

Desirability of Conditions in Rock Climbing Site Selection

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This study examined the desirable conditions and importance placed on these conditions by climbers when choosing sites that match their climbing styles. A literature review identified the different explanatory variables related to a climber's desired style of climbing (bouldering, top rope, hybrid) when deciding to choose a particular site. Three separate data sets were analyzed to determine the similarities and dissimilarities of the explanatory variables for each climbing style. The relative weights were estimated using a mathematical model. Findings revealed that the quality, variety, and difficulty of climbs, and the quality of the natural surroundings, are the site conditions all climbing styles consider most when deciding to visit a climbing site. By identifying those conditions of importance to climbers, resource managers may be more efficient in administering climbing policies and planning appropriate site modifications especially with the assistance of climbers. Implications for both managers and practitioners are presented and discussed.

KEYWORDS: rock climbing, site conditions, site selection

There continues to be a growing interest in rock climbing throughout the United States, (Outdoor Foundation, 2009) transforming it into a highly specialized outdoor activity requiring climbers to possess a variety of skills, employ a range of techniques, utilize an assortment of equipment, and seek out climbing areas depending on the style of climbing practiced (Cox & Fulsaa, 2010). With the current interest and growth in rock climbing, it is important for resource managers to learn more about the conditions rock climbers use to select climbing sites and to respond accordingly in order to optimize the quality of the climbing experience. By identifying the desired conditions of importance to climbers, resource managers may become more efficient in administering climbing policies and planning appropriate site modifications.

Literature Review

Given the above parameters, the purpose of this study was to examine the variety of desirable conditions, and the importance placed on these conditions by climbers when choosing sites that match their climbing styles. Climbers tend to be a diverse group of recreationists, differing in their location choices, styles, and climbing methods (Cox & Fulsaa, 2010; Freeman, McAvoy, & Lime, 1997; Hollenhorst, 1990). Most evident are the various styles of climbing. Bouldering, top-rope, and hybrid were the climbing styles explored in this study.

Bouldering is a style of climbing undertaken without a rope, and close to the ground where falls are usually short and inconsequential (Leubben, 2004). Bouldering is a highly social activity, primarily attracting younger climbers. Emphasis is placed on the difficulty and quality of the boulder problem, and a variety of social, economic and cultural factors (e.g. low cost of entry, accessibility, climbing in small groups of 2-6 people, and camaraderie) associated with the activity (Attarian & Keith, 2008).

Top-rope climbing is a popular format for both beginning and experienced climbers whereby the rope runs from a belayer positioned at the base of a climb, through an anchor system at the top of the climb, and back down to the climber. Climbers practicing top-rope climbing usually identify sites where the climb itself and anchors for securing the rope are easily accessible. Other desirable conditions for top roping include the quality, difficulty, and variety of climbs (Hollenhorst, 1990).

Although not used in climbing circles, researchers have used the term “hybrid climber” as a label to describe those climbers that practice both sport and traditional climbing (Schuster, Thompson, & Hammitt, 2001). Sport climbing relies on permanent anchors placed in the rock and emphasizes the climber’s gymnastic ability, strength and endurance, while eliminating the need to place protection while climbing (Long, 1997). Sport climbers prefer accessible climbing routes that are relatively close to parking, and routes of similar difficulty that are clustered together (Carr, 2005; Waldrup & McEwen, 1994). Traditional (or *trad*) climbing involves the climber temporarily placing protective devices in the rock and subsequently clipping the rope into this equipment (Leubben, 2004). In contrast to sport climbers, traditional climbers favor settings that reflect solitude, quiet, and scenery (Waldrup & McEwen, 1994). Difficult, high quality climbs, length of approach trails, and the presence of overhanging rock are additional site considerations favored by traditional climbers (Carr, 2005).

Climbers make choices on climbing destinations based on the type of climbing in which they participate (Mathieu, 2009). The literature suggests that climbers’ preferences usually extend beyond the traditional rating systems that describe the overall difficulty of climbs to a variety of other temporary and permanent climbing conditions (e.g., crowding and access) (Hanley, Wright, & Koop, 2002; Mathieu, 2009).

When modeling the demand for Scottish rock climbing sites, Hanley, Mourato, and Wright (2001) found that climbers rated the quality of the climb as an important condition for choosing a climbing site. Climbers favor longer high quality climbs in scenic areas, shorter approach times, and small crowds (Hanley et al. 2002). Scarpa and Thiene (2004) noted that the mountain environment, difficulty of climbs, ability of climbers, number of shelters, the number of climbing routes, and the ease of access to the climbing site were important explanatory variables. Climbers in Tennessee's Obed Wild and Scenic River identified rock quality, the number and difficulty of climbs, availability of sport climbing, good protection, solitude, and scenery as the most important conditions they took into consideration when choosing a climbing site (Sims & Hodges, 2004). Similar conditions were reported by Murdock (2010) who noted that climbers in Joshua Tree National Park looked for high quality sites within their climbing ability that offered solitude.

