Understanding Visitors at Devil's Backbone Open Space

2020 Larimer County Visitor Use Study

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Colorado State University
Human Dimensions of Natural Resources Department

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Colorado State University

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Devil's Backbone Open Space

2020 Visitor Use Study

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HUMAN DIMENSIONS OF
NATURAL RESOURCES
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Executive Summary

Over the past decade, visitation at Larimer County's Department of Natural Resources (LCDNR) open space and reservoir park properties has steadily increased with instances of visitor capacity being reached on sites especially near urban areas. The Department prioritized the need to better understand visitors and launched a visitor study in the fall of 2020 at the Devil's Backbone Open Space (DBOS) near Loveland. Primary objectives of the study were to gather and collect data from visitors on a wide range of topics to help guide and inform the department's management considerations.

Devil's Backbone Open Space is located on the western edge of the City of Loveland and offers 17.25 miles of natural surface trails that connect to both Horsetooth Mountain Open Space and the City of Fort Collins Coyote Ridge Natural Area. This ~3,000-acre open space offers towering rock formations and long vistas of native shrublands and grasslands and is an extremely popular destination for hikers, mountain bikers, and equestrians. The property was selected because of increased episodes of high visitation, to coincide with a six-month electric motorized bike study, and to gather and collect baseline information for future comparisons. The objectives of the study were to describe visitors in terms of their:

1. Demographic characteristics (e.g., sex, age, place of residence)
2. Prior visitation rates and trip characteristics (e.g., trip duration, activity participation, reasons for visiting, transportation)
3. Visitor satisfaction
4. E-bike familiarity and support
5. Perceived conflicts with other visitors
6. Perceived crowding

On-site exit surveys were conducted at DBOS from September to October 2020. The surveys were administered by county staff at two locations; the South Trailhead in west Loveland and the North Trailhead (Blue Sky) in Fort Collins. To achieve a random sampling of open space visitors, a stratified-cluster sampling method was used to determine the sampling proportions at each location during weekdays and weekends. Survey sessions at the South and North Trailheads were conducted in the morning, afternoon, and evening. CSU researchers are highly confident that the administration periods and shifts outlined in this report are consistent with the general patterns of visitors at DBOS. A total of 536 visitors completed the survey at DBOS; 416 at the South Trailhead and 120 at the North Trailhead. The survey results focus on indicators of standards of quality for visitor satisfaction, perceived conflict, and perceived crowding.

Key Findings

Demographics

- The average DBOS visitor was 43.6 years old.

- The average South Trailhead visitor was slightly more likely to be female (51%) and self-identified as White (92%). The average North Trailhead visitor was more likely to be male (76%) and self-identified as White (93%).

Residency

- Fifty-eight percent (58%) of South Trailhead visitors were ***residents*** of Larimer County; 42% were non-residents. Eighty-two percent (82%) of North Trailhead visitors were ***residents*** of Larimer County; 18% were non-residents.

- The average length of residency in Larimer County by ***residents*** was 12 years at the South Trailhead and 16 years at the North Trailhead. Twenty-one (21%) of residents at the South Trailhead and (9%) at the North Trailhead had lived in Larimer County for one year or less.

- The top primary origin cities by ***non-residents*** at the South Trailhead included Greeley/Evans (69%), Longmont (18%), and Denver metro (13%); and at the North Trailhead included Greeley/Evans (67%) and the Denver metro area (33%).

- The top primary origin cities of ***residents*** at the South Trailhead included Loveland (59%), Fort Collins (36%), Berthoud (6%), and Windsor (2%); at the North Trailhead included Fort Collins (78%), Windsor (14%), Loveland (7%), and Berthoud (1%).

Visitation

- Visitors at the South Trailhead averaged 4.1 visits to DBOS in the past 12 months compared with 7.8 average visits at the North Trailhead.

- Sixty-one percent (61%) of ***non-residents*** and 23% of ***residents*** visited DBOS for the first time in the past 12 months.

- Twelve percent (12%) of visitors reported that they were **turned away** from visiting DBOS in the past 12 months because the parking lot was full.

- Fifty-eight percent (58%) of visitors at DBOS reported no change in visitation due to COVID-19. Twenty-two percent (22%) reported decreased visitation and 20% reported increased visitation. This response pattern did not differ by gender, age, primary residence, and survey location.

Checked Conditions

- Eighty-three percent (83%) of visitors **did not** utilize any online or social media platforms to check parking and trail conditions prior to their visit to DBOS. Of those that checked conditions, Larimer County's website was the most used source, followed by the COTREX App. Social media was the least utilized source to check conditions.

Group Characteristics

- Visitors at DBOS were more likely to visit with a group than solo. The average group size was 2.45 at the South Trailhead and 2.23 at the North Trailhead. At both trailheads, the number of children in attendance was less than 0.5 during the weekdays and weekends.

Reason for Visiting

- Exercise (59%) was the primary feature that attracted visitors to DBOS at both trailheads. Natural resource values and quality of trails were the other primary features that attracted visitors to the open space.

Activities

- Sixty percent (60%) of South Trailhead visitors listed hiking as their primary activity on the day they completed the survey compared to 10% at the North Trailhead. Mountain biking was listed as the primary activity by 77% of North Trailhead users and 17% of South Trailhead users. Thirteen percent (13%) listed walking dogs and trail running (7%) as their primary activity at the South Trailhead but not at the North Trailhead (0% and 13% respectively).
- At the South Trailhead, primary activities stayed relatively the same on weekdays and weekends.
- At the North Trailhead, there were significant changes in primary activities on weekdays and weekends. Mountain biking was the primary activity reported during the weekdays (91%) and weekends (68%). There was an increase in trail running as the primary activity during weekends (20%) compared to weekdays (2%). Hiking also increased to 12% during weekends compared to 7% on weekdays.

- Visitors use different trails at the south and tend to use multiple trails during their visits. At the South Trailhead, Wild Loop Trail (64%) and the Keyhole Trail (52%) were the most popular trails.

E-Bikes Familiarity and Support

- There was a significant difference regarding visitors' familiarity with e-bikes at the two trailheads. At the North Trailhead, over half of the visitors (57%) reported they were "moderately" to "extremely" familiar with e-bikes, compared to 26% of visitors at the South Trailhead.
- At both trailheads, approximately half of all visitors expressed opposition to e-bikes ranging from slightly opposed to strongly opposed. Thirty-four percent (34%) of North Trailhead visitors and 20% of South Trailhead visitors supported e-bikes on natural surface trails; responses ranged from slightly support to strongly support.

Visitor Satisfaction

- Based on previous meta-analyses, a satisfaction standard for Larimer County park and open space areas was set at 80% or more of visitors should be satisfied with their experience or the services they received.
- Ninety-nine percent (98.7%) of visitors rated their overall experience at Devil's Backbone Open Space as "good" or "excellent;" findings that exceed the satisfaction standard.

Perceived Conflict

- Interpersonal conflict occurs when the physical presence or behavior of an individual or group interferes with the goals of another individual or group. The literature suggests a standard of no more than 25% of visitors should feel interpersonal conflict.
- Results were within this standard. Seventeen percent (17%) of hikers and mountain bikers or less, indicated having interpersonal conflicts with other hikers and mountain bikers, such as acting unsafely or discourteous, at Devil's Backbone Open Space.

Perceived Crowding

- A comparative analysis of 59 different settings (parking areas, trail system, etc.) and activities (hiking, biking, etc.) suggested five distinct categories of standards for perceived crowding. When $\leq$ 35% of the visitors feel crowded, density levels in the area are not a problem.
- In general, the 35% level of perceived crowding standard was met at Devil's Backbone Open Space. There were, however, several exceptions (see "Visitor Survey Conclusions"). Most notably, at the South Trailhead, 50% of visitors felt slightly to extremely crowded by other *hikers on the trail*. On weekends this percentage increased to 66%.

