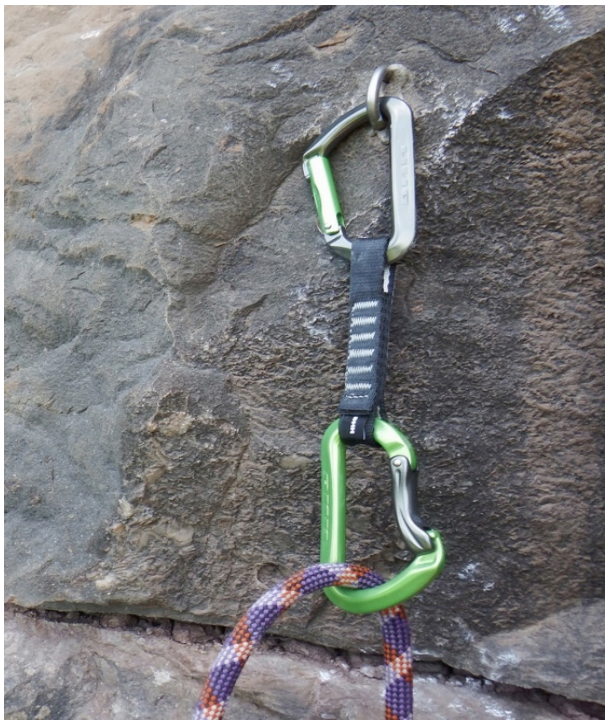

Figure 3. Bolt and a quickdraw for sport climbing

In bouldering, a climber does not use a rope, and generally stays within a safe distance off the ground. Bouldering is usually very difficult climbing and requires more dynamic, explosive movements to complete the summit. Bouldering is also a highly social activity, since most bouldering groups consist of two to six people (Attarian & Keith, 2008).

When climbers face an area where the cracks are too small to climb, or there is no way to climb the rock, they employ aid climbing, which requires both traditional climbing and sport climbing skills. Climbers place gear or connect to a line of bolts pre-placed on the rock face. They connect to those pieces with a carabineer and use webbing ladders to work their way to an area where they either summit or can return to traditional or sport climbing (Figure 4).

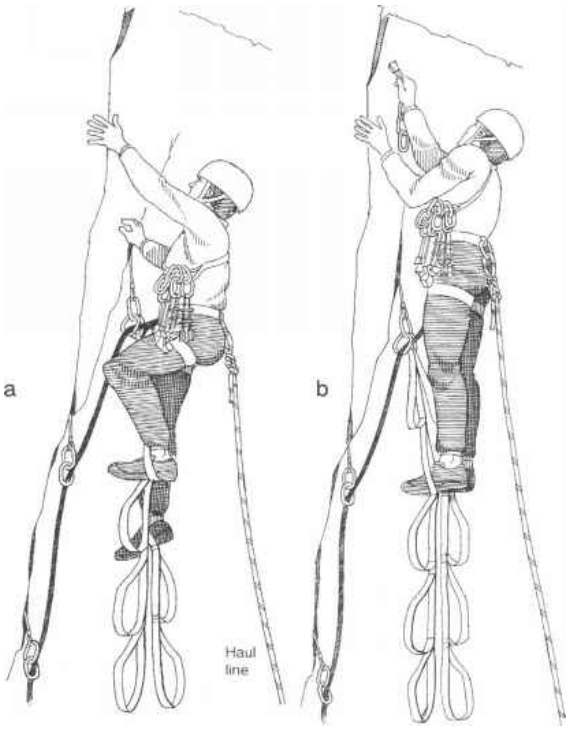

Figure 4. Aid Climbing

Free solo climbing is climbing without ropes. The difference between bouldering and free solo climbing is that the climber ascend to heights greater than when bouldering. This type of climbing is done by experts who have years of training and experience. The most extreme free solo climbers make summits of 2,000 feet or more (Eng, 2010).

Rock Climbing in Yosemite NP

There is a long history of climbing in Yosemite NP, from climbing without ropes in dress shoes in the late 1800s (Yager, 2012) to modern climbing. For example, there is a tale of John Muir summiting Cathedral Peak while tending his herd of sheep in Tuolumne Meadows, credited as the first recorded summit of Cathedral Peak in 1869 (Yager, 2012). John Muir's summit was made without ropes on what is now considered a 5^{th} class climb in which most modern climbers are roped up and protected using traditional climbing techniques. George

Anderson climbed Half Dome in 1875, which was considered unclimbable by the California Geological Survey (Yager, 2012), by drilling holes into the rock and placing eye bolts for footholds. These eyebolts evolved into the popular cable route that hikers use today to summit Half Dome.

This is where we see a split in the two types of climbing, and technical traditional climbing became the focus of most climbers after the first summit of Half Dome in 1957. Many climbers saw the Half Dome summit by Anderson causing a negative impact on the rock face, and the Harding group in 1958 made a successful summit of El Capitan using minimal impact techniques (Yager, 2012). From that point on there have been two camps of climbers; those who use tools that impact the rock face, and those who try to minimize their impact using camming devices, nuts, chalks, and wedges. This is one of the major philosophical differences within the climbing community and still is a major concern for both climbers and managers of rock climbing areas (Attarian & Siderelis, 2012; Noe, Hammitt, & Bixler, 1997; Schuster, Thompson, & Hammitt, 2001).

Traditional climbers and sport climbers have different perceptions of management and they approach environmental stewardship differently (Attarian & Siderelis, 2012; Schuster, Thompson, & Hammitt, 2001) Traditional climbing involves using cams, nuts, chocks, and wedges for protection, this gear is easily removed after it is placed and generally leaves little evidence of its placement. These practices are generally exercised by climbers that want to preserve the climbing experience, by not removing chunks of rock to place gear for their climb. On the other hand, climbers who place bolts, use pins to hammer into cracks, leave evidence of their experience, thus impacting the resource and future climbers.

Understanding what types of climbers utilize Yosemite NP will not only help inform management of climbers' preferences, but also aid in policy and management decisions (Hendee &Dawson, 2002).

Rock Climbing and Crowding

Technical climbing became the focus of most climbers after the first summit of El Capitan in 1957, and climbing was such a novelty that climbers on El Capitan were under threat of expulsion from the Yosemite NP if they were not finished in a designated time (Yager, 2012). The NPS created a time limit for climbers because visitors stopping to watch rock climbers from El Capitan meadow were effectively creating road closures. To this day, visitors can be seen crowded in the meadow, watching climbers. Bottlenecks are created by visitors stopping to view climbers continues to be a management concern for transportation planning and meadow restoration efforts.

There are on average, 2,000 climbers that utilize the approach trail system at the base of El Capitan during the fall climbing season October through November (NPS, 2012). This amount of use on user created informal trails on high angle slopes creates problems like trail erosion and exposed roots. Figure 5 shows an extremely degraded trail in the El Capitan approach system.

Figure 5. Highly eroded section on El Capitan approach trail system.

Depending on climber's desired psychological outcome, trail systems impacts seen in Figure 5 may detract from their experience (Hass, 2001). In addition to physical impacts on the resource, managers have to take into account the social impacts that this degradation creates. Research has shown that there are multiple dimensions to a visitors experience and visual attributes can have an impact on visitor satisfaction (Hass, 2001). A majority of visitors have reported noticing informal trails and trampled vegetation (D'Antonio, Monz, Newman, Lawson, Taft, 2013). In addition to noticing these impacts, D'Antonio et. Al found that the areas of higher use from visitor created sites were out of the ecological standard 97% of the sampled time. This suggest that visitors do perceive impacts, and negatively evaluate crowded, impacted visitor created sites.

Perceived crowding in different situations throughout a visitors experience has been a primary focus in addressing crowding concerns. If crowding is creating visual experiences seen in Figure 5 it is important to understand if climbers feel crowded, and if they are willing to accept management actions implementing a carrying capacity to reduce crowding and its impact on the resource. It is suggested that crowding has both a linear (Manning & Lime, 1996) as well as a curvilinear relationship between use and biophysical impacts (Hammitt & Cole, 1998; Leung & Marion 1996) further supporting the need to analyze crowding in the climbing experience.

Social carrying capacity is simply a value judgment in which a respondent indicates there are too many others in the immediate area (Vaske, Donnelly, & Lehto, 2002).
Climbers at different skill levels have different expectations for their climbing experience. Inexperienced climbers generally climb to be with friends and for social status, whereas more experienced climbers are motivated by the challenge (Ewert, 1985). Different motivations and experience levels may affect peoples' perceptions of crowding (Rogenbuck & Schreyer, 1976). But, with over four million annual visitors to Yosemite NP, climbers expect crowds, especially on their climb. A common theme on SuperTopo.com, a forum for climbers to exchange route information, is that climbers may be crowded but they enjoy their climb anyway.

> "*Got an early start (0430) at the trailhead, and motored up the trail getting blasted on the mist trail in shorts and a t shirt to get to the base [of the climb] in 3 hrs flat to find 10 people total on the route, 5 of them on the ground. The climbing was extremely slow. Why do belay changeovers take 20 minutes? Despite the slow parties, I really enjoyed the hike, climbing on the awesome featured dike and the views… "(McNamara, 2011)*

This quote suggests that climbers are using some form of coping behavior. Recreation researchers study three primary coping mechanisms. The first is rationalization, where visitors make internal adjustments to reduce inconsistencies between their expectations and their experience. Rationalization derives from cognitive dissonance theory (Heberlein, 1977; Heberlein & Vaske, 1977; Johnson & Dawson, 2004; Manning, 2011), where people want to be at ease with their decisions. The second coping mechanism to deal with crowding issues is spatial and/or temporal displacement (Shelby & Heberlein, 1986). Displacement can occur when the number of people in an area is perceived as too many (Manning, 2011). And third, is product shift (Heberlein & Vaske, 1977), where a visitor readjusts an opinion of a site because they perceive the site to be crowded.

Studies show that over time perceived crowding can decline, but this can vary by region and even site level (Vaske & Shelby, 2008). Additionally, studies show that people have different expectations about crowding in the front country than they have in a wilderness setting (Vaske & Shelby, 2008). Yosemite is often crowded, and the world renowned, challenging climbing found in Yosemite is difficult to find outside the Valley, so displaced climbers do not appear to be an issue. The McNamara quote above illustrates, nevertheless, that crowded conditions and coping behavior exist in Yosemite NP.

Preferences and Past Experience

Users' past experiences have been shown to be a predictor of support for different management actions (Andereck & Knopf, 2007; Schreyer, Lime, & Williams, 1984). The more experienced a visitor is with a particular resource, the more time that visitor has to formulate an opinion of impacts and potential management actions (Jacob & Schreyer, 1981). Management preferences

and opinions about resource impacts and management actions to affect those impacts vary with site experience (Andereck & Knopf, 2007). Some experienced visitors are not willing to support management actions, and Hammitt (1981) suggests that this may be because they do not see themselves as creating an impact themselves or they are simply unwilling to change their actions.

Photo Evaluation Technique

The NPS applies aspects of the Visitor Experience and Resource Protection (VERP) management planning process (Hoff & Lime, 1997). The VERP process uses indicators and standards to quantify changes over time to the resource or experience. Because management objectives tend to be broad statements that address the type of experience managers want to provide, planners use indicators to empirically measure management objectives (Manning, 2011). Standards measure the least acceptable amount of impact or change to the resource. Standards and indicators should be based on three broad categories as described by Manning and Lime (1996): resource considerations, social considerations, and management considerations.

Manning (2011) lists nine elements to the VERP framework:

1. Assemble an interdisciplinary project team
2. Develop a public involvement strategy
3. Develop statements of primary park purpose, significance, and primary interpretive themes.
4. Analyze park resources and existing visitor use
5. Describe a potential range of visitor experiences and resource conditions
6. Allocate potential zones to specific locations
7. Select indicators and standards for each zone; develop a monitoring plan
8. Monitor resource and social indicators
9. Take management action

For my research, I focused on step four, analyzing park resources and existing visitor use. Being able to analyze the park resource, and finding a baseline level of acceptance of resource impact, I can help managers understand what issues they may need to address when developing a climbing management plan.

Crowding is a major concern in Yosemite NP. Approximately four million visitors came to Yosemite in 2011(NPS, 2014), and a majority of those visitors came into the Valley. The park reports that some popular climbing approach trail systems within Yosemite Valley see about 2,000 users a month (NPS, 2012). This can lead to excessive impacts on the resource.