The difficulty of a climbing route is an important characteristic that attracts climbers to a particular area (Delignières, Famose, Thépaut-Mathieu, & Fleurance, 2003; Scarpa & Thiene, 2004). Difficulty-rating scales for rock climbing routes were developed to provide climbers with a mechanism for evaluating their progress and abilities to meet or exceed their current skill level. A climber attempting anything harder or more demanding than their technical ability may be exposed to injury, failure, or both (Shaw & Jakus, 1996).

Georinaide (2005) investigated conditions important to rock climbers when choosing to visit a state or federally managed rock-climbing area. Using a nominal regression model, the author described the relationships between one state and two national park units, and conditions considered desirable by climbers when choosing between one of the three sites. Results indicated significant differences between the three climbing sites and six attributes: (1) number of available sport climbs (2) number of available top-rope climbs, (3) access to climbing areas, (4) availability of camping, (5) regulations governing site use, and (6) the presence of park rangers.

When choosing to visit a site, climbers also consider other factors: climbers' technical abilities (Shaw & Jakus, 1996), the specific settings and conditions of the climbing routes (Merrill & Graefe, 1997), proximity to the climber's home, the availability of camping (Rapejle, 2004), and the number of climbing sites in a given region (Cavlovic, 2000). Climate and weather have an influence on the type of climbing and degree of use a climbing site receives, and may also affect climbers' decisions in planning trips (Brandenberg & Arnberger, 2001; Cavlovic, 2000; Mitchell, 1983).

In summary, the literature appears to indicate four primary factors important to the selection of a climbing site: *environmental conditions*, such as climate, weather, and the natural conditions (Cavlovic, 2000; Hanley et al., 2002; Merrill & Graefe 1997; Murdock, 2010; Rapejle, 2004; Sims & Hodges 2004); *conditions of the climbing site* including the quality, variety, number, and difficulty of climbs; the availability of anchors, and availability of shelter (Georinaide, 2005; Hanley, et al., 2001; Hanley et al., 2002; Murdock, 2010, Rapejle, 2004; Scarpa & Thiene, 2004; Sims & Hodges, 2004; Waldrup & McEwen, 1994); the *social conditions* of crowding and conflict (Georinaide, 2005; Hanley et al., 2002; Murdock, 2010); and *management conditions* (regulations, access, facilities, and the presence of management personnel) (Georinaide, 2005; Hanley et al., 2002; Rapejle, 2004).

It is the authors' contention that climbers also take into consideration a range of conditions when deciding which sites to visit for their desired style of climbing. At the very least, it is clear that climbers make choices about visiting a site based on the physical characteristics of the area and their individual skills and abilities (Morey, 1981). Therefore the primary factors and concepts identified in the literature review provide the both the motivation and foundation for this study.

The primary research questions guiding this study were:

- R1. What conditions are most desirable for climbers deciding to visit a particular climbing site?
- R2. Do desirable conditions differ across the different styles of climbing?
- R3. Is the site condition model employed effective in determining the desirable conditions climbers choose when practicing a specific type of climbing?
- R4. What are the management implications, based on the above findings?

Method

The study methods were based on the concept of mathematical expectations (an important characteristic of the probability distribution of a random variable) and the set of explanatory variables that identify the desirability of the varying considerations about the climbing conditions identified in the literature review (Ross, 2007). If we assign the letter w to the weight a climber places on the desirability of a varying condition X , we can express the expectation as wX . We can extend the concept of expectations to include K other explanatory variables, X_1, X_2, \dots, X_K , which we assume to be discrete random variables. The respective weights, w_1, w_2, \dots, w_K , can assume different values in desirability and the weights sum to one.

We express the expectation (E) of X with the value function,

$$E(X) = \sum_{j=1}^K w_j X_j,$$

where, $j = 1, \dots, 16$ explanatory variables¹. For a more comprehensive introduction to the concept of the expected value of random variables, see Taylor III (1999, pp. 514 - 516).

Data Collection

Data for this study were gathered from a sample of three unique climbing destinations: Crowder's Mountain State Park, North Carolina (top roping); New River Gorge National River, West Virginia (hybrid climbing); and the Grandfather Mountain Corridor, North Carolina (bouldering). Each of the three sites were initially surveyed as stand-alone rock climbing studies (Table 1). The New River Gorge study gathered baseline information for assisting the National Park Service in the development of a climbing management plan for the New River Gorge National River. The study conducted at the Grandfather Mountain Corridor gathered information to assist managers in making a series of decisions related to the future of climbing in this area. The overall goal of the research at Crowders Mountain was to develop a set of practices to assist managers in mitigating the impacts caused by guided rock climbing in the park.