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Introduction

The Larimer County's Department of Natural Resources (LCDNR) mission is to establish, protect, and manage significant regional parks and open spaces. LDCNR provides quality outdoor recreational opportunities and stewardship of natural resource values. The County reached a significant milestone of 53,000-acres of conservation land in 2021. These acres represent lands purchased outright by Larimer County and placed under a conservation easement, including those acres where a partner provided financial or other support to or from the County.

The State Demography Office predicts that the population of the northern Front Range (i.e., Weld and Larimer counties) will double by 2050. The LCDNR has prioritized the need to better understand open space visitors. This report summarizes a fall 2020 visitor study at the Devil's Backbone Open Space (DBOS).

DBOS is located on the western edge of the City of Loveland and offers 17.25 miles of natural surface trails that connect to both Horsetooth Mountain Open Space and the City of Fort Collins Coyote Ridge Natural Area. This ~3,000-acre open space offers towering rock formations and long vistas of native shrublands and grasslands and is a popular destination for hikers, mountain bikers, and equestrians. The property was selected because of increased episodes of high visitation, to coincide with a six-month electric motorized bike study, and to gather and collect baseline information for future comparisons.

Study Objectives

This project sought to better understand visitors to DBOS. The specific objectives were to describe visitors in terms of their:

1. Demographic characteristics (e.g., sex, age, place of residence)
2. Prior visitation rates and trip characteristics (e.g., trip duration, activity participation)
3. Satisfaction with the recreation experience and the facilities
4. E-bike familiarity and support
5. Perceived conflicts with other visitors
6. Perceived crowding.

The intent was to (a) provide managers with baseline information against which future research results can be compared and (b) to inform management decisions.

Visitor Survey Planning Framework and Background

Natural resource management agencies strive to provide high quality recreation experiences (Decker, Brown & Siemer, 2001). Not all visitors, however, share the same set of preferences for setting attributes, facilities, and services offered. Some individuals, for example, may desire nothing more than the opportunity to enjoy nature, hike, and watch wildlife; activities that require only a natural setting with minimal provided facilities or services. Other visitors are more demanding in the services they believe should be offered (Donnelly, Vaske, DeRuiter, & King, 1996).

Recognizing this diversity of desires found among recreationists, researchers and managers have attempted to differentiate users into more homogeneous groups (Bryan, 1977). This report compared visitors to two locations within Devil's Backbone Open Space.

Most planning frameworks recommend identifying and establishing quantitative impact indicators and standards (e.g., Visitor Impact Management, Graefe, Kuss, & Vaske, 1990; Visitor Experience and Resource Protection, National Park Service, 1997; Limits of Acceptable Change, Stankey, Cole, Lucas, Petersen, & Frissell, 1985). Indicators are specific, measurable variables that reflect the current situation. A standard of quality is the minimum acceptable condition for each indicator. Standards identify conditions that are desirable (e.g., no litter), as well as conditions that managers do not want to exceed (e.g., encounters with other people). Comparing existing conditions against the standards provides a quantitative estimate of whether the experiences provided are within the limits specified by the standard (Vaske, Whittaker, Shelby, & Manfedo, 2002).

This report considered three sets of indicators and standards that have been used extensively in the literature:

1. Visitor satisfaction
2. Perceived conflict
3. Perceived crowding

Satisfaction Indicator and Standard

Satisfaction has been defined as the congruence between expectations and outcomes (Manning, 2011) and is one of the most used indicators of visitor experience / perceived quality of service received (Vaske et al., 2002). Satisfaction from a recreation experience reflects visitor expectations and management goals. People who experience conditions / services in line with what they expected are likely to be satisfied. From a manager's perspective, providing satisfactory experiences / services to at least X percent of the visiting public reflects a standard for this indicator.

At least two methodologies for investigating satisfaction are evident in the literature. One theory has focused on a multiple satisfactions approach, which assumes that everyone brings his or her own expectations to an experience and these influence the kinds of satisfaction that he or she receives (Hendee, 1974). This framework recognizes the diversity of experiences that visitors seek, and a quality experience for a recreationist involves achieving the satisfactions in which he or she is interested or expects (Manfredo, Fix, Teel, Smeltzer, & Kahn, 2004). The concern is with identifying variables that affect satisfaction and that are susceptible to management or manipulation. If such variables can be identified and monitored, the potential for changing circumstances to create better recreation opportunities is enhanced. To facilitate this applied focus, a report card was developed in the late 1970's for tracking visitor satisfaction (LaPage & Bevins, 1981). The instrument included items that could be influenced by management actions (e.g., restrooms, parking areas, trash receptacles) This applied approach was adopted for this study.

Second, researchers (e.g., Vaske, Donnelly, Heberlein, & Shelby, 1982; Vaske & Roemer, 2013) have defined satisfaction as an overall rating of a recreation experience / service as good or bad. Satisfaction is viewed as a composite of expectations and needs, expressed as a single numerical rating. Defined this way, satisfaction has been operationalized with a single question, such as "Overall, how would you rate the quality of the visitor services provided to you and your group?" The percentage of individuals reporting a given level of satisfaction can be calculated for all participants in an activity and the activities can be compared directly.

There are advantages and disadvantages to both multiple-item and single-item indicators of a concept. Multiple-item indicators can contribute to a more sophisticated understanding of concepts and often have good psychometric properties (e.g., reliability, validity). Measurement reliability means that the multiple items measure the same construct (i.e., the items intercorrelate with each other). Measurement validity means that the scale measures what it was intended to measure. Unfortunately, multiple-item indicators also have disadvantages: (a) they increase respondent burden, (b) they challenge comparisons of findings among studies because different items are used, and (c) they do not necessarily yield clear management standards (Vaske, 2019).

Vaske and Roemer (2013) analyzing differences in overall satisfaction by consumptive and nonconsumptive recreationists over a 30-year period. Based on theory and previous research, two hypotheses were advanced: (a) consumptive recreationists will report significantly lower satisfaction than will nonconsumptive recreationists, and (b) this pattern will remain consistent over time. Data were obtained from published and unpublished studies in 57 consumptive (e.g., hunters) and 45 nonconsumptive (e.g., kayakers) recreation contexts. Each study used the same question measuring overall satisfaction (i.e., "overall, how would you rate your day / trip / experience"). Following previous research (Vaske et al., 1982), responses were collapsed into three categories (i.e., "poor / fair," "good / very good," "excellent / perfect"). The independent variables were activity type and year. Consistent with

the hypotheses and the previous article, consumptive recreationists reported lower satisfaction than did nonconsumptive recreationists, and this pattern of findings generally remained consistent over time.

Visitor Satisfaction Standard. Based on the previous meta-analyses (Vaske & Roemer, 2013; Vaske et al., 1982), the standard for the Larimer County natural areas was set at 80% or more of visitors should be satisfied with their experience or the services they received. Comparing existing satisfaction ratings against the 80% standard provides a quantitative estimate of whether any experiential changes are within the limits specified by the standard (Vaske et al., 2002).

Perceived Conflict Indicator and Standard

Conflict has been a theme in the outdoor recreation literature for decades (e.g., Lucas, 1964). Recreation conflict generally falls into two main categories (Graefe & Thapa, 2004). First, interpersonal conflict (a.k.a., goal-interference) occurs when the physical presence or behavior of an individual or group interferes with the goals of another individual or group (Jacob & Schreyer, 1980). Interpersonal conflict can occur directly via a face-to-face encounter (e.g., between a backcountry skier and a snowmobiler on a shared route), or indirectly where evidence of one group's behavior is sufficient to cause conflict (e.g., a skier smells the exhaust of a snowmobiler). Different groups may share the same goal (e.g., experiencing untracked snow), but have different means of achieving that goal (e.g., skiing vs. snowmobiling), which can influence goal-interference conflict (Graefe & Thapa, 2004).