Normative theory can be applied to crowding by asking visitors their evaluation of impacts (Jackson, 1965; Manning, Freimund, Lime, & Pitt 1996). This approach can help find climbers' preferences or expectations about whether or not they find an area crowded. Many of the impacts that visitors perceive have been found to be social in nature. For example, Manning and Lawson (2002) looked at people per viewscape (PPV) identifying how densities impact the visitor experience. Needham and Rollins (2005) examined boats at one time (BAOT) and found that the size of the boat has an impact on how crowded a person feels. Dawson and Alberga (2004), looked at people at one time (PAOT) which addressed the number of people in a Wilderness setting, and Cole and Stewart (2002) examined encounters with other groups or hikers per day.

One way to measure crowding uses a series of photographs with increasing numbers of people in each successive photo, asking respondents which photo best illustrates too many people. This technique has been used successfully to understand how crowding impacts visitors' experiences in a variety of settings (Manning, 2011; Needham and Rollins, 2008). Similarly, researchers use photo manipulation programs to show representations of different potential resource impacts, inquiring about evaluations of biophysical impacts (Daniels & Marion, 2006; Kim & Shelby, 2006; Kim and Shelby, 2005; Hall & Roggenbuck, 2002). Using photos with evidently increasing impact helps respondents see different levels of impact, and allows researchers to focus on different treatment variables (Cohen, Mangun, Davenport, & Carver, 2008; Kim & Shelby, 2006; Manning & Freimund, 2004).

Kim and Shelby (2006) looked at bare soil on trails as an indicator of quality. They used photos showing an increase in the proportion of visible bare soil in a gradient from 2%, 5%, 10%, 15%, 20%, 25%, 30%, 35%, 40%, 45%, to 50%. They did not include roots or rocks in the study photos because there is no norm for exposed roots, and because it is nearly impossible for managers to control the number of rocks. Cahill, Marion, and Lawson (2008) also used a photo classification system approach to visually display trail impacts. In their study, a class one impacted trail has minimal erosion and few exposed roots or rocks. A class two trail has some exposed roots with bare soil on the perimeter of the trail. A class three trial has more exposed roots and more severe rutting and rock exposure. A class four trail potentially has braided trails and even more trail rutting. And, a class five trail has no visible trail; it is simply a trail delineated by a rocky or muddy region (D'Antonio, Monz, Newman, Lawson, & Taff, 2013; Cahill, Marion, & Lawson, 2008).

Chapter 3: Methods

Methodological Approach and Research Design

I conducted survey research to test my two hypotheses:

H_1: There is a relationship between climbers' experience levels and their support for management actions.

H_2: There is a relationship between perceived crowding and climbers' experience level.

My dependent variables were perceived level of crowding, and responses to different management actions. My independent variables were type of climbing, number of years climbing, and experience level. I measured crowding using a nine-point scale developed by Heberlein and Vaske (1977) that has been used in a number of crowding studies making my results comparable with other studies. I measured trust in management by asking one question concerning climbers' feelings that managers have adequate knowledge about climbing to properly manage climbing in the Valley. I measured acceptability of resource impacts by showing five photos with increasing degradation.

Sampling Schema

Study subjects were female and male English speaking climbers 18 and older camping or climbing in Yosemite Valley. Salant and Dillman (1994, p.55) suggest that a sample of 384 yields a plus or minus 5% sampling error given a 50/50 population split for a population of 1,000,000. I collected 384 questionnaires to ensure adequate representation of the Yosemite NP climber population and because I was unsure of the total climbing population in Yosemite NP. Although, the NPS estimates about 2,000 visitors utilize the El Capitan approach trail system over the course of one month (NPS, 2012), so a larger sample size is required to be able to

extrapolate to the larger population. Also, with a larger sample size, I minimized the sampling error while representing the entire, undefined population (Vaske, 2008).

I identified potential subjects located at the study sites by their climbing gear. Climbers tend to carry very specialized gear (i.e., ropes, cams, chalks, chalk bags, and harnesses). Other identifiers for potential climbing subjects were their apparel and appearance. In addition to carrying climbing gear, climbers sometimes wear "approach" shoes that are like tennis shoes but have a larger toecap made of rubber, and they have chalked hands.

Once I identified these potential subjects, I initiated the survey protocol, listed in Appendix A. I used a field notebook to keep track of the sampling locations and number of questionnaires administered. I also recorded any weather anomalies that may have affected data collection efforts I encountered in the data collection process.

Data Collection and Instrumentation

I administered my onsite questionnaire between September and November 2013. I conducted an onsite survey because there is no address list or phone number list of Yosemite Valley climbers.

I used the following questions to test $H_{1:}$

For the independent variable I used the climbers self-identified level of experience, and for the dependent variable I used climber's level of support for different management actions affecting both resource and social based actions. For example, climber's levels of agreement with improving popular approach trails, using informative trailhead signs detailing climbing

locations. And, for social management actions, I asked questions such as issuing permits for specific types of climbing, developing trails to less used sites to reduce crowding.

I used these questions to test $H_{2:}$

I used the independent variables asking about climber's perceived level of experience to run against the dependent variable of how crowded they feel. I asked climbers what their perceived level of crowding was at different points of their trip.

I also collected sociodemographic date in order to build a typology of Yosemite NP climbers in my study.

Given that use levels can be relatively high at these sites, it was not feasible or necessary to survey every person. Instead, I selected individuals through a systematic random sampling procedure (e.g., if there were more than two people in a group, I sampled the person with the next birthday, as well as the person with the second, and fourth closest birthday). This reduced selection bias and is among the most widely accepted onsite sampling approaches for providing a representative sample from a large number of recreationists (Salant & Dillman, 1994). I asked users if they would be willing to complete a questionnaire, read a letter of consent/recruitment, and then complete the questionnaire onsite. It took respondents less than 15 minutes to complete the questionnaire. This approach is consistent with social science and recreation research (Mitra & Lankford, 1999).

To account for turnover at Camp 4 and to decrease the chances of sampling the same individual more than once, I sampled by alternating between two study sites per day with two

four-hour samples per day. The morning sample began at 8:00 AM and ended at 11:00AM and the evening sample began at 12:00 PM and ended at 4:00 PM. I also sampled Camp 4 later in the evening, until 6:00 PM. Once I began, I continued administering as many surveys as possible until the conclusion of the sample period, with at least twenty surveys per sample period.

Study Sites

I chose to use a systematic random sample of climbers in five areas of Yosemite NP. The first area was in the primary climbers' campground, historic Camp 4 (Figure 5), located in Yosemite Valley. Camp 4 is a designated walk in campground that caters to climbers and has been a rendezvous point for climbers since the 1950s. The other survey sites included three high day use climbing areas: Churchbowl (Figure 6), near the Ahwahnee hotel, the Manure Pile, and El Capitan Meadow, where climbers of all skill levels congregate. I also sampled during Facelift at Yosemite Village, which is a popular event where the climbing community convenes in the Valley to volunteer and clean up Yosemite Valley. During Facelift there are also social events, films, and other activities that draw a large number of climbers from all over the world.

Figure 6. Yosemite NP climber preferences survey sites

The Questionnaire

I administered the survey instrument via offline computer tablets because there is no internet connectivity onsite. I used two ASUS MeMo 7 inch Android tablets as well as an Apple iPad iOS 5.0.1 10 inch tablet (Figure 7). I used the SurveyGizmo website (www.surveygizmo.com), operated by Widgix Software, LLC, to create the off line interface which I ran on each tablet via the Google Chrome web browser. The offline mode used HTTPS5 protocol and that allowed respondents to page through the survey interface easily. I saved each response to the tablet hard drive. At the end of the day I uploaded all responses to the SurveyGizmo website servers. This also reduced the data entry burden and minimized data entry mistakes.

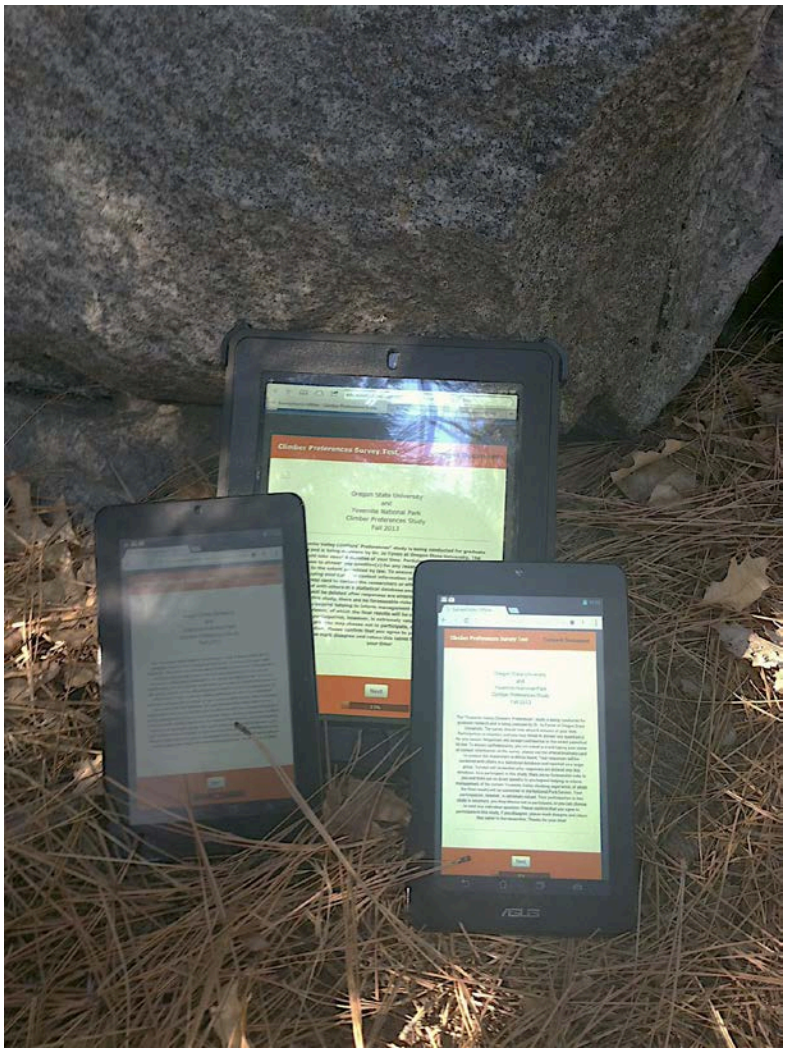

Figure 7. Apple iPad, 10 inch; and ASUS MeMo 7 inch tablets

Photo Evaluation Technique

I captured the photos for the survey on site in Yosemite Valley. I used my personal Nikon D90 14 megapixel digital single lens reflex (DLSR) camera. I used different settings with consistent white balance to ensure I captured the same colors within the different locations in Yosemite Valley. I imported my photos into Adobe Photoshop Creative Suite 5 (CS5) where I used the layering tool to alter the original photos. In the trail photos, my initial photo represented a pristine condition (Figure 8). In the second photo I added 10% more “degradation” (Figure 9),

and in each subsequent photo, I added 10% more “cover” (see Figure 10, Figure 11, Figure 12). Cover consisted of adding items like boulders and rocks to the center of the trail, and adding more disturbed soil to the perimeter of the trail.

For the restored trail photos, I went through the same process of collecting photos with my Nikon DSLR and found a highly degraded approach trail (Figure 5) and “designed” two options that respondents could rate by level of acceptability for each treatment. For the first treatment I added small boulders layered to look like stone steps to the photo (Figure 13). For the second treatment, I added wood bars or logs to the photo and back filled the slope with a layer that looked like crushed rock (Figure 14).

The final color photos were approximately 1.5 x 2 inches on the smaller tablets, almost 2 x 3 inches on the iPad screen. Respondents could also zoom in on each photo, or they could view an 8.5 by 11 inch color printed version.