Data for top-rope climbing. Crowders Mountain State Park, located near Charlotte, North Carolina has approximately 140 documented rock climbs and is considered by many to be an exceptional regional top-rope climbing destination (Busch, 2008; Lambert & Shull, 2002).

¹ For a list of the explanatory variables used in this study see Table 2.

Potential respondents' names and addresses were gleaned from mandatory climbing and rappelling permits. Park personnel estimated that 90% of the individuals who climbed in the park completed permits (M. Derstine, personal communication, October 11, 2001). The names and addresses of the individuals who completed the climbing and rappelling permits between October, 2001, and May, 2002, were recorded. Duplicate names and addresses were removed. Non-respondents and 441 individuals drawn randomly were mailed the questionnaire. In total, 170 usable questionnaires were returned and analyzed (39% response rate).

Data for hybrid climbing. New River Gorge National River is an important national climbing destination that contains over 1600 recorded rock climbs (Cater, 2006). Almost one half (45%) of the visitors are hybrid climbers (Ramthun & Blake, 2002). Data were collected on-site, on randomly selected week and weekend days from 297 climbers exiting three primary access points. A mail-back questionnaire was sent within one week of contact, and 148 usable questionnaires were returned (response rate of 53.4%).

Data for bouldering. Grandfather Mountain Corridor is located on the Blue Ridge Parkway near Blowing Rock, North Carolina. The area, known for excellent bouldering, contains over 400 boulder problems and has been referred to as "bouldering's holy grail" (Young, 2001, p. 70). Data were collected on-site, on randomly selected week and weekend days from 177 climbers at three primary access points. A mail-back questionnaire was sent within one week of contact, and 90 usable questionnaires were returned (response rate of 50.8%).

Table 1

Climbing Site Information

Information	New River Gorge (Hybrid)	Crowder's Mountain (Top-Rope)	Grandfather Mountain (Bouldering)
Location	Glen Jean, WV	Kings Mountain, NC	Blowing Rock, NC
Management	NPS	NC State Parks	NPS
Available climbs	1900+	140+	600+
Primary type of climbing	Hybrid	Top-rope	Bouldering
Sampling	On-site interviews	Random sample	On-site interviews
Data collection	Mail-questionnaire	Mail-questionnaire	Mail-questionnaire
Sample size	148	186	90
Response rate	53.4%	42.2%	50.8%
Survey dates	4-9/1997	10/2001-5/2002	10/2003-11/2004
Climber's sex	80% male	91% male	81% male
Mean age	28 years	31 years	28 years
Mean yrs. climbing	3.6	8.2	8.4
Mean miles from home	375 (one way)	93 (one way)	98 (one way)

Each of the three independent surveys had one section with a similar set of questions asking respondents to consider the desirability of the listed conditions when choosing a rock climbing a site. Respondents were asked to rate the desirability of each varying condition based on five-point response scales (1 = not desired, 3 = neutral, 5 = highly desired) for the Crowders Mountain and Grandfather Mountain Corridor surveys. The New River Gorge items had a nine-point response scale (1 = not desired, 5 = neutral, 9 = highly desired²). The same question on the three questionnaires was: *Listed below are the conditions that you might consider when choosing a rock climbing site. Please think about each condition and circle the number that best indicates how desirable or undesirable it is to you when selecting a climbing area.*²

Analysis

To identify the mean differences in the sample data for each of the 16 explanatory variables by the differing climbing styles, a series of one-way analysis of variance tests were conducted. One of the assumptions of the analysis of variance statistic is that the within-group variances of the respondents' mean responses from the different sample sites are all the same, i.e., they exhibit homoscedasticity. If the variances are different among the climbing styles, they exhibit heteroscedasticity. The probability of obtaining a statistically significant result for an explanatory variable is true even though we assume that the responses are no different for that variable when it is greater than the desired significance level. If the level of heteroscedasticity is high, the one-way analysis tests results can be seriously misleading (Handbook of Biological Statistics, 2010). Bartlett's test evaluated the null hypothesis that all the climbing style sample variances were equal against the alternative that at least two are different. The null hypothesis was rejected when the chi-square value was less than or equal to 0.05.