Second, social values conflict occurs between groups who may not share similar norms or values about an activity (Vaske, Donnelly, Wittmann, & Laidlaw, 1995). Unlike interpersonal conflict, social values conflict can occur even when there is no direct contact between the groups (Carothers, Vaske, & Donnelly, 2001; Vaske, Needham, & Cline, 2007). For example, although encounters with llama packing trips may be rare, individuals may philosophically disagree about the appropriateness of using these animals in the backcountry (Blahna, Smith, & Anderson, 1995).

Interpersonal Conflict. Research on recreational conflict has traditionally focused on the asymmetrical relationships that occur when different activity groups interact (Kuss, Graefe, & Vaske, 1990). Studies, for example, have shown the presence of a one-way conflict between paddling canoeists and motorboaters (Adelman, Heberlein, & Bonnicksen, 1982). Paddling canoeists disliked motorboaters, but the people using motor-powered craft were not bothered by, and often enjoyed seeing and interacting with paddlers. This one-way type of conflict has also been shown between hikers and mountain bikers, oar-powered and motor-powered whitewater rafters, cross-country skiers and snowmobilers, backpackers and horsepackers, water skiers and anglers, and hunters and non-hunters. In general, the research has shown that for those recreationists for whom the interaction has negative consequences (e.g., disrupts the solitude of the experience, or inhibits one's ability to catch fish or hunt game), conflict increases.

Hikers and mountain bikers differ in their method of experiencing the environment, but the participants share similar characteristics. Research has profiled mountain bikers as "30 something" white males, from a range of income levels, who believe the activity is important to their identity (Chavez, 1999). Similarly, many hikers are over 30, white males, from a range of income levels and who identify with the sport (Wellner, 1997). Individuals in both activities tend to participate frequently (Ruibal, 1996) and many pursue both activities (Chavez, 1999). Such similarities suggest that conflict, to the extent it exists between hikers and mountain bikers, is likely to reflect interpersonal problems rather than differences in social values. Interpersonal conflict between hikers and mountain bikers may be related to speed, lack of courtesy, crowding, or safety concerns (Moore, 1994). Safety issues, for example, have been linked to trail design (blind corners) and the behaviors of some mountain bikers who ride too fast for existing conditions (Hoger & Chavez, 1998).

Social Values Conflict. The importance of social acceptability judgments in conflict management is relatively new to the recreation literature (Blahna et al., 1995). McShea, Wemmer, and Stuwe (1993), for example, describe the social conflicts that erupted between hunters and anti-hunters when the National Zoo's Conservation and Research Center (CRC) attempted to open the area to hunting to reduce the size of a controversial deer herd. The conflict was primarily based on differences in values held by the CRC

and animal rights groups. The CRC was concerned with protecting exotic hoofed animals from disease caused by the deer, whereas the animal rights groups advocated a position favoring the rights of individual deer. These findings reflect broader societal value differences toward consumptive versus non-consumptive uses of wildlife.

Social value differences between hikers and mountain bikers may reflect anticipated threats. Existing research (Hoger & Chavez, 1998; Moore, 1994), for example, suggests that some hikers believe mountain bikers increase safety concerns (i.e., riding irresponsibly), degrade the natural resource (i.e., creating informal trails), and lower the quality of the experience (i.e., lack of user etiquette). Similar to the controversy over allowing hunting in certain locations (Vaske et al., 1995), these reactions suggest that, for at least some individuals, mountain biking is not a socially acceptable activity and should not be allowed on trails traditionally used by hikers. Such value judgments are reinforced when mountain bikers are stereotyped as "crazy kids out for an adrenaline rush" (Hoger & Chavez, 1998).

Hiking represents a traditional activity on most trails whereas mountain biking is a relatively new sport. Past research has demonstrated that traditional users frequently question the social acceptability of any non-traditional activity in natural resource settings (Blahna et al., 1995). As the number of individuals participating in non-traditional activities like mountain biking increases (Ruibal, 1996), hikers' tolerance levels for bikers may decrease and the potential for social values conflict can increase.

Interpersonal versus Social Values Conflict. Vaske et al. (1995) examined the magnitude of interpersonal and social values conflict for two general classes of events. Hunting-associated events included seeing an animal being shot, seeing people hunting, and hearing guns being fired. Human-wildlife interaction events were represented by evaluations of people disturbing, harassing, and feeding wildlife. Comparisons were made between hunters and non-hunters and between frequent and infrequent visitors to Mt. Evans, a 14,150-foot mountain located about 70 miles west of Denver. Results indicated that interpersonal conflicts between hunters and non-hunters on Mt. Evans were minimized due to the mountain's natural visual barriers and the Colorado Division of Wildlife's regulations that prohibit hunting near the road where most non-hunters are found. To the extent that conflict existed for hunting associated events, much of the problem was associated with differences in social values held by the non-hunting public. Conflict in social values remained relatively constant across frequency of visitation; findings that supported the argument that a visitor's value orientation is independent of the number of prior visits to an area.

Carothers et al. (2001) examined social values and interpersonal conflict reported by hikers, mountain bikers, and those participating in both activities. Across all three groups, less conflict was reported for hiking than for mountain biking. To the extent that conflict did exist for hiking, mountain bikers and dual-sport participants were more likely than hikers to report unacceptable behaviors. For evaluations of mountain biking behavior, hikers were more likely than mountain bikers to experience conflict, whereas dual-sport participants fell in between these two extremes. All three groups reported more interpersonal than social values conflict.

Both interpersonal and social values conflict can be influenced by recreationists' lifestyle tolerance; the tendency to accept or reject lifestyles different than one's own (Jacob & Schreyer, 1980). As noted by Ivy, Stewart, and Lue (1992), tolerance is typically associated with beliefs about a particular group, rather than reactions to specific behaviors. When recreationists encounter others, a cognitive processing of information occurs. This action often results in the categorization of others according to some group membership, which helps to simplify and order environmental stimuli. Differences in lifestyles are often communicated via visual cues such as the equipment used by recreationists engaged in different activities (e.g., guns for hunting versus binoculars for wildlife viewing, Vaske et al., 1995). Recreation in-groups and out-groups represent categories an individual establishes on the basis of perceived or imagined lifestyle similarities and differences (Jacob & Schreyer, 1980). Though useful for maintaining a view of the world, it can also lead to unjustified generalizations about other groups (Ramthun, 1995). Those who demonstrate low tolerance for persons with differing lifestyles will be more likely to experience conflict.

Out-group versus in-group lifestyle tolerance differences have been noted for several recreation activities. Research (Vaske, Carothers, Donnelly, & Baird, 2000; Williams, Dossa, & Fulton, 1994), for example, has indicated that skiers and snowboarders have differing views of each other. Skiers felt threatened by the snowboarders' different approach; evaluated the language, clothes, and on-slope behavior of snowboarders as intimidating; and had the perception that snowboarders purposely created conflict situations. Snowboarders, on the other hand, perceived skiers as predictable and showed less concern for their presence on the slopes. Watson, Williams, and Daigle (1991) found that mountain bikers were more likely than hikers to perceive the two groups as similar in terms of socio-demographic characteristics, as well as their relationship to the resource (attitudes about the environment, values of the area). Hikers perceived more differences between the two groups. Other research has shown that hikers view mountain biking as intrusive and are concerned with the impact mountain biking has on the environment and safety issues related to multiple use trails (Hoger & Chavez, 1998).