Figure 8. Class one, low impact approach trail

Figure 9. Class two, medium impact approach trail

Figure 10. Class three, medium high impact approach trail

Figure 11. Class four, high impact approach trail

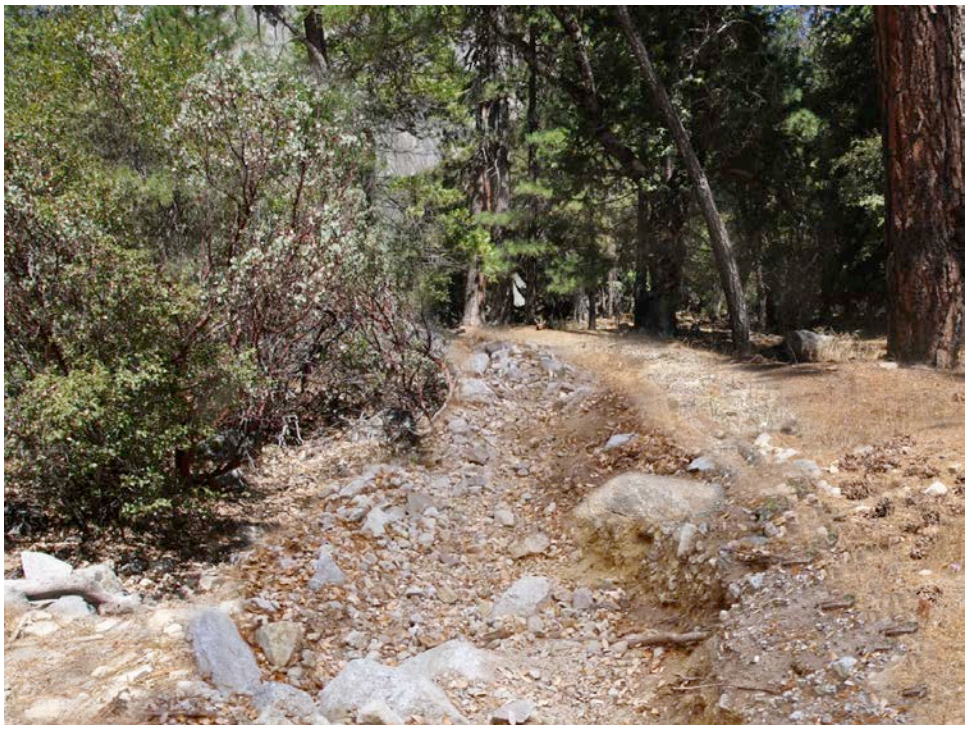

Figure 12. Class five, totally degraded approach trail

Figure 13. Example of restoration with stone steps

Figure 14. Restoration example with wood steps

Data Management

After data collection was completed for the day, I connected the computer tablets via WiFi and saved the completed questionnaires to the SurveyGizmo website. I also downloaded the data daily and entered it in an Excel spreadsheet on my personal computer. I saved all the data on my personal computer and backed up on my personal hard drive. The data saved on the SurveyGizmo website will be accessible until my subscription expires at the end of January 2015. I conducted a quality control analysis to ensure data was uploaded correctly, comparing the uploaded data to the data displayed on the SurveyGizmo website. I also used Excel to filter the data to ensure correct uploads.

Data Processing and Analysis

My clean data was uploaded into a copy of the Statistical Package for Social Sciences (SPSS). I ran a frequency analysis to ensure I had the data correctly imported and labeled. I also examined my descriptive statistics to build a typology of climbers who utilize the Valley as a climbing resource. I used SPSS to create cross tabulation tables to understand the proportion of responses by each group. I also ran multiple chi-square tests on the variables appropriate to address my hypotheses. I chose a chi-square analysis, with a Pearson's correlation to determine the strength of the relationship (if any). I chose to use chi-square because I want to analyze if there is a relationship between the independent and dependent variables., both categorical, and having only one independent and dependent variable. According to Vaske chi square is the most appropriate analysis considering my variable data type and number of independent and dependent variables (2008).

In the following chapter, I present the results of my analysis.

Chapter 4: Findings and Analysis

Introduction

In this chapter, I present the results from the data analysis described in chapter three in two sections. First, I address my response rates, followed by respondent demographics. Then, I follow this with climbers' trip characteristics including the types of climbing that respondents participated in, the number of days they visited the Yosemite Valley, their days climbing outside Yosemite Valley but within the park, and the number of days they visited during the survey period. I will then address both of my hypothesis and the chi-square analysis.

Response Rate

I contacted a total of 400 climbers at the four study locations. There were 46 climbers who refused to participate, so I collected 354 completed questionnaires. This resulted in an 88% response rate. Sample sizes obtained allowed me to make generalizations about the overall population of summer users at the 95% confidence level, if they were found to be statistically significant (Salant & Dillman, 1994).

I eased the response burden for climbers by using a Likert scales asking climbers how crowded they were while climbing, belaying, on the trail, and over all how crowded they were.

I asked about different resource based management actions, and what climber's level of support for each action was. I asked about improving popular trails, designating specific trails, informative trail head signs at climbing areas, carabineer signs to indicate approach trails, providing trail maps to popular climbing sites, using natural barriers to direct climbers to

climbing sites, using fences to direct climbers to climbing sites, or if managers should take no action concerning approach trail conditions.

To address how climbers perceive management actions to address social impacts like crowding I asked climber's their level or support for social management actions. I asked climber's support for issuing permits for overnight big wall climbs, issuing permits for day use climbing, issuing permits for Wilderness climbing, reducing parking at popular approach trails to limit use, developing trails to less used climbing areas, climbers should self regulate crowding issues, and if managers should take no action concerning crowding at approach trails.

As a surrogate for understanding level of experience, I asked climbers the number of trips they have made to the valley in the past twelve months, how many days they are climbing in the Valley this trip, how many years they have been climbing, and their self identified skill level (novice, beginner, intermediate, and advanced).

Sociodemographic Characteristics

Climber Demographics

I chose to investigate sociodemographic characteristics because there is no empirical social science based data on Yosemite Valley climbers. This analysis also addresses my objective to help inform managers of basic climber characteristics.

Gender

In my sample, 27% of respondents were female and 83% were male. This percentage of female climbers in my study is low despite my effort at the halfway point during collection to recruit additional female respondents. If there were other women in the group I approached, I would

ask them if they were willing to participate. This was a deviation from my protocol, but I felt it necessary to increase the female representation.

Education

Twelve percent of respondents indicated that a high school diploma was their highest degree held. Ten percent of respondents report having an Associate's degree. Forty-three percent of respondents indicated that they hold Bachelor's degrees. Eighteen percent of respondents reported that postgraduate degree was their highest academic degree. Sixteen percent of respondents had some college experience, but no degree.

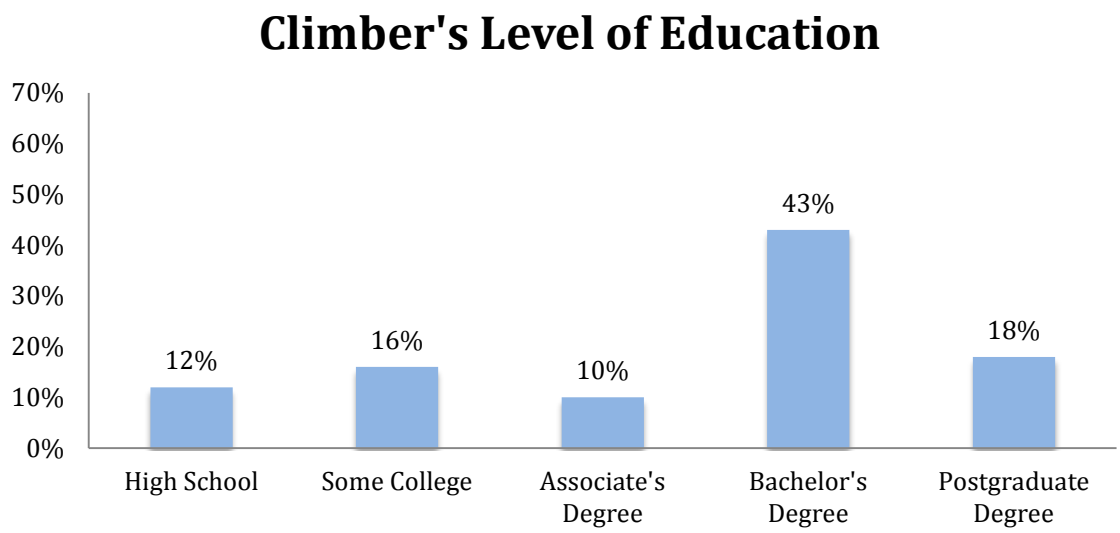

Figure 15. Percentage of climbers with at least a high school education

Trip Characteristics

The top four climbing areas for respondents' most recent climb were El Capitan (15%), Manure Pile (11%), Church Bowl (10%), and Five Open Books (10%). Other locations frequented by climbers were Camp 4 Wall, Cookie Cliffs, Half Dome, Royal Arches, and Reeds Pinnacle.

The majority (59%) of respondents reported their primary activity while visiting Yosemite NP was to climb “trad” or traditional climbing (Figure 16). Far fewer respondents said they engaged in big wall (14%), bouldering (10%), or cragging (8%). In the “other” category, climbers said their primary activity was sport climbing, free soloing, or slack lining.

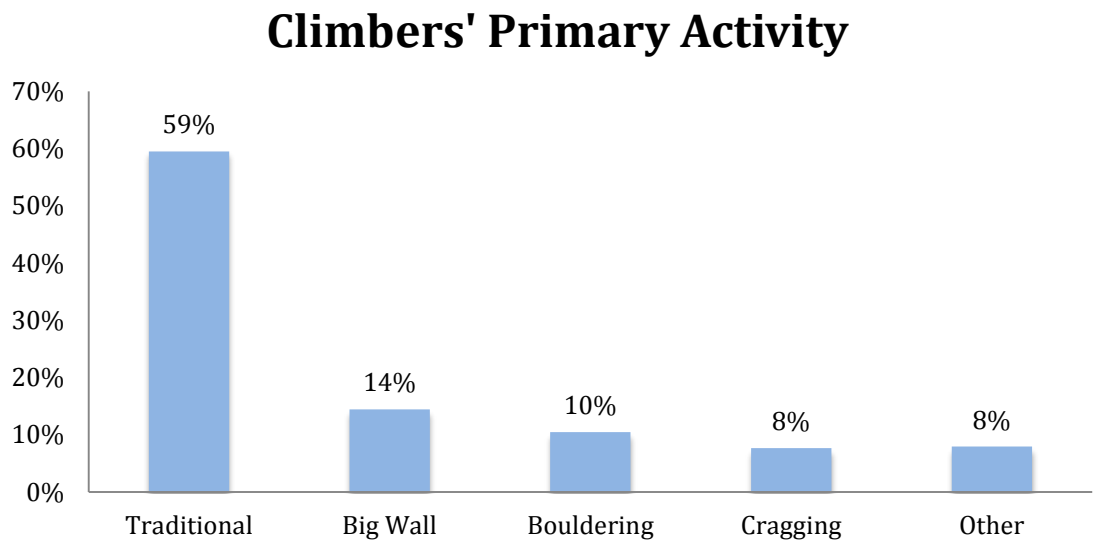

Figure 16. Climbers’ primary activity

On average, Yosemite Valley climbers took over three trips to the park in the twelve months prior to the survey (Table 1). Climbers’ trip visits to Yosemite NP lasted typically between one and 15 days. On average, respondent’s spent more time in Yosemite Valley than outside of the Valley.

Table 1. Trip patterns

	Mean	Min.	Max.	Std. Deviation
Number of visits in the past year	3.5	1	90	11.2
Number of days visiting YV	7.3	0	80	8.7
Number of days climbing outside YV	1.1	0	18	2.7

I used the number of years a person has climbed as a surrogate for the respondent's climbing skill level. I also asked respondents outright what they thought their skill level was (Table 2). I broke down the percent of respondents by their self-identified skill level (Figure 17).

Table 2. Skill level

	Mean	Min	Max.	Std. Deviation
Years climbing[a]	9.30	1	43	7.86
Self-identified skill level[b]	3.0	1	4	0.83

Note. [a]. Years climbing from 1-100 years. [b]. Skill level was a 4 option scale where 1=Novice, 2=Beginner, 3=Intermediate, and 4=Advanced.