Estimating Variable Weights

As specified earlier by the expected value function (Equation 1), as a decision-making criterion, the weights of the explanatory variables in explaining a climber's decision to take the most recent site visit were estimated. A mathematical program for the sample size of N climbers allowed for the estimation of the weights (w),

$$\begin{aligned} & \text{Min } \sum_{i=1}^N \sum_{j=1}^N w_j (X_{ij} - \bar{X}_j) \\ & \text{subject to} \\ & w_1, w_2, \dots, w_{16} \geq 0 \\ & w_1, w_2, \dots, w_{16} \leq 1 \\ & w_1 + w_2 \dots w_{16} = 1. \end{aligned}$$

The variance in the distributions of the various desirability measures for each of the 16 explanatory variables (X) was minimized for the purpose of estimating the weights separately using the optimizer in Microsoft's Excel Solver for each of the three climbing styles. In effect,

² The nine-point item response scale for the explanatory variables in the New River Gorge instrument was collapsed into a five-point response scale for comparison purposes with the other on-site surveys. The recoding followed this action: 1, 2 = 1; 3, 4 = 2; 5 = 3; 6, 7 = 4; 8, 9 = 5.

we should find the following outcome to be true for each explanatory variable: the greater the amount of agreement among respondents about their expectations regarding the desirability of that variable in deciding to take recent trips, the lower the amount of variance in the distribution of that variable's weight, and the higher the desirability of that consideration among respondents for their last visits.

Results

Overall, 424 usable questionnaires from the three separate datasets were collected and analyzed. The average respondent age was 29 years, and well over three-fourths (84%) were male. Respondents reported an average 6.7 years of climbing experience. Table 2 shows the remaining differences between climbing styles and the explanatory variables.

Explanatory variables exhibiting heteroscedasticity by respondents in their considerations about their last site visits were the number of sport climbs, top-rope climbs, availability of parking, ranger presence, and the rules and regulations (Table 2). The heteroscedasticity present in the number of sport climbs and top-rope climbs expected was given that respondents were contacted at sites primarily catering to those types of climbing styles. The remaining explanatory variables had satisfactory within-group variances. However, no significant mean differences between the different types of climbing styles were noted for the number of traditional climbs ($F = 0.055$) and the presence of other climbers ($F = 0.662$), suggesting that the presence of other climbers was neither desirable nor undesirable to the respondents when selecting a climbing site. The significant differences across each explanatory variable in deciding to visit climbing sites are described in the next section.

Desired Site Conditions

Table 3 displays the weightings for each of the 16 explanatory variables by climbing styles and hence, the overall intensity of their desirability in meeting the expectations of the respondents. The research questions addressed the varying, potential site conditions climbers consider most or least desirable when deciding to visit climbing sites, and the relative importance or weights given those considerations by respondents. The variables quality, variety, and difficulty of the climbs, and quality of the natural surroundings displayed higher weights ($w > 5.0$) and therefore the most desirable site conditions noted by all climber types. The availability of anchors was identified as a desirable site condition for top-rope climbers, and the availability of parking was important to both top-rope and bouldering participants. The availability of campsites was a desirable site condition for hybrid climbers along with access to climbing areas. Least desirable ($w < 5.0$) were the regulations that governed an area and the presence of rangers.

The model successfully predicted the desirable conditions and importance placed on these conditions by climbers in choosing sites that matched their climbing styles. Climbers with specialized styles differed in their opinions about the desirability of certain climbing conditions. The weights (w) reported in this investigation support the notion that quality of the climb is one of many important conditions for choosing a climbing site. All three climbing styles placed importance on the quality of climbs. Apparently, top-rope ($w=9.7$) and hybrid climbers ($w=11.8$) differed on the importance they placed on the quality of climbs. Minor differences were also noted in the weighted preferences between top-rope climbers ($w=9.7$) and bouldering participants ($w=8.3$). Similarly, differences appear between top-rope ($w=9.7$) and hybrid climbers ($w=11.8$). Differences were also noted on the difficulty of climbs between top-rope climbers ($w=6.5$) and hybrid climbers ($w=7.6$). Further analysis revealed mean differences between top-rope climbers and bouldering, and bouldering and hybrid climbers for the difficulty variable.