Simple classifications of individuals into groups (e.g., skier vs. snowboarder, or hiker vs. biker), however, can introduce problems when attempting to understand conflict (Watson, Zaglauer, & Stewart, 1996). Many recreationists participate in multiple activities (i.e., both hiking and biking) and consequently, their tolerance for others may be altered. Analyses should distinguish these dual sport participants from individuals who pursue only one activity.

There are a variety of ways to operationalize interpersonal versus social values conflict. Vaske et al. (1995) suggests combining the frequency (observed vs. not observed) of seeing different events with corresponding perceived problem (problem vs. not a problem) variables (Figure 1). Individuals who have not observed a given event, or who have observed it (e.g., bikers riding fast) yet do not perceive it to be a problem, are considered a no conflict group (either in terms of interpersonal or social values conflicts). Those who have never seen a particular event, but believe a problem exists for that event, are expressing a conflict in social values. Conversely, those who witness a particular situation and believe that the event has caused a problem are indicating an interpersonal conflict.

Figure 1. Conflict evaluation figure

		Perceived Problem	
		No	Yes
Observed	No	No Conflict	Social Values Conflict
	Yes	No Conflict	Interpersonal Conflict

Source: Vaske et al. 1995

Conflict Standard. Unlike the other indicators and standards considered here (i.e., satisfaction, perceived crowding), standards for acceptable levels conflict are more variable. The existing research suggests that the magnitude of conflict depends on the:

1) activity (e.g., traditional [hiking] vs. non-traditional [mountain biking, E-bikes]),
2) visitors (e.g., tolerances for other user groups, perceived similarities between the groups),
3) environment (e.g., unpaved vs. paved trails that allow for faster speeds),
4) management (e.g., zoning to separate potentially incompatible activities).

As a starting point, the researcher recommends that no more than 25% of the respondents should report interpersonal conflict.

Crowding Indicator and Standard

Researchers have recognized the difference between density and crowding, but even scientists sometimes use the word "crowding" inappropriately when referring to high density (Shelby & Heberlein, 1986; Vaske, 2019). Density is a descriptive term that refers to the number of people per unit area. It is measured by counting the number of people and measuring the space they occupy, and it can be determined objectively. Crowding, on the other hand, is a negative evaluation of density; it involves a value judgment that the specified number is too many. The term *perceived crowding* is often used to emphasize the subjective or evaluative nature of the concept.

Heberlein and Vaske (1977) developed a relatively simple measure of perceived crowding that asks people to indicate how crowded the area was at the time of their visit. Responses are given on the scale below:

Figure 2. Example of crowding response scale

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

In this item, two of the nine scale points label the situation as uncrowded, and the remaining seven points label it as crowded to some degree. The rationale is that people may be reluctant to say an area was crowded because crowding is an undesirable characteristic in a recreation setting. An item that asked, "Did you feel crowded?" might lead most people to say "No." The scale is sensitive enough to pick up even slight degrees of perceived crowding, just as measures of undesirable chemicals (e.g., pollutants or carcinogens) are sensitive to even low levels of these substances.

Crowding Standard. Shelby, Vaske, and Heberlein (1989) developed crowding standards based on this indicator. Their comparative analysis of 59 different settings and activities suggested five distinct categories of standards (suppressed crowding, low normal, high normal, over capacity, and greatly over capacity). When $\leq$ 35% of the visitors feel crowded, density levels in the area were not a problem. For locations where between 50 and 60% of visitors felt crowded, the setting was approaching its carrying capacity, and visitors started to experience access and displacement problems. Locations and activities where over 65% of the visitors felt crowded were considered over carrying capacity.

A subsequent meta-analysis (Vaske & Shelby, 2008) examined crowding ratings for 615 different settings and activities. These studies were conducted across the United States, Canada, New Zealand, Ecuador, Sweden, and Taiwan. The activities included hunting of many types, fishing of many types, rafting, kayaking, canoeing, floating, boating, rock climbing, mountain climbing, backpacking, day hiking, biking, sailing, photography, and driving for pleasure. The areas studied show considerable diversity, with some showing extremely high density and use impact problems, others showing low densities and no problems, and still others actively utilizing management strategies to control densities and use impacts. In total, 85,451 individuals have been asked the crowding question.

Both meta-analyses (Shelby et al., 1989; Vaske & Shelby, 2008) supported the five distinct categories of standards based on the 9-point perceived crowding scale (Table 1). The five categories were established based on the percent of visitors reporting any level of crowding (scale points 3 through 9). For all 615 evaluation contexts, 40% showed suppressed crowding, 18% low normal crowding, 17% high normal crowding, 16% over capacity, and 9% greatly over capacity. In the United States, 40% of the 522 evaluation contexts showed suppressed crowding, whereas 16% were over capacity and 9% were greatly over capacity.

Table 1. Carrying capacity standards based on levels of perceived crowding [1]

Percent feeling crowded	Capacity judgment	Comment	Total # of contexts (n = 615)	Percent of contexts
0-35%	Suppressed crowding	Crowding is likely limited by management, situational factors, or natural factors may offer unique low-density experiences.	245	40%
36-50%	Low normal	Access, displacement, or crowding problems are not likely to exist at this time. Similar to the above category, may offer unique low-density experiences.	111	18%
51-65%	High normal	These locations or activities probably have not exceeded carrying capacity but may be tending in that direction. Should be studied if increased use is expected, allowing management to anticipate problems.	107	17%
66-80%	Over capacity	These locations or activities are generally known to have overuse problems, and they are likely to be operating at more than their capacity. Studies and management necessary to preserve experiences.	99	16%
81-100%	Greatly over capacity	It is generally necessary to manage for high-density recreation. A crowding problem has typically been identified.	53	9%

1. Source: Vaske and Shelby (2008)

Visitor Survey Methods

On-site surveys were administered by trained interviewers from September 1 to October 13, 2020. Surveys were administered at both the South and North Trailheads of Devil's Backbone Open Space. The South Trailhead is located off Highway 34 in Loveland and the North Trailhead is located off County Road 38E in Fort Collins. Survey administration was suspended on October 14 due to the proximity of the Cameron Peak Fire and the closure of the open space.

The sampling of open space visitors was based on a stratified-cluster random sampling design. Sampling proportions for the two locations were stratified by weekdays and weekends (Table 2). Within each stratum, all respondents exiting the trailhead were interviewed (i.e., the cluster). Sampling times (shifts) were randomly selected (Table 3).

Table 2. Stratified-cluster random sampling design

Open Space	Time of week	Proportion of use on weekday vs. weekend	% of total effort to allocate
Devil's Backbone Trailhead	Weekday	56%	28%
Devil's Backbone Trailhead	Weekend	44%	22%
Blue Sky Trailhead	Weekday	56%	28%
Blue Sky Trailhead	Weekend	44%	22%

Survey shifts were 2.5 hours at the South Trailhead and 3 hours at the North Trailhead. The shorter shifts at the southern location were due to the higher volume of visitors; less time was needed to collect a representative sample (Table 3). Surveys were administered during the morning, afternoon, and evening. Survey administration always began at 9 a.m. Given average visitation times of a couple of hours, the sampling procedures captured earlier visitors exiting the property. Overall, the survey administration

shifts were consistent with the general patterns of visitors at Devil's Backbone Open Space and provided a representative sample of the population.

A total of 536 visitors completed the survey (Table 3). Of these, 416 surveys (78%) were collected at the South Trailhead and 120 (22%) at the North Trailhead. Slightly less than two-thirds of all surveys were obtained on weekends. The relatively low percentage of visitors at the North Trailhead during the 1 p.m. to 4 p.m. shift (6%) was due to low visitation.