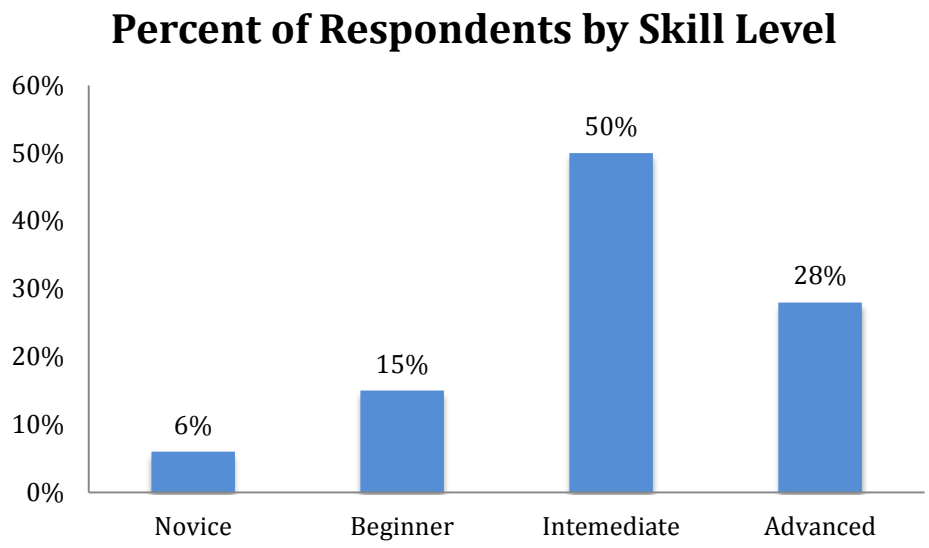

Figure 17. Percent of respondents by self-identified skill level

I also looked at the number of climbs in Yosemite Valley according to SuperTopo Climbing guide book. I counted all of the climbs listed in YV (118) and divided by the number of novice climbs (5.0-5.50), beginner climbs (5.6-5.8), the number of intermediate climbs (5.9-5.10) and the number of advanced climbs (5.11-5.12) (Figure 18).

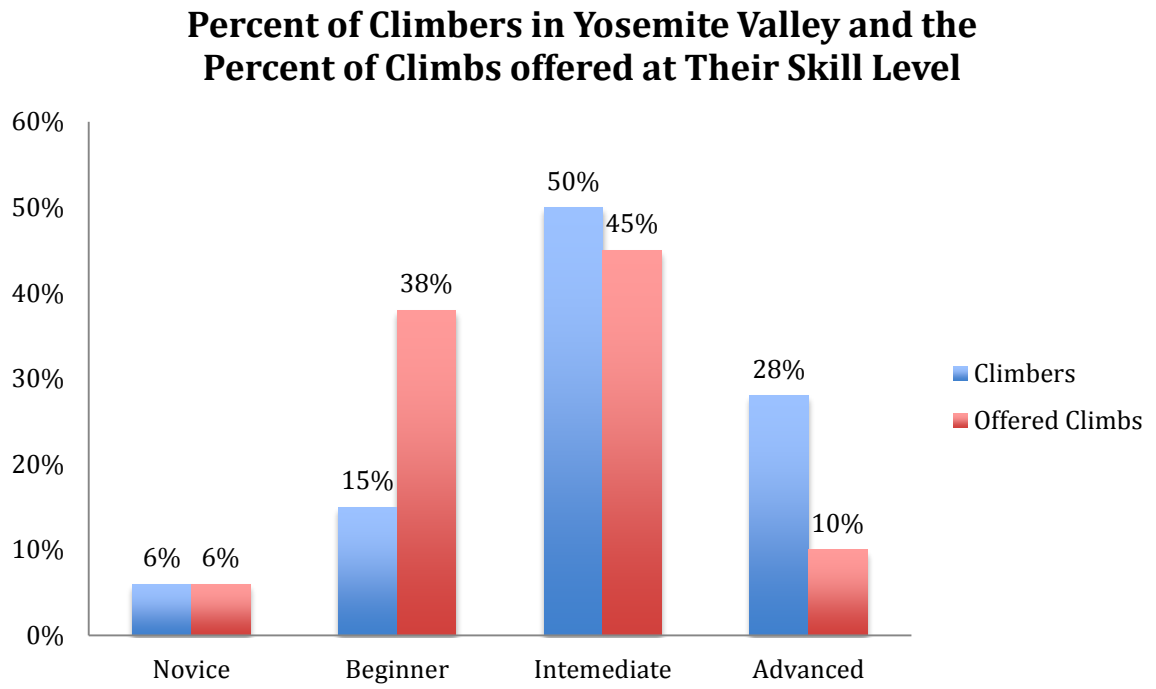

Figure 18. Percent of climbers, by skill level compared to the number of climbs offered within their skill level according to SuperTopo.

Crowding

I measured crowding on a 9- point scale originally developed by Heberlein and Vaske (1977). I asked climbers about crowding on their most recent climbing experience (Table 3).

Table 3. Descriptive climbing at different points during the trip

	Mean[a]	Min	Max	Std. Dev.
Approach trail	1.85	0	9	1.56
Belaying	2.42	0	9	1.82
Climbing	2.39	0	9	1.72
Overall	2.60	1	9	1.72

Note. [a] . 1-9 Likert-based scale; 0 "I did not do this today";1 "Not at all crowded"; "2" "Somewhat crowded"; "3", "4", "5"; "6" and "7" "Moderately crowded";"8" and "9" "Extremely crowded. n= 353

A summary of the total sample's response to different management action statements to reduce crowding is shown in Table 4. If crowding was a concern to respondents,

Table 4 shows potential actions to protect the climbing sites from overcrowding and the level of support each action would receive from Yosemite Valley climbers.

Table 4. Potential management actions for crowding concerns

	Mean[a]	Min.	Max.	Std. Dev.
Issue permits for overnight big wall climbs	5.29	1	7	1.75
Issue permits for day use climbing	5.93	1	7	1.37
Issue permits for Wilderness climbing	5.37	1	7	1.71
Reduce parking at popular approach trails to limit use	5.18	1	7	1.44
Develop trails to less used climbing areas	3.47	1	7	1.65
Managers should take no action concerning crowding at approach trails	3.90	1	7	1.52
Allow climbers to self-regulate crowding issues	2.67	1	7	1.36

Note. [a] . On a 1-7 Likert-based scale with 1 being "strongly support" and 7 "strongly oppose;" 4 is "neutral". n = 353

Management Actions

Management actions based on facility design are reported for the entire sample (n=354). These actions include trail restoration, more signage at trailheads, maps, and paving of non-wilderness trails

Table 5. Management actions for impacted trails

	Mean[a]	Min	Max	Std. Deviation
Improve trails	2.75	1	7	1.35
Designate trails	2.83	1	7	1.48
Informative trail signs	3.60	1	7	1.81
Carabineer signs	2.43	1	7	1.45
Trail maps	3.51	1	7	1.79
Pave non-wilderness trails	5.25	1	7	1.72

Note. [a] . On a 1-7 Likert- based scale with 1 being "strongly agree" and 7 "strongly disagree;" 4 is "neutral". n=354

Table 6 shows the total sample's response to different facility and resource management actions to address perceived resource degradation.

Table 6. Management actions for directing climbers

	Mean[a]	Min.	Max.	Std. Dev.
Use natural barriers to direct climbers to climbing sites	2.89	1	7	1.45
Use fences to direct climbers to climbing sites	5.14	1	7	1.67
Managers should take no action concerning approach trail	4.51	1	7	1.44

conditions

Note. [a] . On a 1-7 Likert-based scale with 1 being “strongly agree” and 7 “strongly disagree;” 4 is “neutral”. n= 354

I asked climbers their agreement with statements that described typical physical characteristics, such as switchbacks, width of trails for moving gear to the base of a climb, and if trails should be designed to reduce erosion (Table 7). Most climbers agreed that the best approach trail shouldn’t have switchbacks, should be wide enough for them to carry loads of gear, and should be free of loose gravel.

Table 7.Physical qualities of a good approach trail

	Mean[a]	Min.	Max.	Std. Dev.
The best approach trails should be clear of vegetation	3.72	1	7	1.39
The best approach trails should be wide for gear	4.29	1	7	1.45
The best trails should be designed to reduce erosion	2.40	1	7	1.38
The best approach trails shouldn't have switchbacks	4.63	1	7	1.30
The best approach trails should be free of loose gravel	4	1	7	1.33
The best approach trails should have trees and shrubs to grab onto for catching your falls	3.92	1	7	1.40

Note. [a] . On a 1-7 Likert-based scale with 1 being “strongly agree” and 7 “strongly disagree;” 4 is “neutral”. n= 354

Acceptability of Impacts

I showed respondents photographs illustrating increasing degree of trail impact and asked them to evaluate the acceptability of the five trails (Table 8). Each photo was based on recreation ecology theory using different impact classes, from class one showing few signs of use, to class five where the trail is completely negatively impacted

Table 8. Average responses for impacted photo set

	Mean[a]	Min.	Max.	Std. Dev.
Photo Class 1 Low Impact	1.68	1	7	0.89
Photo Class 2 Medium Impact	2.18	1	7	1.19
Photo Class 3 Medium High Impact	2.93	1	7	1.55
Photo Class 4 High Impact	3.78	1	7	1.88
Photo Class 5 Total Degradation	4.19	1	7	1.97

Note. [a] . On a 1-7 Likert-based scale with 1 being "Very Acceptable" and 7 "Very Unacceptable;" 4 is "neutral". n= 354

I asked climbers which locations they think needed restoration, or if they believed that restoration should be management tool at all (Figure 19).

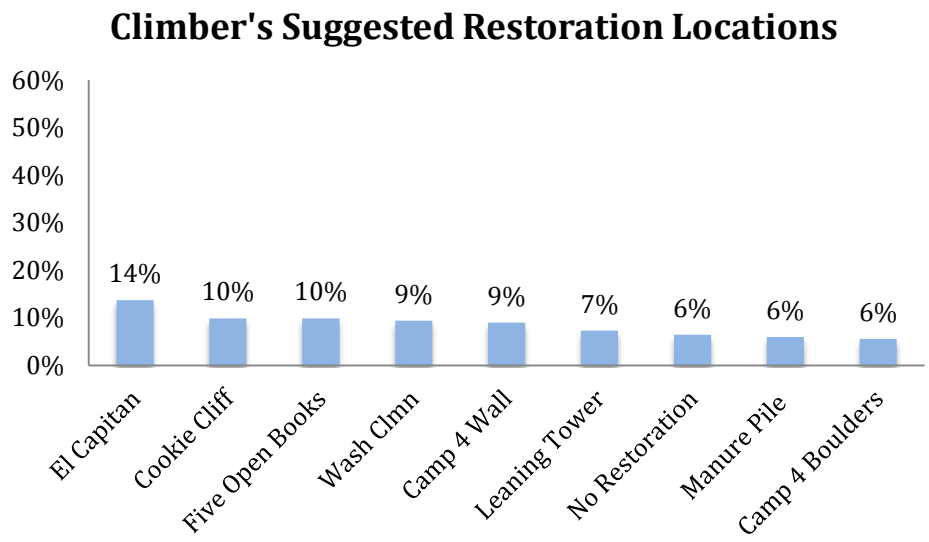

Figure 19. Climbers' suggested Yosemite Valley restoration locations

Before addressing my hypotheses I want to show that climbers, at different experience levels, do perceive a resource impact. There is a significant relationship between impact class three, or medium high impact trail, and climbers' reported experience level (χ^2 (9, N=354) = 39.8, p<.001) (Figure 20). This shows the acceptability from a 7 point Likert scale, split at the neutral level. Intermediate climbers have the highest level of acceptability of degradation The number of days climbers spent in Yosemite Valley is also significantly related to resource impacts (χ^2 (12, N=353) = 37.26, p<.001) (Figure 21). These figures show which climbers may have a concern with the resource conditions, which will help when looking at climbers' support for management actions.