Table 2

Mean Differences of Explanatory Variables by Climbing Styles

Explanatory variable Climbing style	Mean (SD)	F-value	Bartlett's test	Mean differences
Quality of climbs				
Top-rope climbers	4.50 (.643)	0.002	0.163	Top-rope, Hybrid
Bouldering	4.61 (.648)			
Hybrid climbers	4.74 (.560)			
Variety of climbs				
Top-rope climbers	4.44 (.699)	0.020	0.968	Top-rope, Bouldering Bouldering, Hybrid
Bouldering	4.21 (.710)			
Hybrid climbers	4.44 (.712)			
Difficulty of climbs				
Top-rope climbers	4.20 (.787)	0.002	0.942	Top-rope, Bouldering Bouldering, Hybrid
Bouldering	3.77 (.804)			
Hybrid climbers	4.14 (.808)			
No. of sport climbs				
Top-rope climbers	3.62 (1.00)	0.000	0.010	ns
Bouldering	2.80 (.901)			
Hybrid climbers	3.91 (1.18)			
No. of traditional climbs				
Top-rope climbers	3.59 (1.03)	0.055	0.353	ns
Bouldering	3.55 (1.00)			
Hybrid climbers	3.84 (1.13)			
No. of top-rope climbs				
Top-rope climbers	4.02 (1.07)	0.000	0.000	ns
Bouldering	2.81 (.934)			
Hybrid climbers	2.82 (1.36)			
Availability of anchors				
Top-rope climbers	3.97 (.923)	0.000	0.819	Top-rope, Bouldering Top-rope, Hybrid Bouldering, Hybrid
Bouldering	3.27 (.971)			
Hybrid climbers	4.33 (.958)			
Access to climbing areas				
Top-rope climbers	3.67 (.992)	0.000	0.613	Top-rope, Bouldering Top-rope, Hybrid Bouldering, Hybrid
Bouldering	3.10 (.912)			
Hybrid climbers	4.19 (.994)			
Proximity from home				
Top-rope climbers	3.62 (1.05)	0.002	0.596	Bouldering, Hybrid
Bouldering	3.44 (1.00)			
Hybrid climbers	3.89 (.976)			

Table continues.

Table 2 (cont'd).

Availability of campsites				
Top-rope climbers	3.16 (1.01)			Top-rope, Bouldering
Bouldering	2.77 (.871)	0.000	0.105	Top-rope, Hybrid
Hybrid climbers	4.20 (.872)			Bouldering, Hybrid
Availability of parking				
Top-rope climbers	3.48 (.866)			
Bouldering	3.62 (.855)	0.000	0.008	ns
Hybrid climbers	3.97 (1.07)			
Ranger presence				
Top-rope climbers	3.20 (1.00)			
Bouldering	2.40 (.699)	0.000	0.000	ns
Hybrid climbers	2.85 (1.22)			
Regulations				
Top-rope climbers	2.92 (1.05)			
Bouldering	3.16 (.962)	0.000	0.002	ns
Hybrid climbers	2.60 (1.31)			
Natural surroundings				
Top-rope climbers	4.15 (.755)			Top-rope, Hybrid
Bouldering	4.34 (.736)	0.000	0.138	Bouldering, Hybrid
Hybrid climbers	4.64 (.648)			
Presence of other climbers				
Top-rope climbers	3.05 (.885)			
Bouldering	3.08 (.856)	0.622	0.098	ns
Hybrid climbers	2.97 (1.02)			
Presence of other visitors				
Top-rope climbers	2.74 (.991)			Bouldering, Hybrid
Bouldering	3.00 (.899)	0.003	0.240	
Hybrid climbers	2.54 (1.05)			

Additional Site Conditions

Reviewing the pattern of differences (Table 3) revealed climber access ($w=5.0$) and camping ($w=6.4$) more important to hybrid climbers when compared to other climbing styles. Parking is a desired site condition for top-rope climbers ($w=5.1$) and boulderers ($w=5.4$). Regulations (top-rope $w=3.4$, bouldering $w=4.0$, hybrid $w=2.6$) and the presence of other visitors (non-climbers) (top-rope $w=3.8$, bouldering $w=4.4$, hybrid $w=3.1$) were site conditions identified by all three climbing styles as unimportant factors taken into consideration when choosing a climbing site. The availability of anchors was a desirable condition for top-rope climbers ($w=5.4$).

Table 3

Weights of Explanatory Variables in Respondents' Decisions to Visit the Climbing Sites

Variable	<u>Top-rope</u>	<u>Bouldering</u>	<u>Hybrid</u>
	Crowders Mountain	Grandfather Mountain	New River Gorge
Quality of climbs	9.7	8.3	11.8
Variety of climbs	7.5	7.3	9.0
Difficulty of climbs	6.5	5.8	7.6
Number of sport climbs	4.4	4.2	3.7
Number of traditional climbs	3.9	4.4	4.2
Number of top-rope climbs	4.1	4.2	2.6
Availability of anchors	5.4	4.4	4.8
Access to climbing areas	4.8	4.6	5.0
Proximity from home	4.4	4.3	4.7
Availability of campsites	4.1	3.9	6.4
Availability of parking	5.1	5.4	4.5
Ranger presence	3.8	4.2	2.8
Regulations	3.4	4.0	2.6
Natural surroundings	7.0	7.3	7.5
Presence of other climbers	4.8	4.7	3.9
Presence of other visitors	3.8	4.4	3.1