Table 3. Visitor survey data collection effort at DBOS

	Devil's Backbone Open Space	
Location	South Trailhead (n = 416) 78% %	North Trailhead (n = 120) 22% %
Month		
September 2020	71	50
October 2020	29	50
Day of Week		
Weekday (Mon-Fri)	37	38
Weekend (Sat-Sun)	64	62
South Trailhead Shifts:		
9:00 a.m. - 11:30 a.m.	53	
1:00 a.m. - 3:30 p.m.	37	
4:00 p.m. - 6:30 p.m.	10	
North Trailhead Shifts:		
9:00 a.m. -12:00 p.m.		72
1:00 p.m. - 4:00 p.m.		6
4:00 p.m. - 7:00 p.m.		22

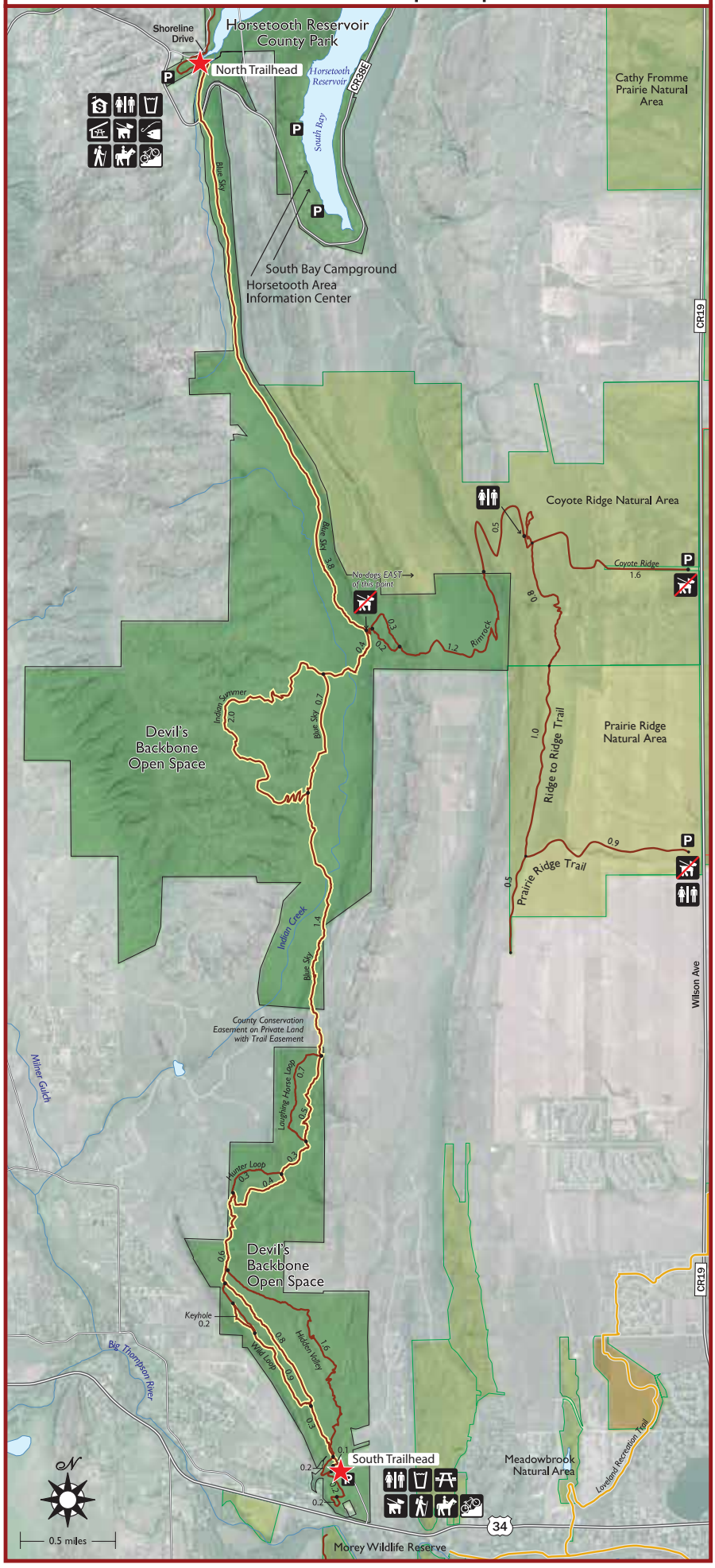
Data Analysis Reference

In this report, two types of statistics are presented: (a) Chi-square (χ^2) and (b) *t*-values.
The choice of statistic depends on how the dependent variable was coded, for example:
if the dependent variable was dichotomous (e.g., male vs. female) or categorical (level of education), χ^2 was used.
if the dependent variable was continuous (e.g., number of people in a group), *t* was used.
The independent variable was typically dichotomous (e.g., South vs. North Trailhead interview location).
If the *p*-value for a given statistic was $\leq .05$, the groups being compared differed statistically.
The χ^2 and *t*-values highlight when statistical differences exist, but do not indicate the strength of the relationship.
The latter is shown via two effect size measures:

(a) Cramer's *V* (or simply *V*) for χ^2 and
(b) eta (η) for *t*-values.

The cut points for these two effect sizes are:
for *V*: .1 = a minimal relationship, .3 = a typical relationship, and .5 = a substantial relationship
for η: .1 = a minimal relationship, .243 = a typical relationship, and .371 = a substantial relationship.

Devil's Backbone Open Space



Visitor Survey Results

Demographics

The average age of South Trailhead visitors was 42.8 years; the average for North Trailhead visitors was 44.4 years (Table 4). South Trailhead visitors were more likely to be female (51%) and self-identified as White (92%). Seventy-six percent (76%) of North Trailhead visitors were more likely to be male (76%) and self-identified as White (93%). Eight percent (8%) of visitors at both locations were Hispanic or Latino. Most of the differences between the visitors at the two locations were not statistically significant and the effect sizes tended to be minimal.

Table 4. Demographic profile of visitors to DBOS

	Open Space [a]				
	South Trailhead %	North Trailhead %	Test statistic χ^2 or *t*-value	*p*-value	Effect size *V* or η
Gender			28.83	< .001	.226
Male	49	76			
Female	51	24			
Age			30.50	< .001	.235
16-24	13	7			
25-34	24	14			
35-44	20	28			
45-54	16	33			
55-64	15	16			
65-78	12	3			
Mean age	**42.8**	**44.4**	1.21	.227	.045
Ethnicity			.005	.944	.003
Hispanic or Latino	8	8			
Not Hispanic or Latino	92	92			
Race					
White	92[b]	93	.01	.944	.003
African American	3	<1	1.72	.190	.051
Asian	2	3	.77	.38	.04
American Indian/Native Alaskan	2	0	4.61	.032	.07
Native Hawaiian	1	0	2.04	.154	.047
Other	4	4	.03	.873	.007

[a] Cell entries are either percentages or means.
[b] Some participants selected more than one category on Race, thus the total may not equal to 100%.

Residency

Fifty-eight percent (58%) of South Trailhead visitors were residents of Larimer County; 42% were non-residents (Table 5). Over 80% of visitors to the North Trailhead are residents of Larimer County and 18% are non-residents. There was a difference between the average number of years South Trailhead visitors have lived in Larimer County (12.2 years) versus North Trailhead visitors (15.8 years).