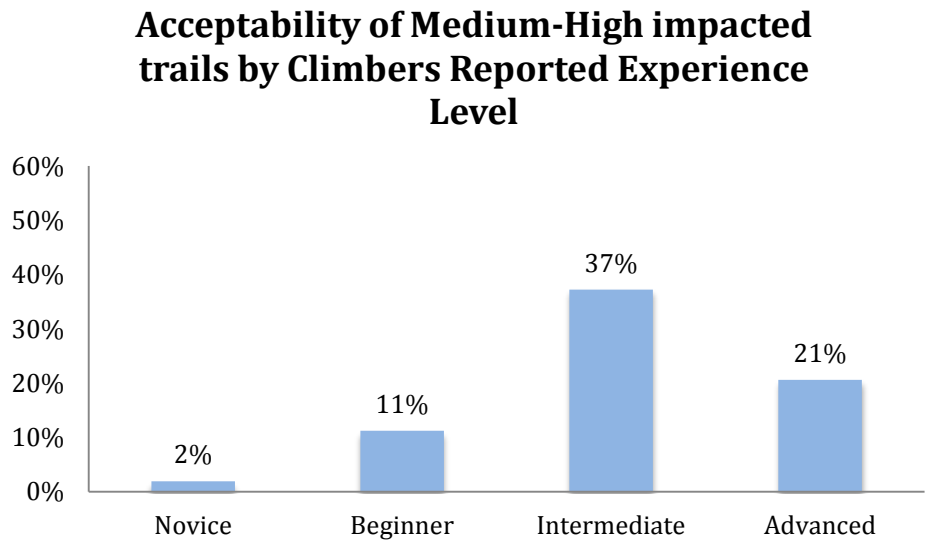

Figure 20. Photo class three, medium-high impact, level of acceptability by climbers' reported experience level

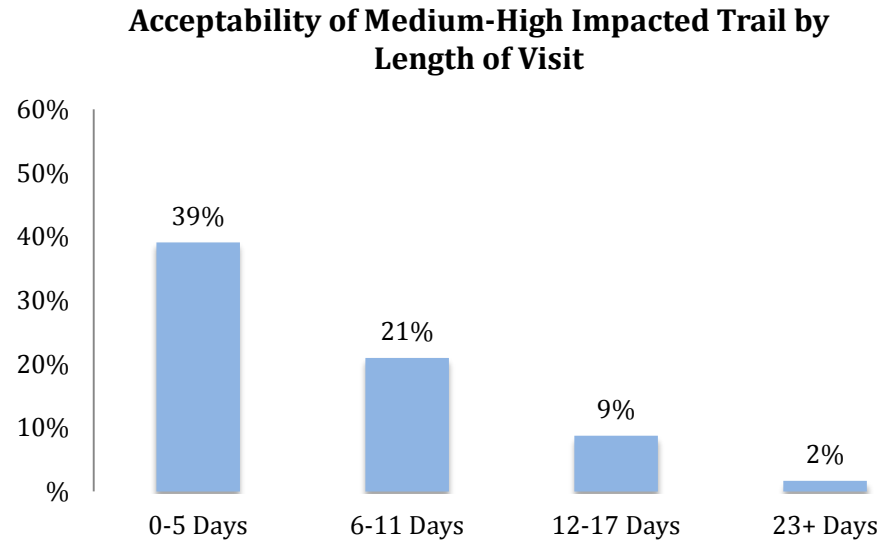

Figure 21. Photo class three, medium-high impact, level of acceptability by climber's length of visit

Photo impact class four, highly impacted trails are significantly related to the type of climbing (χ^2 (21, N=354) = 39.63, p=.008) (Figure 22). There was also a significant relationship between highly impacted trails and climbers' self-identified skill level (χ^2 (9, N=354) = 23.36, p=.005) (Figure 23).

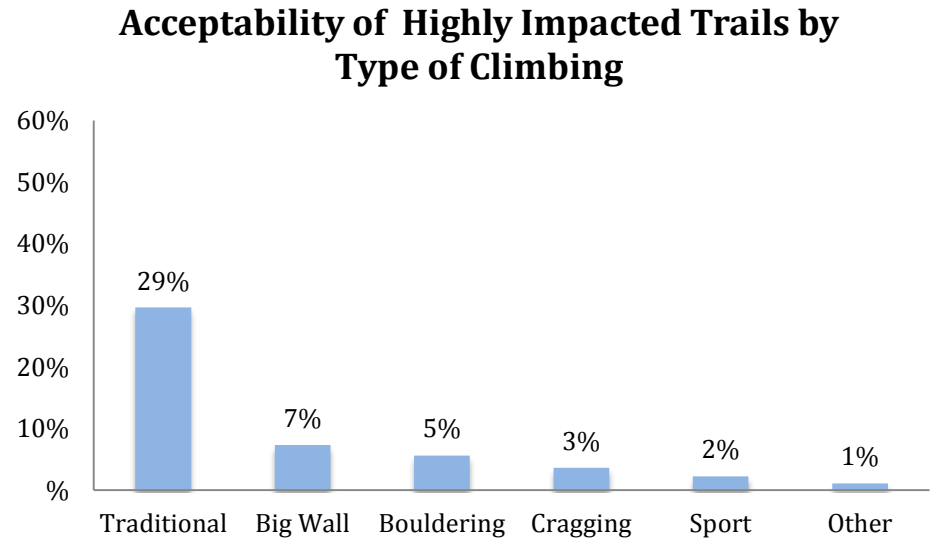

Figure 22. Photo class four, highly impacted trail, level of acceptability by type of climbing

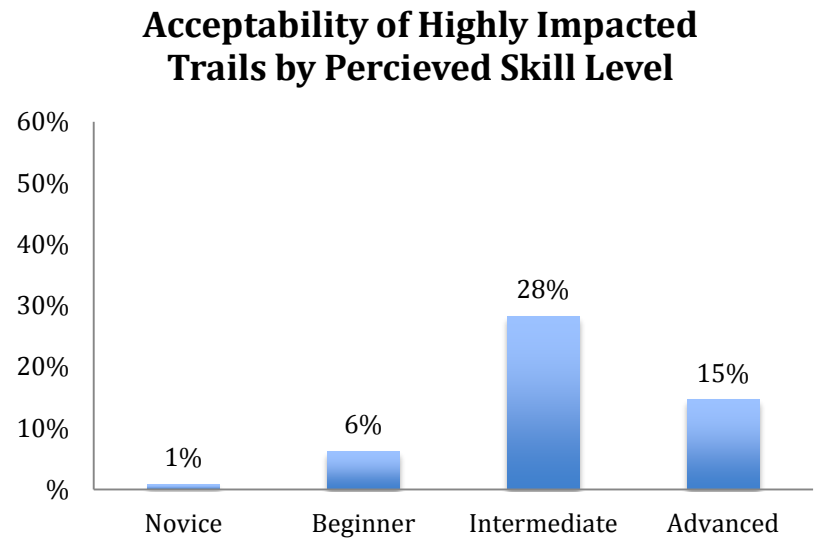

Figure 23. Photo class four, highly impacted trails, level of acceptability by skill level

The level of acceptability declines between highly impacted trails and totally degraded trails. There is a significant relationship between skill level and the almost complete degradation of trail conditions (χ^2 (9, N=354) = 24.53, p=.004) (Figure 24). Complete trail degradation is also related to the number of years a person has been climbing. (χ^2 (9, N=354) = 23.36, p=.005) (Figure 25).

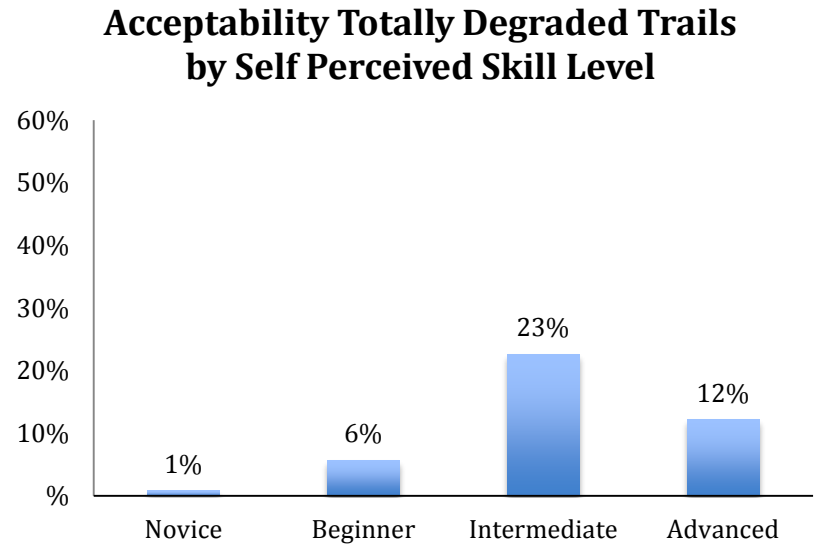

Figure 24. Photo class five, totally degraded trails, level of acceptability by skill level

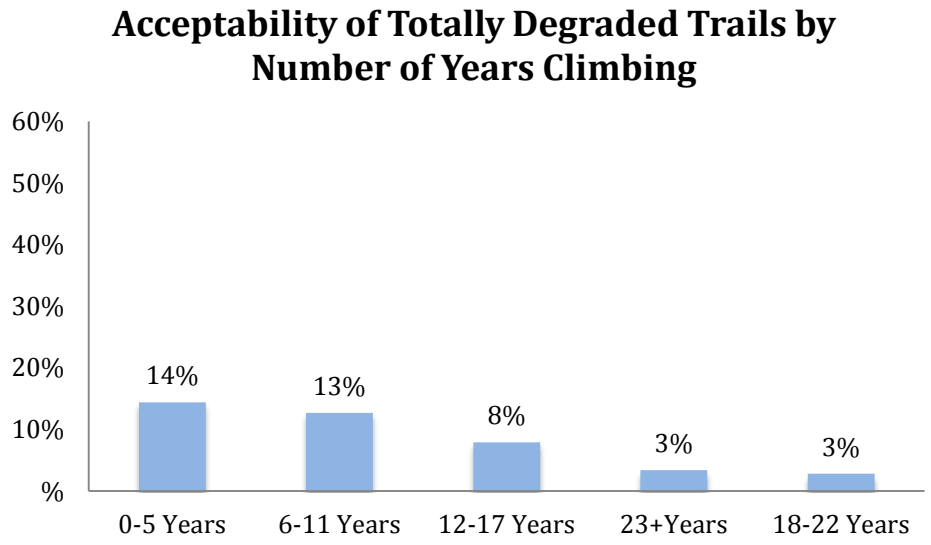

Figure 25. Photo class five , totally degraded trail, level of acceptability by the number of years climbing

Cross Tabs Analyses

To address my hypotheses I used cross tabs analyses with a 95% confidence interval. I chose to

Hypothesis One

To address my first hypothesis, H1: There is a relationship between climbers' experience levels and their support for management actions, I used climber's responses from resource based management actions and social management actions and ran the chi-square against climbers self identified level of experience.

Climbers Support for Management Actions

In the following chi square analysis I specifically looked at climbers' self-identified skill level and the number of years climbing, and compared those with different management actions to

address H1: There is a relationship between climbers experience level and their support for management actions.

Table 9 shows the relationship between climbers' self-identified skill level (novice, beginner, intermediate, and advanced) and their level of acceptability of increasing impacts (i.e., increasing impacts as illustrated in Figure 8 through Figure 12). This was the first step in understanding if climbers perceive impacts as a concern, and if there is an impact level warranting management action (Table 9). Clearly, as levels of impact increase, climbers increasingly rate the impact as unacceptable.

Actions addressing resource impacts

There are significant relationships between climber's self-identified skill level and different management actions. Designing informative trailhead signs showed a significant relationship with climbing site information $\chi 2$ (9, n=354) = 52.06, $p<0.001$, offering approach trail maps $\chi 2$ (9, n=354) = 52.80, $p<0.001$, and using fences to direct climbers to climbing sites $\chi 2$ (9, n=354) = 64.45, $p<0.001$. Agreement with each of these management actions is associated with climbers' self-identified skill level.