Discussion

The purpose of this study was to examine the variety of preferable conditions and the importance placed on these conditions by climbers in choosing sites that match their climbing styles. This study relied on data sets 6-12 years of age. Since the original data were well documented and prepared, we were able to add value to the original data. Recognizing this we elected to use this information for a number of reasons. First, data were readily available to test our site condition model and investigate the preferred conditions rock climbers consider when selecting a climbing site. Second, the current investigation provided us with baseline information with the intent of answering future research questions and testing new models, and third, use of the existing data will allow us to conduct comparative investigations across areas and over time.

Each of the research questions related to desired site conditions were answered. Conditions most desirable for climbers include the quality, variety, and difficulty of the climbs, and quality of the natural surroundings. Mean differences in quality were noted between top-rope and hybrid climbers. The characteristics associated with a quality rock climb include solid rock, consistent grade, and aesthetic line on the formation, good views, low popularity, and a

high star rating³. One explanation for this difference can be attributed to the number of available climbing routes at each of the two locations. According to guidebooks there are 140+ documented rock climbing routes at Crowder's Mountain State Park (Lambert & Shull, 2002) in comparison to over 1900 in the New River Gorge (Cater, 2006), where there are limited top-rope climbing routes. Therefore, the larger number of climbing routes found in the New River Gorge suggests that a greater number of opportunities for a hybrid climber exist to choose higher quality climbs.

Variety was also identified as a desirable factor that attracted all three climbing styles to a climbing site. Variety notes the number and diversity of rock climbs or boulder problems found in a particular area. Variety can also include the different types of climbing available in that same area (e.g. face, crack, or slab climbing). Here again, the type and size of an area and the number of existing climbs may be a factor. Crowders Mountain is a top-rope area with no (or very limited) opportunities for bouldering, and is relatively small in area when compared to the New River Gorge (63,000 acres) (New River Gorge, 2008). The New River Gorge because of its large acreage provides a greater variety of climbs from which to choose. A common factor affecting variety at a popular bouldering area like the Grandfather Mountain Corridor is access to a high concentration (600+) of boulder problems. In all instances, climbers desire variety in a climbing area or on a specific climbing route that makes the rock climb or boulder problem unique.

Data analysis also revealed mean differences between top-rope, bouldering, and hybrid climbing for the variable difficulty of climbs. Researchers determined that difficulty of a climbing route is an important characteristic that attracts climbers to a particular area (Delignières et al., 2003; Scarpa & Thiene, 2004). The difficulty of a climbing route is a subjective rating given the climb by the first ascentionists. The Yosemite Decimal System (YDS) was created by climbers to assign numerical values to climbing routes that rate the difficulty of rock climbs in North America (Cox & Fulsaa, 2010). Difficulty of a rock climb ranges in values from 5.0 to 5.15; the higher the number the harder the climb. Climbers in general placed greater importance on the difficulty of climbs with the tendency to select sites having routes that match their skill levels. Compared to top-rope climbers at Crowders Mountain, a larger number of more difficult climbing routes are located at the New River Gorge. Like quality and variety, the highly difficult climbing routes at the New River Gorge may explain the difference between the two sites. A similar explanation may also account for the difficulty of boulder problems found in the Grandfather Mountain Corridor.

The natural surrounding or setting is a primary element of the outdoor recreation experience and a highly rated motive for participation (Morey, 1981). Although the differences regarding the desirability of the natural surroundings are slight among climbers (top-rope $w=7.0$, bouldering $w=7.3$), the tendency is for hybrid climbers ($w=7.5$) to place a greater importance on natural surroundings when choosing a climbing site. In this study, the natural setting is an extremely desirable condition climbers took into consideration when choosing a climbing site. In all cases, each of the three study areas exhibit high scenic quality, since each represent a state park and units of the National Park system. For this reason, rock climbers are attracted to these natural areas as a backdrop for their climbing experiences, to get close to nature, and to achieve the satisfaction from pursuing the sport.

Findings also suggested that various facilities or conveniences (e.g. anchors, camping, parking, and access) specific to the style of climbing being practiced are important site features

³ A "star" rating in climbing guidebook refers to how remarkable (or un-remarkable) the route is to climb. 5 stars imply that the climb is spectacular to climb, whereas 1 star means that the route is not so good.

the practitioner (climber) considers when choosing a climbing site. Differences in the expected value of anchor availability were cited as a desirable condition, particularly to top-rope climbers ($w=5.4$). To safely attach the rope in a top-rope climbing system, adequate anchors are required. Hybrid climbers also placed some importance on anchor availability ($w=4.8$). In the New River Gorge, anchors are permanently and strategically placed along the entire climbing route (for sport routes) and natural features (i.e. cracks) are available for those practicing traditional climbing. Anchors are not used in bouldering, and therefore not a desired site condition ($w=4.4$).