Table 5. Residency of visitors to DBOS

	South Trailhead %	North Trailhead %	Test statistic χ^2 or *t*-value	*p*-value	Cramer's *V*
Resident of Larimer County			25.36	<.001	.209
Yes	58	82			
No	42	18			
Years lived in Larimer County by residents			11.74	.019	.178
1 year or less	21	9			
2-4 years	20	15			
5-10 years	19	24			
11-20 years	20	23			
21-57 years	20	30			
Range	1-57	1-48			
Mean	**12.2**	**15.8**			

Most of the visitors at DBOS were from Colorado. Forty-five percent (45%) of South Trailhead visitors live in Loveland and 69% of North Trailhead visitors live in Fort Collins (Table 6). The remaining six primary residences of visitors included Greeley/Evans, Berthoud, Longmont, Denver metro-area, and Windsor.

Table 6. Top primary residences of DBOS visitors

	South Trailhead %	North Trailhead %
Loveland	45	7
Fort Collins	28	69
Greeley/Evans	14	7
Berthoud	5	1
Longmont	4	0
Denver	3	4
Windsor	1	12

$\chi^2 = 108.68$, $p < .001$. Cramer's $V = .497$

In terms of non-residents of Larimer County, 69% of South Trailhead visitors and 67% of North Trailhead visitors were from the Greeley and Evans area, followed by Longmont and Denver metro area (Table 7).

Table 7. Top primary origin cities of *non-residents* of Larimer County to DBOS

	Non-residents of Larimer County (n = 199)	
	South Trailhead %	North Trailhead %
Greeley/Evans	69	67
Longmont	18	0
Denver metro area	13	33

$\chi^2 = 7.08$, $p = .069$. Cramer's $V = .268$

For residents of Larimer County, 57% of South Trailhead visitors live in Loveland and 78% of North Trailhead visitors live in Fort Collins (Table 8).

Table 8. Top primary origin cities of *residents* of Larimer County to DBOS

	Residents of Larimer County (n = 327)	
	South Trailhead %	North Trailhead %
Loveland	57	7
Fort Collins	36	78
Windsor	2	14
Berthoud	6[a]	1

$\chi^2 = 96.12$, $p < .001$, Cramer's $V = .512$.

[a] Because of rounding, the total may be slightly higher or lower than 100%.

Visitation

Fourteen percent (14%) of visitors reported going to South Trailhead for the first time in comparison to 8% for North Trailhead visitors (Table 9). There was a substantial difference between the frequency of visits (in the past 12 months). At the South Trailhead, the average was 4.1 visits; at the North Trailhead, the average was 7.8 visits.

Table 9. Number of Visits to DBOS in the past 12 months

	South Trailhead %	North Trailhead %	Test statistic χ^2 or *t*-value	*p*-value	Effect Size *V* or η
Visits			47.06	<.001	.300
0 (first visit)	14	8			
1	29	11			
2-4	29	21			
5-9	15	27			
10-14	7	19			
15-24	5	10			
25-46	1	5			
Range	1-30	1-30			
Mean	**4.1**	**7.8**	5.25	< .001	.368

Sixty-one percent (61%) of non-residents made their first visit or second visit to DBOS, compared to 23% of the residents. Larimer County residents reported more visits (6.53), on average, to Devil's Backbone Open Space than non-residents (2.19) (Table 10).

Table 10. Overall number of visits to DBOS in the past 12 months by residents and non-residents of Larimer County

Visits	Non-Resident %	Resident %
0 (first visit)	21	7
1	40	16
2-4	25	29
5-9	13	21
10-14	2	15
15-24	<1	9
25-46	<1	3
Range	0-25	0-30
Mean	**2.19**	**6.53**

$\chi^2 = 108.89$, $p < .001$. Cramer's $V = .536$

Twenty-one percent (21%) of non-residents visited the South Trailhead for the first time in comparison with only 9% of the residents (Table 11). On average, non-residents visited this trailhead less frequently than residents at 2 visits and 6 visits, respectively.

Table 11. Number of visits to the *South Trailhead* at DBOS in the past 12 months by residents and non-residents of Larimer County

Visits	Non-Resident %	Resident %
0	21	9
1	43	18
2-4	25	32
5-9	10	19
10-14	<1	12
15-24	<1	8
25-46	0	3
Range	0-23	0-30
Mean	**1.87**	**5.72**

$\chi^2 = 85.72$, $p < .001$. Cramer's $V = .423$

At the North Trailhead, 23% of non-residents and 4% of residents visited for the first time in 2020. (Table 12). On average, non-residents visited less frequently than residents at 5 visits and 8 visits, respectively.

Table 12. Number of visits to the *North Trailhead* at DBOS in the past 12 months by residents and non-resident of Larimer County

Visits	Non-Resident %	Resident %
0	23	4
1	14	10
2-4	23	20
5-9	27	27
10-14	9	21
15-24	0	12
25-46	5	5
Range	0-25	0-30
Mean	**4.77**	**7.81**

$\chi^2 = 13.02$, $p = .043$. Cramer's $V = .325$.

Of all respondents, only 12% reported being turned away from DBOS at some point because the parking lot was full (Table 13). Of those that reported being turned away, 11% of visitors reported three times or less in the past 12 months.

Table 13. Visitors turned away from visiting DBOS because the parking was full

Turned away	Number	Percent
No	472	88
Yes	64	12
If yes, how many times in past 12 months		
1	26	5
2	20	4
3	8	2
4	3	1
5+	7	1

Checked Conditions

Eighty-three percent (83%) of survey respondents at both trailheads indicated that they did not check conditions prior to their visit. Of those that did, Larimer County's website was the most used source, followed by the COTREX App.

Table 14. Checked the conditions before visiting DBOS on the day of the interview

	Open Space				
	South Trailhead %	North Trailhead %	χ^2	*p*-value	Cramer's *V*
Did you check the conditions?			0	.983	.001
No	83	83			
Yes	17	17			
What did you check					
LCDNR website	6	9	6.31	.043	.109
COTREX App	5	4	0.80	.673	.039
Social media	4	2	2.18	.354	.064
Trailhead webcam	< 1	2	4.68	.096	.089
Others	5	1	8.27	.016	.124

Group Characteristics

A group was defined as more than one individual (Table 15). At both trailheads, visitors were more likely to visit with a group (67% at the South Trailhead and 56% at the North Trailhead). At the South Trailhead, the average group size was 2.45 visitors while North Trailhead respondents had an average of 2.23 visitors per group. On average, these groups reported 2.12 adults at South Trailhead and 1.8 adults at North Trailhead. At both locations, the average number of children in attendance were less than 0.5. Overall, seventeen percent (17%) brought children in their groups during weekdays and weekends.

Table 15. Group characteristics of DBOS visitors

	South Trailhead %	North Trailhead %	χ^2 or *t*-value	*p*-value	Effect size *V* or η
I visited the open space			5.26	.022	.100
Alone	33	44			
With a group	67	56			
Number of people in group			12.29	.031	.144
1	33	44			
2	36	32			
3	12	15			
4	9	4			
5	4	1			
6+	6	4			
Range	1-20	1-16			
Mean	**2.45**	**2.23**	1.04	.300	.045
Number of adults in group			12.46	.29	.137
1	37	48			
2	39	32			
3	12	15			
4	6	3			
5	2	0			
6+	4	2			
Range	1-20	1-6			
Mean	**2.12**	**1.8**	2.17	.031	.093
Number of children in group			23.76	.003	.211
0	84	89			
1	5	3			
2	7	3			
3	2	2			
4	1	0			
6+	0	4			
Range	0-7	0-10			
Mean	**.32**	**.43**	0.74	.462	.044

Reasons for Visiting

At the South Trailhead, more than half of visitors (56%) reported exercise as the primary feature that attracted them to the open space on the day of the interview (Table 16), followed by natural resource values (34%) and quality of trails (30%). At the North Trailhead, the primary reason for visiting was exercise (59%), followed by quality of trails (57%) and natural resource values (23%).