Table 9. Relationship between resource-based management actions and self-identified skill level

	Self-identified Skill Level							
	Novice (%)	Beginner (%)	Intermediate (%)	Advanced (%)	Total (%)	χ^2	*p*	Cramer's V
Managers should take no action on approach trail conditions								
Agree	4.2	9.3	23.4	11.3	48.3	13.720	0.133	0.114
Disagree	0.3	2.3	13.3	8.5	24.3			
Use fences to direct climbers to climbing sites								
Agree	4.8	5.9	6.8	3.4	20.9	64.450	<0.001	0.246
Disagree	1.4	7.9	38.4	22.6	70.3			
Use natural barriers to direct climbers to climbing sites								
Agree	5.1	11.6	38.1	19.2	74.0	8.508	0.484	0.090
Disagree	0.3	1.7	5.9	5.1	13.0			
Pave popular non-Wilderness approach trails								
Agree	4.8	6.2	6.8	2.3	20.1	74.607	<0.001	0.265
Disagree	0.8	7.3	38.1	23.2	69.5			
Provide approach trail maps to popular climbing sites								
Agree	6.2	11.9	29.4	10.5	57.9	52.797	<0.001	0.223
Disagree	0.0	1.7	14.4	13.8	29.9			
Informative trail head signs detailing climbing area								
Agree	6.5	11.0	27.1	8.8	53.4	52.050	<0.001	0.221
Disagree	0.0	2.3	18.4	14.4	35.0			
Designate specific approach trails								
Agree	5.9	12.4	38.1	18.6	75.1	14.087	0.119	0.115
Disagree	0.6	1.1	7.9	7.1	16.7			
Improve popular approach trails								
Agree	5.6	12.4	39.5	19.2	76.8	9.47	0.395	0.094
Disagree	0.3	1.4	4.5	4.2	10.2			
Discrete carabineer signs to indicate approach trails								
Agree	5.7	12.5	39.7	19.3	77.1	6.949	0.326	0.099
Disagree	0.3	1.1	4.5	4.2	10.2			

Note. On a 1-7 Likert-based scale with 1 being "strongly agree" and 7 "strongly disagree;" 4 is "neutral". Categories include 1-3 as "agree", and 5-7 as "disagree". n= 354.

Management actions concerning resource impacts have significant relationships with the number of years climbing (Table 11). Using fences to direct climbers to the base of climbs χ^2 (12, n=354) =33.79, p=0.001, and providing approach trail maps to climbing areas χ^2 (12, n=354) = 52.79, p<0.001 are significantly related to the number of years a respondent has been climbing.

Looking at the two different kinds of resource-based restoration actions (i.e., stone steps and wood steps) I asked climbers their acceptability of these two techniques (Table 12). I found no significant relationship between climbers' self-identified skill level and their level of acceptability for steps although both kinds of steps appear to be acceptable to all climbers.

Table 10. Acceptability of Impact by self-identified skill level

	Self-Identified Skill Level					χ^2	*p*	Cramer's V
	Novice (%)	Beginner (%)	Intermediate (%)	Advanced (%)	Total (%)			
Low Impact								
Acceptable	6.2	14.4	47.7	26.6	94.9	6.658	0.354	0.097
Unacceptable	0.0	0.6	0.3	1.7	1.7			
Medium Impact								
Acceptable	5.1	14.1	44.1	24.3	87.6	7.771	0.255	0.105
Unacceptable	1.1	0.3	2.8	2.9	6.2			
Medium High Impact								
Acceptable	2.0	11.3	37.3	20.6	71.2	39.883	<0.001	0.194
Unacceptable	4.2	3.4	8.5	4.0	20.1			
High Impact								
Acceptable	0.8	6.2	28.2	14.7	50	23.362	0.005	0.148
Unacceptable	5.1	7.9	17.2	10.2	40.4			
Total Degradation								
Acceptable	0.8	5.6	22.6	12.1	41.2	24.530	0.004	0.152
Unacceptable	5.4	9.0	22.6	11.3	48.3			

Note. On a 1-7 Likert-based scale with 1 being "totally acceptable" and 7 "totally unacceptable;" 4 is "neutral". Categories include 1-3 as acceptable, and 5-7 as unacceptable. n= 354.

Table 11. Relationship between resource-based management actions and number of years climbing

	Number of Years Climbing								
	0-5 (%)	6-11 (%)	12-17 (%)	18-22 (%)	23+ (%)	Total (%)	χ^2	*p*	Cramer's V
Managers should take no action on approach trail conditions									
Agree	5.9	9.6	5.6	1.7	1.4	24.3	25.382	0.013	0.115
Disagree	23.4	12.7	5.6	3.4	3.1	48.3			
Use fences to direct climbers to climbing sites									
Agree	12.4	4.2	2.8	1.4	0.0	20.9	33.785	0.001	0.178
Disagree	25.1	22.6	12.4	4.2	5.9	70.3			
Use natural barriers to direct climbers to climbing sites									
Agree	29.4	23.4	12.7	5.1	3.4	74.0	19.081	0.087	0.134
Disagree	5.1	3.4	1.1	0.8	2.5	13.0			
Pave popular non-Wilderness approach trails									
Agree	13.0	5.1	1.1	0.6	0.3	20.1	35.499	<0.001	0.183
Disagree	22.6	22.3	13.6	4.8	6.2	69.5			
Provide approach trail maps to popular climbing sites									
Agree	27.1	16.9	8.5	3.7	1.7	57.9	52.797	<0.001	0.223
Disagree	7.9	9.9	6.2	1.7	4.2	29.9			
Informative trail head signs detailing climbing area									
Agree	26.3	15.0	6.8	2.8	2.5	53.4	28.311	0.005	0.163
Disagree	9.6	11.6	7.6	3.1	3.1	35.0			
Designate specific approach trails									
Agree	32.2	22.0	11.0	4.2	5.6	75.1	12.340	0.419	0.108
Disagree	5.1	5.1	4.0	1.7	0.8	16.7			
Improve popular approach trails									
Agree	32.8	20.9	13.0	5.1	5.1	76.8	20.303	0.062	0.138
Disagree	3.4	4.0	1.7	0.6	0.6	10.2			
Discrete carabineer signs to indicate approach trails									
Agree	32.9	21.0	13.0	5.1	5.1	77.1	7.221	0.513	0.101
Disagree	3.4	4.0	1.7	0.6	0.6	10.2			

Note. On a 1-7 Likert-based scale with 1 being "strongly agree" and 7 "strongly disagree;" 4 is "neutral". Categories include 1-3 as "agree", and 5-7 as "disagree". n= 354.

Table 12. Acceptability of two suggested restoration efforts

		Self-identified Skill Level							
		Novice (%)	Beginner (%)	Intermediate (%)	Advanced (%)	Total (%)	χ^2	*p*	Cramer's V
Stone Steps Restoration									
	Acceptable	6.2	15.0	44.6	25.4	91.2	8.390	0.495	0.089
	Unacceptable	0.0	0.0	1.7	1.1	2.8			
Wood Steps Restoration									
	Acceptable	6.2	13.6	40.1	21.5	81.4	9.246	0.160	0.114
	Unacceptable	0.3	0.8	5.6	3.1	9.9			

Note. On a 1-7 Likert-based scale with 1 being "totally acceptable" and 7 "totally unacceptable;" 4 is "neutral". Categories include 1-3 as acceptable, and 5-7 as unacceptable. n= 354.

Addressing crowding impacts

There are significant relationships between the self-identified skill level and respondents' support for management actions concerning crowding (Table 13) and number of years a respondent has been climbing (Table 14).

Looking at management actions for just resource impacts doesn't take into account the social aspect of crowding impacts. Therefore, I asked climbers their acceptability of different management actions to address crowding. Overall, respondents tended to be more crowded when considering their whole Yosemite Valley experience than when they were at specific sites (Table 3). But, in general, climbers did not report being crowded. Respondent skill level and potential management actions if crowding were to become a concern were significantly related for all management actions with one exception. There was no relationship with skill level and the option to develop trails to less-used climbing sites (χ^2 (9, n= 354) = 16.9, p=0.05) (Table 13). Respondents also appeared to be split on whether or not managers should take any action concerning crowding (χ^2 (9, n = 354) = 47.581, p<0.001).

Table 13. Relationship between management actions on social impacts and climbers' self-identified skill level

	Self-identified Skill Level							
	Novice (%)	Beginner (%)	Intermediate (%)	Advanced (%)	Total (%)	χ^2	*p*	Cramer's V
Permits for overnight big wall								
Agree	4.5	7.3	8.5	1.4	21.8	86.205	<0.001	0.285
Disagree	0.6	6.2	36.7	24.9	68.4			
Permits for day use climbing								
Agree	4.8	5.9	6.8	3.4	20.9	73.825	<0.001	0.264
Disagree	1.4	7.9	38.4	22.6	70.3			
Permits for wilderness climbing								
Agree	4.0	5.4	9.6	2.5	21.5	43.669	<0.001	0.248
Disagree	1.7	9.0	37.0	24.6	72.3			
Reduce trailhead parking								
Agree	2.5	4.2	6.8	2.8	16.4	27.446	<0.001	0.161
Disagree	3.1	9.0	35.9	23.2	71.2			
Develop trails to less used sites								
Agree	5.6	10.2	29.7	13.8	59.3	16.685	0.05	0.125
Disagree	0.8	2.0	6.8	4.2	13.0			
Managers should take no action concerning crowding								
Agree	1.1	2.3	23.7	13.3	40.4	47.581	<0.001	0.212
Disagree	4.8	9.9	15.0	6.8	36.4			
Climbers should self-regulate crowding issues								
Agree	2.3	10.5	38.4	21.5	72.6	22.941	0.006	0.147
Disagree	2.0	2.3	4.8	2.3	11.3			

Note. On a 1-7 Likert-based scale with 1 being "strongly agree" and 7 "strongly disagree;" 4 is "neutral". Categories include 1-3 as "agree", and 5-7 as "disagree". n= 354.

Table 14.Relationship between management actions on social impacts and number of years climbing

	Number of Years Climbing								
	0-5 (%)	6-11 (%)	12-17 (%)	18-22 (%)	23+ (%)	Total (%)	χ^2	*p*	Cramer's V
Permits for overnight big wall									
Agree	15.5	4.8	1.1	0.3	0	21.8	63.876	<0.001	0.245
Disagree	19.2	21.8	15.3	5.6	6.5	68.4			
Permits for day use climbing									
Agree	7.3	1.4	0.6	0.0	0.0	9.3	28.511	0.005	0.164
Disagree	31.1	26.8	15.8	5.9	6.5	86.2			
Permits for Wilderness climbing									
Agree	12.7	5.4	2.5	0.6	0.3	21.5	25.815	0.001	0.191
Disagree	23.7	23.7	13.8	5.4	5.6	72.3			
Reduce trail head parking									
Agree	8.8	5.1	2.3	0.0	0.3	16.4	28.146	0.005	0.163
Disagree	24.3	21.8	13.8	5.1	6.2	71.2			
Develop trails to less used sites									
Agree	26.8	17.2	8.2	4.0	3.1	59.3	14.502	0.270	0.117
Disagree	8.5	7.9	6.5	1.7	2.5	27.1			
Managers should take no action concerning crowding									
Agree	8.8	16.1	9.9	2.3	3.4	40.4	42.863	<0.001	0.201
Disagree	20.9	7.6	4.0	2.0	2.0	36.4			
Climbers should self-regulate crowding issues									
Agree	25.7	23.2	14.7	4.0	5.1	72.6	21.094	0.049	0.141
Disagree	6.5	2.8	0.6	0.8	0.6	11.3			

Note. On a 1-7 Likert-based scale with 1 being "strongly agree" and 7 "strongly disagree;" 4 is "neutral". Categories include 1-3 as "agree", and 5-7 as "disagree". n= 354.

Hypothesis Two

To address my second hypothesis, H2: There is a relationship between perceived crowding and climbers experience level, I ran a χ^2 analyses to determine if there was any relationship between perceived crowding and experience level. I examined different types of experiences including the number of years climbing, the number days climbing in Yosemite Valley, and respondents' self-identified skill level.

Number of years climbing and crowding

The number of years climbing was not significantly related to the level of overall perceived crowding (χ^2 (8, 354 n=) =16.9, p=0.05) (Table 15).

Number of days climbing in Yosemite Valley and crowding

There was no significant relationship between the number of days climbing in the Yosemite Valley and crowding (Table 16).

Skill level and crowding

Climbers' self-identified skill level was not significantly related to their perceived level of crowding (Table 17).

54

Table 15. Number of years climbing and perceived crowding

	Number of Years Climbing								
	0-5 (%)	6-11 (%)	12-17 (%)	18-22 (%)	23+ (%)	Total (%)	χ^2	*p*	Cramer's V
Approach trail									
Crowded	2.6	3.8	1.7	0.6	0.6	9.2	7.737	0.460	0.106
Not Crowded	37.6	26.6	14.5	5.8	6.1	90.5			
Belay Site									
Crowded	9.5	8.5	4.9	0.9	1.2	25.0	5.132	0.741	0.088
Not Crowded	28.4	22.3	12.5	5.8	5.8	74.7			
Climbing									
Crowded	7.2	6.9	3.5	0.6	0.9	19.1	13.048	0.110	0.137
Not Crowded	32.4	23.4	13.0	5.5	5.8	80.1			
Overall									
Crowded	9.6	8.2	4.2	1.7	0.8	24.6	7.221	0.513	0.101
Not Crowded	30.8	22.0	12.1	4.5	5.6	75.1			

Note. On a 1-9 Likert-based scale with 1 being "not at all crowded" and 9 "extremely crowded;" 6 is "moderately crowded". Categories include 1-3 as "not crowded", and 4-9 as "crowded". n= 354.