The availability of camping is a desirable site consideration for hybrid climbers ($w=6.4$) since the average climbing trip to the New River Gorge lasts over three days ($mean=3.6$ days) (Attarian, 1999b). Multiple day trips require overnight lodging and therefore require the climber to plan ahead. This is important for climbers visiting the New River Gorge, where no National Park Service camping is available. However, camping is available at multiple area locations with one campground catering exclusively to climbers (Cater, 2006). In contrast, camping was not a desirable condition for bouldering participants ($w=3.9$) since most visiting the Grandfather Mountain Corridor are local climbers traveling a median distance of 22.5 miles to the bouldering trailhead and therefore don't anticipate overnight accommodations (Attarian, 2005).

Parking was identified as a desirable site condition for both top-rope climbers ($w=5.1$) and bouldering participants ($w=5.4$). Parking lots are placed strategically at or near trailheads to allow climbers access to climbing and bouldering sites (e.g. Crowders Mountain). Some have limited spaces and have to be shared with other visitors. Once parking lots are filled to capacity, climbers and others wait for a space to open or are forced to park elsewhere, sometimes illegally. During busy weekends parking comes at a premium. Climbing sites may develop their own informal parking areas, including road shoulders and pullouts (e.g. Grandfather Mountain Corridor), or may lead to increased use of existing parking areas. Because of dispersed use, parking is not an important site condition for hybrid climbers ($w=4.5$).

Access is a desirable factor that practitioners consider when planning a climbing trip (Georinaide, 2005; Scarpa & Thiene, 2004). Access to a climbing area involves approaching, entering and exiting a climbing site, the amount of time it takes to reach a chosen climbing route, whether or not access is through public or private land, and whether or not the climbing site is open to climbing. Access is likely to be perceived differently by climbers for a variety of reasons. For example, climbers may desire sites with difficult access to climbs to get away from crowding. The access situation at the New River Gorge ($w=5.0$) requires climbers to drive and then hike to the various sites, and in some cases, rappel the cliff face to access the climbing routes (Cater, 2006).

The unimportance of the reported social and management conditions by hybrid climbers relative to each of the other climbing styles may be explained by topography. The expansiveness of the New River Gorge coupled with dispersed climbing areas tends to spread out climbers; therefore, climbers do not concern themselves with the presence of other visitors. This finding is supported by Ramthun and Blake (2002) who determined that 60% of hybrid climbers reported that social interference (the presence of other visitors) had no effect on their climbing experience. Alternatively, Crowders Mountain top-rope climbers expect to encounter other climbers (over 8,000 climber visits per year) and visitors since the state park is located in one of the most populated metropolitan areas in North Carolina. Consequently, climbers are conditioned to the presence of other climbers and visitors and therefore, the desirability of this consideration is less likely to influence their visits (Crowders Mountain State Park, 2002).

Overall, results revealed that the model was successful in predicting the desirable conditions and importance placed on these conditions by climbers choosing sites that matched their climbing styles. By identifying the desirability of those varying conditions of importance to climbers, site managers may be better able to meet the climbing needs of this specialized sport.

This exchange of information can assist officials in the implementation of work plans, development and modification of existing policies, and maintaining climbing resources. In doing so, the integration of the significant climbers' views from this study must be balanced with the relevant site examinations by officials to sustain climbing resources. The following section addresses the implications based on the study results and incorporates examples of management and practitioner practices to support each.

Implications for Managers and Practitioners

Faced with a limited climbing resource base and increasing demands, managers must decide how much and what kinds of climbing use are acceptable, recognizing that any visitation, climbing or otherwise, has the potential to generate some degree of resource damage. Managers must clearly and openly define when climbing related changes (environmental, social, managerial, conditions of the climbing site) become unacceptable, requiring management involvement. If the goal of managers is to increase visitors, research and monitoring can inform such decisions, but managers must make them, preferably in consultation with the climbing community.

On the other hand, practitioners have become more proactive by educating themselves on the actions they can take to enhance and preserve their climbing experience by becoming more aware of the factors that are important to them when choosing a climbing site. Given the desirable conditions described above, what can park and protected area managers and practitioners do to manage the climbing resource? The following discussion presents examples of current practices that have been implemented to manage the climbing experience and improve site conditions.