Table 16. Primary features that attracted visitors at DBOS on the day of the interview [a]

	South Trailhead %	North Trailhead %	χ^2	*p*-value	Cramer's *V*
Natural resource values	34	23	5.23	.022	.097
Quality of trails	30	57	28.81	<.001	.236
Exercise	56	59	.32	.57	.025
Solitude	20	19	.06	.804	.011
Wildlife	12	10	.23	.634	.02
Other [b]	13	10	.80	.371	.038

[a] The percent is based on respondents who responded yes out of all the possible responses.

[b] Other primary features reported by visitors include location (proximity, easy access, close to home), social (hanging out with friends and family), free parking, walking dogs, having an e-bike permit, and mining history.

Visitation Characteristics under COVID-19

This study also examined the impact of COVID-19 on the frequency of visits at Devil's Backbone Open Space (Table 17). Results indicated that 58% of respondents did not change their visitation frequency; 22% decreased visitation, and 20% increased visitation. Visitation during COVID-19 did not vary by sex gender, age, residence (of Larimer County or not), or survey location (South or North Trailhead). There was a significant difference in visitation frequency by visitors based on their previous number of visits in the past 12 months. Visitors with four or fewer previous visits in the past 12 months reported decreased visits to DBOS due to COVID-19. Visitors with more than five visits in the past 12 months reported increased their frequency of visits during COVID-19.

Table 17. Impact related to frequency of visits by visitors due to COVID-19 at DBOS

	Impact of COVID-19 on Visitation [1]					
	Decreased Visitation *n* = 120 22%	No Change in Visitation *n* = 310 58%	Increased Visitation *n* = 106 20%	χ^2	*p*-value	Cramer's *V*
Demographics						
Gender				0.491	.782	.030
Male	22	59	19			
Female	23	56	21			
Age				6.03	.813	.076
< 24	19	60	21			
25 to 34	24	59	17			
35 to 44	27	53	20			
45 to 54	20	54	26			
55 to 64	22	60	18			
65 +	19	65	15			
Mean	**42.7**	**43.4**	**42.7**			
Resident of Larimer County				1.65	.437	.055
Yes	21	57	21			
No	24	59	17			
Location				4.44	.108	.091
South Trailhead	24	58	18			
North Trailhead	17	58	25			
Visits in the past 12 months				34.50	< .001	.176
0	16	14	6			
1 visit	26	26	20			
2 to 4 visits	37	25	25			
5 to 9 visits	14	16	26			
10 to 14 visits	4	11	14			
15 to 24 visits	3	7	5			
25 to 46 visits	0	2	6			
Mean	**3.2**	**5.0**	**6.6**			
Primary Activity				8.34	.015	.142
Hiking	26	59	15			
Mountain Biking	19	55	26			

Activities

At the South Trailhead, sixty percent (60%) of visitors listed hiking as their primary activity, followed by mountain biking (17%) and walking dogs (13%). Seventy-seven percent (77%) of North Trailhead visitors listed mountain biking as their primary activity, followed by trail running (13%) and hiking (10%) (Table 18). Visitors at the South Trailhead participated in all of the listed activities while visitors at the North Trailhead only reported mountain biking, hiking, and trail running.

Table 18. Primary activities at DBOS

	South Trailhead %	North Trailhead %
Hiking	60	10
Mountain biking	17	77
Walking dog(s)	13	0
Trail running	7	13
E-biking	< 1	0
Horseback riding	<1	0
Wildlife viewing	2	0
Other	1	0

$\chi^2 = 195.23$, $p < .001$. Cramer's $V = .587$.

Overall, the primary activities on weekdays and weekends did not differ statistically (Table 19). Hiking was the primary activity on both weekdays (48%) and weekends (49%). The second highest primary activity was mountain biking, at 33% for weekdays and 28% for weekends. Ten percent (10%) of visitors reported trail running as the primary activity during weekends, compared to only 4.5% during weekdays.

Table 19. Primary activities at DBOS on weekdays (Monday–Friday) and weekends (Saturday–Sunday)

	Mon – Fri %	Sat – Sun %
Hiking	48	49
Mountain biking	33	28
Walking dog(s)	10	10
E-biking	< 1	< 1
Trail running	4.5	10
Horseback riding	1	< 1
Wildlife viewing	2	2
Other	2	< 1

$\chi^2 = 10.53$, $p = .161$, Cramer's $V = .138$

At the South Trailhead, primary activities on weekdays and weekends yielded insignificant differences (Table 20). Hiking was reported to be the primary activity at 60% on both weekdays and weekends. The second highest primary activity was mountain biking, at 16% for weekdays and 17% for weekends. Thirteen percent (13%) of visitors reported walking dogs as the primary activity during both weekends and weekdays. Trail running increased slightly on weekends (8%) compared to weekdays (5%).

Table 20. Primary activities at the *South Trailhead* at DBOS on weekdays (Monday-Friday) and weekends (Saturday-Sunday)

	Mon–Fri %	Sat–Sun %
Hiking	60	60
Mountain biking	16	17
Walking dog(s)	13	13
Wildlife viewing	3	2
E-biking	<1	<1
Trail running	5	8
Horseback riding	1	<1
Other	2	1

$\chi^2 = 4.71$, $p = .695$, Cramer's $V = .108$

Primary activities at the North Trailhead on weekdays and weekends yielded significant differences (Table 21). Mountain biking was the primary activity during weekdays (91%) and dropped to 68% on weekends. Trail running increased during weekends (20%) compared to weekdays (2%). Hiking also increased to 12% during weekends from 7% from weekdays. In short, mountain biking was more popular during weekdays, and trail running, and hiking were more popular during weekends.

Table 21. Primary activities at the *North Trailhead* at DBOS on weekdays (Monday-Friday) and weekends (Saturday-Sunday)

	Mon–Fri %	Sat–Sun %
Mountain biking	91	68
Hiking	7	12
E-biking	0	0
Trail running	2	20
Walking dog(s)	0	0
Horseback riding	0	0
Wildlife viewing	0	0
Other	0	0

$\chi^2 = 11.94$, $p = .003$, Cramer's $V = .288$

Visitors' primary activity at DBOS differed by gender. Mountain bikers were more likely to male (83%) versus female (17%). Hikers were 40% males and 60% female. This trend was similar for both trailheads.

Table 22. Hiking and mountain biking activities by gender at DBOS

	DBBOS Overall[1]	
	Hiking %	Mountain biking %
Male	40	83
Female	60	17

[1]Responses include those who rated either hiking or mountain biking as their primary activity (n = 421).

There were also some differences in primary activity in terms of age groups at Devil's Backbone. Out of 421 responses that listed either hiking or mountain biking as the primary activity, hiking was more popular than mountain biking among all age groups except for the 45-54 age group. This was the only age group who reported mountain biking as their primary activity more than hiking.

At the South Trailhead, the top five most visited trails were the Wild Loop Trail (64%), Keyhole Trail (52%), Hunter Loop Trail (30%), Hidden Valley Trail (20%), Laughing Horse Loop (15%), and Blue Sky Trail (13%) (Table 23). At the North Trailhead, the most visited trails reported by visitors were the Blue Sky Trail (96%) and Indian Summer Trail (56%).