Table 16. Number of Days climbing in Yosemite Valley and perceived crowding

	Number of Days Climbing in Yosemite Valley								
	0-5 (%)	6-11 (%)	12-17 (%)	18-22 (%)	23+ (%)	Total (%)	χ^2	*p*	Cramer's V
Approach trail									
Crowded	4.9	2.0	1.2	0.3	0.9	9.3	7.763	0.457	0.083
Not Crowded	51.3	25.5	9.9	1.4	2.3	90.4			
Belay Site									
Crowded	13.8	5.8	4.0	0.3	0.3	24.8	4.508	0.809	0.088
Not Crowded	40.7	23.2	7.3	1.5	2.1	74.9			
Climbing									
Crowded	7.2	6.9	3.5	0.6	0.9	19.1	12.317	0.138	0.134
Not Crowded	42.5	23.5	8.1	1.2	2.0	80.0			
Overall									
Crowded	14.7	5.7	3.1	0.3	0.8	24.6	4.417	0.818	0.079
Not Crowded	41.1	22.4	7.9	1.4	2.3	75.1			

Note. On a 1-9 Likert-based scale with 1 being "not at all crowded" and 9 "extremely crowded;" 6 is "moderately crowded". Categories include 1-3 as "not crowded", and 4-9 as "crowded". n= 354.

Table 17. Skill level and crowding

	Climbers' self–identified skill level							
	Novice (%)	Beginner (%)	Intermediate (%)	Advanced (%)	Total (%)	χ^2	*p*	Cramer's V
Approach trail								
Crowded	0.9	1.2	4.3	2.9	9.2	1.702	0.945	0.05
Not Crowded	5.5	13.0	46.0	26.0	90.5			
Belay Site								
Crowded	2.7	4.9	11.0	6.4	25.0	9.103	0.168	0.118
Not Crowded	3.7	8.5	38.7	23.8	74.9			
Climbing								
Crowded	2.0	2.0	10.4	4.6	19.1	4.553	0.602	0.115
Not Crowded	42.5	23.5	8.1	1.2	80.0			
Overall								
Crowded	2.8	3.7	12.1	5.9	24.6	7.599	0.269	0.104
Not Crowded	3.7	11.3	38.1	22.0	75.1			

Note. On a 1-9 Likert-based scale with 1 being "not at all crowded" and 9 "extremely crowded;" 6 is "moderately crowded". Categories include 1-3 as "not crowded", and 4-9 as "crowded". n= 354.

Chapter 5

Analyses Evaluation

I tested two hypothesis concerning social and resource impacts due to climbers using unmaintained social approach trails.

Hypothesis One

There is a relationship between climbers' experience level and their support for management actions.

I believed that because more people are becoming interested in rock climbing (Ewert, Attarian, Hollenhorst, Russell, & Voight, 2006), the need to understand climbers' preferences and how their activities impact the resource (Ewert, et al., 2006) is more vital than ever. Given the potential for increase in climber use in Yosemite NP, park managers need this empirical data to develop an adequate, and comprehensive climbing management plan (Cole, et al., 1997).

My results show that there is a relationship between resource management actions and climbers' experience levels. Knowing that most climbers in Yosemite Valley consider themselves to be at least intermediate climbers (Table 2), managers can feel confident that climbers will support these proposed management actions. Social desirability bias should be taken into consideration. Climbers may want managers to think they are supportive of their decisions. In an effort to limit this bias I assured respondent anonymity. Alternatively, there is no relationship between climbers' skill levels and climbers' support for social management actions to reduce crowding in Yosemite Valley.

By using photos to illustrate different management actions and resource impacts, climbers could better visualize the types of impacts that concern managers (Daniels & Marion, 2006; Hall & Roggenbuck, 2002; Kim & Shelby, 2006). I found that climbers' acceptability of resource impacts decreases as the impact level increases. Because the acceptability of impact decreases, it may suggest that climbers may be supportive of management actions to mitigate resource impacts. And, in fact they are supportive of some management actions, for example not using fences to direct climbers to climbing sites, rather using natural barriers to improve popular approach trails.

I did not anticipate a relationship between "managers should take no action concerning crowding" and "climbers should self-regulate crowding" with both number of years climbing and self-identified skill level. Of those who responded, 40% of climbers think that managers should take no action, and almost 30% of climbers said they wanted something more than self-regulation for crowding social impacts.

Hypothesis Two

I tested my second hypothesis, $H_{2:}$ there is a relationship between perceived crowding and climbers' experience level. I expected this relationship because I believed it intuitive that climbers at different skill levels have different expectations for their climbing experience. Inexperienced climbers tend to climb with friends and for social status, whereas more experienced climbers do so for the challenge (Ewert, 1985). Also, different motivations and experience levels may affect peoples' perceptions of crowding (Rogenbuck & Schreyer, 1976). The χ^2 analysis, however, revealed that there is no significant relationship between skill levels and perceived crowding. Both intermediate and advanced climbers did feel more crowded

while climbing than novice and beginner climbers, although there was no significant relationship.

Limitations

This study has a few limitations. Data collection occurred immediately following the government shutdown of 2013. This may have had an impact on how many climbers I encountered. The final sample may not be truly representative of Yosemite Valley climbers since some climbers may not have been sure if, or when, the park would to re-open.

Additionally, climbers may have used coping mechanisms (e.g., product shift) to deal with crowding – and that may have affected how climbers reported their perceived level of crowding. Most climbers know that the Yosemite Valley is going to be crowded, so they know what to expect when they visit. Displacement due to crowding, for example, can occur as the number of people in an area increases (Shelby & Heberlein, 1986). People who become dissatisfied with their experience can change their plans or visit less used areas (Manning, 2011).

Another limitation that may have impacted my study is the size of the illustrative photos on the survey instrument. SurveyGizmo on a tablet was only able to show a small format photo, although I provided a larger format photo upon request. Other studies used poster size photos or printouts (Cahill, Marion, & Lawson, 2008; D'Antonio, Monz, Newman, Lawson, & Taff, 2013). It is not clear how – or if - photo size may have affected responses.

Summary and Management Implications

As the number of climbers visiting Yosemite NP increases, managers need to understand who their climbing clients are, and how climbers feel about different management actions. With an increase in the numbers of climbers to Yosemite NP, there are going to be more resource impacts and even longer waits to get onto popular climbs. This study addressed both physical resource and social crowding concerns. This information may help with the development of baseline data, if managers choose to address climbing in a management plan.

Most climbers identify themselves as intermediate or advanced climbers (78% of respondents), managers should consider this a majority and manage for the needs of the more skilled groups. The intermediate and advanced climbers tend to agree that managers should take no action concerning crowding, except for developing trails to less used sites. If managers decide to prioritize more advanced climbers needs, beginners will not have permits for climbing, or intervention from management concerning crowding.

Intermediate and advanced climbers think that the resource should be left natural, for example they agree with the statements managers should use natural barriers to direct climbers, and that they should not pave popular non-Wilderness trails. But, the novice and beginner groups believe fencing and paving is acceptable form of management. If managers were to provide for the advanced group, the inexperienced group may not be supportive if there are no fences, or paved trails to climbing sited.

A majority of Yosemite Valley climbers have at least had some college course work so managers can assume that their climbing community is fairly educated. Most climbers in my

sample are male, have been climbing an average of nine years, and consider themselves to be intermediate climbers. The average climber makes almost four trips to the Yosemite Valley per year, visiting for a week, and climbing outside the Valley for only a day or so. This means that most climbers may be familiar with climbing the Yosemite Valley. They may also feel a sense of ownership over their access to climbing areas. Climbers should be involved in the management process. Climber Coffee, which is a meeting between the YNP climbing rangers and the climbing community in Camp 4 is a great way to build and maintain the relationship between managers and climbers.

Addressing crowding using a nine point scale (Heberlein & Vaske, 1977) allows managers to compare the results of this study to prior studies in simmilar settings. For example, Vaske and Shelby (2008) describe the different ways that the 9-point scale has been used in the past, used to determine crowding as specific sites and points during the recreation activity. Yosemite Valley is different from many climbing locations because it experiences very high visitation, so crowding may be anticipated. Generally, climbers do not report feeling crowded at climbing sites. Although, climbers appear to not feel crowded while climbing, on average, climbers feel that their overall climbing experience was more crowded than at specific sites. If managers do provide easier acces through the supported actions like maps, restored trails, and trail head signs, crowding may become more of a concern for climbers in the future. Future studies may provide insight into how climbers cope with crowding issues. Also, there may be more resource impact with guided use. Trails may need to be hardened to provide use for more climbers.

Novice and beginner climbers tend to view impacted sites as more acceptable compared to intermediate and advanced climbers. But, the level of acceptability decreases with an increase in impact, with a significant relationship to self-identified skill level. Climbers are perceptive to resource impacts and appear to support management actions that address resource impacts. If managers provide experiences for more experienced groups, they should address resource impacts such that there is little impact on the natural environment. Experienced climbers prefer more natural settings without limits to their access to different sites.

Climbers support management actions that are resource-based, such as trailhead signs detailing the climbing area, improved popular approach trails, signs advising the use of discrete carabineers, and natural barriers to direct climbers. Agreement with these statements suggests that climbers support specific management actions to reduce impacts on the resource. Managers can use this information to support their current restoration projects as well as future project proposals.

Conclusion

There is a significant relationship between climbers' level of experience and their support for resource management actions (e.g. trailhead signs, rehabilitating approach trails, or designating specific approach trails) in support of hypothesis one. There is no significant support for the relationship between crowding management actions (e.g. permits or altering parking) and self-identified skill level. I found no significant relationship between experience level and perceived crowding. I fail to support hypothesis two, as there is no relationship between experience level and crowding.

Looking into different coping factors, and how climbers deal with crowding in the Valley is a suggestion for future studies. For example, I know one site was extremely crowded, but a climber told me that he was “self-regulating his climbing experience.” Even though he felt crowded he may not have reported it in his response, further suggesting a desirability bias. Addressing how climbers cope with crowding at sites they know are going to be crowded would help inform managers on how to deal with any crowding issues that may arise. Alternative resource management actions were based on current actions, or restoration techniques. Other types of restoration outside the realm of what Yosemite NP is planning to do would enhance our understanding. For example, future studies might examine sustainable trails or the use of erosion resistant tiles.

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Appendix A: Visitor Contact Protocol

Administrator: "Hello!
My name is _____ I am working with Oregon State University and I am interested in your opinion of future management actions in Yosemite NP.

Would you like to participate in a short 6 minute survey"?

Climber: No thanks

Administrator: "That's okay; can I ask you a few questions about yourself"? (ask the non-response questions)
----or no----
Administrator: "Okay, thanks for your time, enjoy your visit"!

----or-----

Climber: Sure

Administrator: "Great! We are collecting data on a tablet, are you familiar with this technology"?

Climber: Yes/No

Administrator: "Okay, here is the survey, it should only take 6 minutes, I am here if you have any questions, and I will be back in 6 minutes to collect the tablet. Once you are done the survey will refresh itself, and just return the tablet to me"

(if no) "Okay, here is the tablet, you can easily tap on indicated areas to record your answers and once you are done, the program saves your responses. Do not close the browser and return the tablet to me".

Upon conclusion of the estimated completion time—

Administrator: "Hi do you have any questions"? (address any issues) "Thanks for taking the time to answer our questions, climb on!"