Collaborative management. Traditionally, practitioners of one type or another (e.g. climbers, guides, university/college outdoor program providers, climbing gyms, and other leisure service organizations) have shared in the responsibility of managing and maintaining climbing resources by collaboratively working with resource managers to directly enhance the various conditions climbers find preferable when choosing to visit a climbing area. Given today's fiscal and other constraints, practitioners and Local Climbing Organizations (LCO) may be valuable resources in helping agencies achieve management and maintenance goals, and in turn improve various site conditions (Keough & Blahna, 2006).

Collaboration has been effective in creating positive relationships with area managers and meeting the needs of practitioners, especially as they pertain to site conditions (Attarian, 1999a). The Access Fund, a non-profit organization representing the climbing community dedicated to keeping climbing areas open and conserving the climbing environment, has been instrumental in providing the impetus in organizing and educating climbers nationwide. The Access Fund has also been successful working with federal, state, and local land managers on a variety of climbing and environmental issues (Access Fund, 2010). Conversely, practitioners have been less supportive when management actions limit or abolish climbing and bouldering opportunities without consultation (Frauman, Collette, & Weller, 2007).

Information and education. Management actions can indirectly influence climber preferences by providing (or not providing) practitioners with reliable and timely information on environmental conditions. In other instances, managers, through direct management approaches, influence climbers by refusing to maintain anchors, closing trails, closing sites, or prohibiting climbing, and thereby controlling their climbing options. Practitioners usually contribute to this information by updating and writing guidebooks, creating and providing websites, maintaining

anchors and trails, conducting and assisting in research, and keeping management abreast of local ethics and concerns. These actions may lead (and usually do) to more preferable site and management conditions for climbers⁴.

Quality, variety, difficulty, and natural setting. The natural setting of a climbing or bouldering area can be associated with a satisfying climbing experience, and requires official focus on maintaining the existing vegetation; improving trail conditions, staging areas, and cliff faces. Maintaining the staging areas directly beneath the climbing or bouldering route is one means of preventing further soil erosion and improving the naturalness of a climbing area. On some occasions informal trails are established as climbers make repeated visits to climbing routes and consequently, are subject to erosion or adversely affect the aesthetic values of the site. Managers respond by conducting trail inventories (in some cases with climber assistance) to eliminate unnecessary social trails (City of Rocks National Reserve, 1988; Joshua Tree National Park, 1998). Other management options include signage, distributing brochures, kiosk placement, and posting information about site advisories or area closures. Other strategies may include redistributing use by making access to an area difficult, or altering trails to climbing areas. Other practitioner and manager approved approaches include educating bouldering participants to limit group size, and scrub chalk from hand-holds to increase the quality and naturalness of the climbing routes (Attarian & Keith, 2008), require climbers to pack out their waste in a biodegradable bag system (Friends of Indian Creek, 2008), or strict enforcement of a pet policy (Smith Rocks State Park, 2008). Through their involvement with LCOs, practitioners contribute time, effort, and money to conduct trail work, litter clean-ups, search and rescue, and other work necessary to maintain climbing areas.

Managing and monitoring the climbing route can improve the quality, variety, and difficulty of rock climbs. This can be achieved by creating new route committees that oversee the development of new routes. New route committees are comprised of practitioners and resource managers responsible for polling the climbing community to determine whether or not they support new route proposals (Action Committee for Eldorado, 2009). Because of liability concerns, managers in all publicly managed climbing areas do not install, inspect, or maintain fixed anchors. Instead, most land management agencies relinquish these practices to LCOs. (Action Committee for Eldorado, 2009; Ellis, 1999).

Camping and parking. Campsites are an important component of the climbing experience for many climbers, and therefore recommended. Campsites should include conveniences like toilet facilities and parking. In high-use areas officials should encourage low-impact camping practices, site monitoring, designation of bivouac sites, permit requirements, or in some cases provide a primitive facility with limited resources (Attarian & Keith, 2008).

Parking issues usually include the demand for parking exceeding capacity, particularly during peak visitor periods; increasing use of undesignated areas for overflow parking and vehicular congestion at popular visitor areas. Other concerns include vehicle camping in sensitive areas and visitor effects on natural resources (e.g. vegetation trampling, wildlife disturbance, and improper human waste disposal).

In conclusion, climbers tend to be a highly specialized group of recreationists, with each style of climbing requiring its own set of preferable conditions. By better understanding the various styles of climbing and the set of desirable conditions for each, both managers and

⁴ For more information and examples of practitioner related stewardship projects go to:
http://www.accessfund.org/site/c.tmL5KhNWLrH/b.5000885/k.ECEE/Stewardship_and_conservation.htm

practitioners can continue to develop strategies to help them manage and regulate the sport of rock climbing more effectively.

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