Appendix B: Questionnaire

Climber Preferences Survey

Consent Document

The "Yosemite Valley Climbers' Preferences" study is being conducted for graduate research and is being overseen by Dr. Jo Tynon at Oregon State University. The survey should take about 6 minutes of your time. Participation is voluntary and you may refuse to answer any question(s) for any reason. Responses will be kept confidential to the extent permitted by law. To ensure confidentiality, you are asked to avoid typing your name or contact information on the survey, please use the offered business card to contact the researchers or ethics board. Your responses will be combined with others in a statistical database and reported as a larger group. Surveys will be deleted after responses are entered into this database. As a participant in this study, there are no foreseeable risks to you and there are no direct benefits to you beyond helping to inform management of the current Yosemite Valley climbing experience, of which the final results will be submitted to the National Park Service. Your participation, however, is extremely valued. Your participation in this study is voluntary, you may choose not to participate, or you can choose to omit any individual question. Please confirm that you agree to participate in this study, if you disagree, please mark disagree and return this tablet to the researcher. Thanks for your time!

Your Activities

1) What type of climbing are you primarily participating in during this trip?
( ) Bouldering
( ) Cragging
( ) Sport
( ) Traditional
( ) Big wall
( ) Free soloing
( ) Other: _____

2) What area have you climbed at most recently?
[ ] Ahwahnee Boulders
[ ] Camp 4 Boulders
[ ] Camp 4 Wall
[ ] The Cathedral Spires
[ ] Church Bowl
[ ] Cookie Cliff
[ ] Curry Village Boulders
[ ] El Capitan

[ ] Five Open Books
[ ] Glacier Point Apron
[ ] Housekeeping Boulders
[ ] Leaning Tower
[ ] Manure Pile Buttress
[ ] Pat and Jack
[ ] Washington Column
[ ] Other: _____

3) How many Yosemite Valley climbing trips have you made this year?
_____

4) How many days are you climbing in the Valley this trip?
_____

5) During this trip, how many days are you climbing outside the Valley, but within the park?
_____

6) How many years have you been climbing?
_____

7) How would you rate your experience level?
( ) Novice
( ) Beginner
( ) Intermediate
( ) Advanced

Crowding

8) How crowded did you feel hiking the approach trail?
( ) I have not done this
( ) Not at all crowded
1 ( ) 2 ( ) Slightly Crowded
3 ( ) 4 ( ) 5 ( ) Moderately crowded
6 ( ) 7 ( ) 8 ( ) Extremely crowded
9

9) How crowded did you feel while belaying?
( ) I have not done this
( ) Not at all crowded
1 ( ) 2 ( ) Slightly Crowded
3 ( ) 4 ( ) 5 ( ) Moderately crowded
6 ( ) 7 ( ) 8 ( ) Extremely crowded
9

10) How crowded did you feel while climbing?
( ) I have not done this

( ) Not at all crowded
1 ( ) 2 ( ) Slightly Crowded
3 ( ) 4 ( ) 5 ( ) Moderately crowded
6 ( ) 7 ( ) 8 ( ) Extremely crowded
9

11) Overall, how crowded did you feel today?
( ) Not at all crowded
1 ( ) 2 ( ) Slightly Crowded
3 ( ) 4 ( ) 5 ( ) Moderately crowded
6 ( ) 7 ( ) 8 ( ) Extremely crowded
9

Your opinions of management actions

12) Do you think Yosemite National Park managers have adequate knowledge about climbing to properly manage climbing in the Valley?
( ) Yes
( ) No
( ) I don't know

13) Park managers are interested in your opinion about different management actions to reduce the impact of multiple approach trails to climbing sites around the Valley. Please indicate your level of support for each of the following management actions:

	Strongly Agree	**Agree**	**Somewhat Agree**	**Neutral**	**Somewhat Disagree**	**Disagree**	**Strongly Disagree**
Improve popular	( )	( )	( )	( )	( )	( )	( )

approach trails							
Designate specific approach trails	( )	( )	( )	( )	( )	( )	( )
Informative trail head signs detailing climbing areas	( )	( )	( )	( )	( )	( )	( )
Discrete carabineer signs to indicate approach trails	( )	( )	( )	( )	( )	( )	( )
Provide approach trail maps to popular climbing sites	( )	( )	( )	( )	( )	( )	( )
Pave popular non-Wilderness approach trails	( )	( )	( )	( )	( )	( )	( )
Use natural barriers to direct climbers to climbing sites	( )	( )	( )	( )	( )	( )	( )
Use fences to direct climbers to climbing sites	( )	( )	( )	( )	( )	( )	( )
Managers should	( )	( )	( )	( )	( )	( )	( )

take no action concerning approach trail conditions							

14) People have suggested ways to manage climbing use to reduce crowding or impacts. Please indicate your level of support for each of the following management actions:

	Strongly Support	**Support**	**Somewhat Support**	**Neutral**	**Somewhat Oppose**	**Oppose**	**Strongly Oppose**
Issue permits for overnight big wall climbs	( )	( )	( )	( )	( )	( )	( )
Issue permits for day use climbing	( )	( )	( )	( )	( )	( )	( )
Issue permits for Wilderness climbing	( )	( )	( )	( )	( )	( )	( )
Reduce parking at popular approach trails to limit use	( )	( )	( )	( )	( )	( )	( )
Develop trails to less used climbing areas	( )	( )	( )	( )	( )	( )	( )
Managers should take no action concerning crowding	( )	( )	( )	( )	( )	( )	( )

at approach trails							
Allow climbers to self regulate crowding issues	( )	( )	( )	( )	( )	( )	( )

Your opinion of impacted trails

15) The following statements describe some characteristics of approach trails, please indicate your level of agreement with the following trail condition statements.

	Strongly Agree	**Agree**	**Somewhat Agree**	**Neutral**	**Somewhat Disagree**	**Disagree**	**Strongly Disagree**
The best approach trails should be clear of vegetation	( )	( )	( )	( )	( )	( )	( )
The best approach trails should be wide to carry loads of gear	( )	( )	( )	( )	( )	( )	( )
The best approach trails should be designed to reduce erosion	( )	( )	( )	( )	( )	( )	( )
The best approach trails shouldn't have	( )	( )	( )	( )	( )	( )	( )

switchbacks							
The best approach trails should be free of loose gravel	( )	( )	( )	( )	( )	( )	( )
The best approach trails should have trees and shrubs to grab onto for catching your falls	( )	( )	( )	( )	( )	( )	( )

16) Please choose your top three sites that you think need restoration to help maintain an ecologically healthy approach trail system.
[ ] Ahwahnee Boulders
[ ] Camp 4 Boulders
[ ] Camp 4 Wall
[ ] The Cathedral Spires
[ ] Church Bowl
[ ] Cookie Cliff
[ ] Curry Village Boulders
[ ] El Capitan
[ ] Five Open Books
[ ] Glacier Point Apron
[ ] Housekeeping Boulders
[ ] Leaning Tower
[ ] Manure Pile Buttress
[ ] Pat and Jack
[ ] Washington Column
[ ] Managers should not restore any of the approach trails
[ ] Other: _____

17) The five photos on the question below show varying types of impact conditions. As a climber who uses these trails, please rate the acceptability of the different level of impacts. Ask if you would like to see larger print outs of the same photos.

	Very Acceptable	**Acceptable**	**Somewhat Acceptable**	**Neutral**	**Somewhat Unacceptable**	**Unacceptable**	**Very Unacceptable**
Photo Class 1	( )	( )	( )	( )	( )	( )	( )
Photo Class 2	( )	( )	( )	( )	( )	( )	( )
Photo Class 3	( )	( )	( )	( )	( )	( )	( )
Photo Class 4	( )	( )	( )	( )	( )	( )	( )
Photo Class 5	( )	( )	( )	( )	( )	( )	( )

Preferred Trail

18) Below are two different restoration methods used by trail crews to stabilize eroding approach trails. Please tell us how acceptable you think each of these methods are for use on Yosemite Valley approach trails.Ask if you would like to see larger print outs of the same photos.

	Very Acceptable	**Acceptable**	**Slightly Acceptable**	**Neutral**	**Slightly Unacceptable**	**Unacceptable**	**Very Unacceptable**

Stone Steps	( )	( )	( )	( )	( )	( )	( )
Wood Steps	( )	( )	( )	( )	( )	( )	( )

19) If managers begin developing a management plan, what do you think their primary concern should be?
( ) Addressing bolts
( ) Addressing fixed lines
( ) Camping
( ) Climbing museum
( ) Permits for overnight big walls
( ) Other: _____

And a little bit about yourself

20) What is your gender?
( ) Male
( ) Female

21) What is your country of residence?
( ) United States
( ) Afghanistan
……
( ) Yemen
( ) Zambia
( ) Zimbabwe

22) If you live in the United States, what state do you reside in?
( ) Not Applicable

( ) Alabama
……
( ) Wyoming

23) Please indicate the highest level of education you have completed.
( ) 12th grade or less
( ) Graduated high school or equivalent
( ) Some college, no degree
( ) Associate degree
( ) Bachelor's degree
( ) Post-graduate degree

Additional Comments

24) Please tell us any other thoughts you may have that would help inform climbing management in Yosemite Valley.
_____
_____
_____

Appendix C: Non-Response Bias Form

Non response #	Location	Date	Number of Years Climbing	Reason for Non-Response
1	California	28-Sep	2	time
2	Pines CG	28-Sep	5	time
3	IL	28-Sep	2	time
4	UT	29-Sep	5	time
5	unkn	29-Sep	unk	time
6	Australia	20-Oct	4	time
7	Spain	20-Oct	3	Language
8	BC	20-Oct	5	time
9	Germany	21-Oct	6	Language
10	Seattle	21-Oct	2	non-interest
11	California	22-Oct	5	time
12	California	22-Oct	1	time
13	France	23-Oct	2	Language
14	CO	25-Oct	6	time
15	California	26-Oct	10	time
16	MA	26-Oct	17	lack of YOSE experience
17	California	26-Oct	unk	unkn
18	California	27-Oct	3	time
19	California	1-Nov	6	time
20	California	1-Nov	13	time
21	California	1-Nov	10	time
22	France	2-Nov	15	Language
23	CO	2-Nov	11	Language
24	Oregon	2-Nov	unk	time
25	CO	2-Nov	unk	time
26	MD	2-Nov	7	time
27	MD	5-Nov	10	time
28	UT	5-Nov	1	time/disinterest
29	California	6-Nov	1	lack of YOSE experience
30	Ukraine	6-Nov	3	Language
31	Ukraine	6-Nov	1	Language
32	New Zealand	8-Nov	6	time
33	California	9-Nov	5	time
34	California	9-Nov	1	time
35	California	9-Nov	2	time
36	IL	9-Nov	1	time/lack of knowledge
37	California	10-Nov	5	time
38	California	10-Nov	10	time
39	California	10-Nov	12	time

40	Australia	10-Nov	2	time/lack of knowledge
41	Australia	10-Nov	5	lack of YOSE experience
42	New Jersey	10-Nov	3	time
43	California	10-Nov	4	time
44	California	11-Nov	10	time
45	Idaho	11-Nov	13	time
46	Germany	11-Nov	5	Language
47	Oregon	11-Nov	2	time
48	Oregon	11-Nov	10	time
49	Unkn	11-Nov	unkn	Language

Appendix D: Sampling Schedule

September 2013

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
						AM VC; PM VC
29	30					
AM VC; PM VC						

Notes:

AM Sampling begins at 8:00 AM and PM Sampling begins at 3:00. C=Churchbowl sample site, 4=Camp 4 sample site, EC=El Cap, VC=Visitor Center

October 2013

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
		GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN
6	7	8	9	10	11	12
GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN
13	14	15	16	17	18	19
GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	GOV SHUTDOWN	AM EC; PM Man
20	21	22	23	24	25	26
PM 4	AM C; PM C	AM Man; PM C	AM C; PM C	AM EC	AM EC; PM C	AM C; PMEC
27	28	29	30	31		
AM 4; PMEC						

Notes:

AM Sampling begins at 8:00 AM and PM Sampling begins at 3:00. C=Churchbowl sample site, 4=Camp 4 sample site, EC=El Cap, VC=Visitor Center

November 2013

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
					Am C; PM M	AM EC; PM C
3	4	5	6	7	8	9
		AM EC; PM C	AM EC; PM 4	AM C; PM EC	AM 4; PM EC	AM EC; PM 4
10	11	12	13	14	15	16
AM EC; PM C	AM EC; PM 4					
17	18	19	20	21	22	23
24	25	26	27	28	29	30
	Notes:					
	AM Sampling begins at 8:00 AM and PM Sampling begins at 3:00. C=Churchbowl sample site, 4=Camp 4 sample site, EC=El Cap, VC=Visitor Center					