Table 23. Specific trails used at DBOS on the day of the interview [a]

	South Trailhead		North Trailhead	
Trail	Counts	Percent (%)	Counts	Percent (%)
Wild Loop Trail	267	64	1	1
Keyhole Trail	216	52	2	2
Hunter Loop Trail	125	30	9	8
Hidden Valley Trail	83	20	9	8
Laughing Horse Loop	63	15	10	8
Blue Sky Trail	52	13	115	96
Indian Summer Trail	24	6	67	56
Morrison Trail	11	3	1	1
Rimrock Trail	10	2	7	6

[a] Visitors often reported using multiple trails during their visits

The primary activities varied depending on the specific trail at DBOS. Along the Wild Loop Trail[a], 71% reported hiking as their primary activity, followed by walking dog(s) (12%), trail running (7%), mountain biking (7%), and wildlife viewing (3%) (Table 24). At Keyhole Trail, the primary activities were hiking (73%), walking dog(s) (14%), trail running (6%), mountain biking (4%), wildlife viewing (2%), and e-biking (<1%). At Hidden Valley trail, the primary activities were mountain biking (51%), hiking (19%), trail running (14%), walking dog(s) (5%), wildlife viewing (3%), and e-biking (2%). At Blue Sky Trail, the primary activities were mountain biking (81%) and trail running (19%).

Table 24. Specific user types on the most popular trails used at DBOS

	Wild Loop Trail	Keyhole Trail	Hidden Valley Trail	Blue Sky Trail
	%	%	%	%
Hikers	71	73	19	0
Walking dog(s)	12	14	5	0
Trail Runners	7	6	14	19
Mountain Bikers	7	4	55	81
Wildlife Viewing	3	2	3	0
Other	1	<1	0	0
E-Bikers	0	<1	2	0
Total count	269	218	91	142

[a] Disclaimer: These results are self-reported by visitors. Their reported activities may not comply with permitted use on trails. For example, mountain biking is not permitted on the Wild Loop and Keyhole trails, and hiking is not permitted on the Hidden Valley Trail.

Electric Motorized Bicycles (e-bikes) – Familiarity and Support

There was a significant difference regarding visitors' familiarity with e-bikes at the two trailheads (Table 25). At the North Trailhead, over half of the visitors (57%) reported they were "moderately" to "extremely" familiar with e-bikes, compared to only 26% of visitors at the South Trailhead.

Table 25. Familiarity with e-bikes at DBOS

	South Trailhead %	North Trailhead %
Not familiar	48	17
Somewhat familiar	14	16
Slightly familiar	11	11
Moderately familiar	14	28
Very familiar	9	18
Extremely familiar	3	11

$\chi^2 = 50.89$, $p < .001$, $V = .305$

At both trailheads (Table 26), approximately half of all visitors expressed opposition to e-bikes ranging from slightly opposed to strongly opposed. Thirty-four percent (34%) of North Trailhead visitors and 20% of South Trailhead visitors were in favor of e-bikes on natural surface trails ranging from slightly supportive to strongly supportive. Even though visitors at the North Trailhead were more familiar with e-bikes they were less supportive of e-bikes than visitors at the South Trailhead.

Table 26. Support for e-bikes on natural surface trails at DBOS

	South Trailhead %	North Trailhead %
Strongly opposed	27	32
Moderately opposed	13	12
Slightly opposed	6	11
Neither	24	12
Slightly support	5	11
Moderately support	7	12
Strongly support	8	11
Not sure	10	1

$\chi^2 = 30.00$, $p < .001$, $V = .235$

Visitors' familiarity with e-bikes was related to their primary activities (Table 27). Hikers were less familiar with e-bikes (54%) compared to mountain bikers (17%). Over a quarter of the mountain bikers (26%) were "very" or "extremely" familiar with e-bikes; 11% of the hikers expressed this level of familiarity.

Table 27. Familiarity with e-bikes on natural surface trails among hikers and mountain bikers at DBOS overall

	Primary activity	
	Hiking %	Mountain biking %
Not familiar	54	17
Somewhat familiar	14	16
Slightly familiar	11	13
Moderately familiar	9	28
Very familiar	8	17
Extremely familiar	3	9

$\chi^2 = 73.64$, $p < .001$, $V = .408$

Support for e-bikes varied by the user's primary activity (Table 28). Half of the hikers (50%) opposed e-bikes, 23% were neutral, and 16% supported e-bikes; 10% were not sure. Among the mountain bikers, 46% opposed e-bikes; 21% were neutral, and 21% supported e-bikes; 2% were not sure.

Table 28. Support for e-bikes on natural surface trails among hikers and mountain bikers at DBOS.

	Hikers %	Mountain bikers %
Strongly opposed	31	24
Moderately opposed	11	14
Slightly opposed	8	8
Neither	23	21
Slightly support	5	9
Moderately support	6	9
Strongly support	5	13
Not sure	10	2

$\chi^2 = 23.44$, $p = .001$, $V = .23$

Visitor Satisfaction

Nearly all respondents (98.7%) rated their overall experience at DBOS as "good" or "excellent" (Table 29). These findings far exceed the 80% standard for quality as set forth by previous research.

Table 29. Overall experience rating by visitors at DBOS

Ratings	% of responses
Poor	0
Fair	0
Neutral	1.3
Good	24.4
Excellent	74.3
Total	100%

At the South Trailhead, over 80% of visitors rated the quality of facilities as "good" to "very good" (Table 30). At the North Trailhead, over 89% of visitors rated the quality of the restrooms, parking areas, trash receptacles, kiosks, and trails as "good" to "very good". Except for drinking fountains (79%) and picnic areas (69%) at the North Trailhead (primarily due the low reported use of these facilities), all other facilities at both trailheads exceeded the 80% standard for satisfaction.

Table 30. Perceived quality of facilities at Devil's Backbone Open Space [a]

	South Trailhead %	North Trailhead %	χ^2	*p*-value	Cramer's *V*
Restrooms	83	90	.89	.346	.078
Parking Areas	92	92	0	1	.005
Drinking Fountain	86	79[b]	.67	.414	.083
Picnic Areas	86	69[c]	5.38	.027	.206
Trash Receptacles	80	89	1.65	.199	.085
Kiosk & Sign Information	84	89	.75	.385	.048
Trails	97	95	1.16	.281	.05

[a] Cell entries are the percent of respondents rating each facility from good to very good.

[b, c] At the North Trailhead, only 33 visitors rated the drinking fountain. One visitor rated the drinking fountain as poor, six visitors rated it as average, and 26 of visitors rated it as good or very good. Similarly, only 26 visitors reported the use of the picnic areas. Nine visitors rated it as average, and 18 visitors rated it as good or very good.

Perceived Conflict

At the South Trailhead, eighty-four percent (84%) or more of all respondents "never" *observed* hikers, mountain bikers or equestrian riders behaving unsafely or discourteously (Table 31). When these behaviors were witnessed, the top three most negative reported behaviors were "mountain bikers behaving unsafely" (16%), "hikers behaving unsafely" (12%), and "hikers being discourteous" (10%). Similarly, at the North Trailhead, eighty-three percent (83%) of all respondents "never" *observed* hikers, mountain bikers or equestrian riders behaving unsafely or discourteously. When these behaviors were witnessed, the top three most reported behaviors were "mountain bikers being discourteous" (17%), "mountain bikers behaving unsafely" (13%), and "hikers being discourteous" (6%).

Table 31. Witnessed unsafe and discourteous behaviors at DBOS on the day of the interview [a]

	South Trailhead %	North Trailhead %	χ^2	*p*-value	Phi
Saw hikers behaving unsafely	12	5	10.04	.040	.111
Saw mountain bikers behaving unsafely	16	13	16.10	.003	.194
Saw equestrian riders behaving unsafely	1	1	1.03	.597	.033
Witnessed hikers being discourteous	10	6	6.37	.173	.107
Witnessed mountain bikers being discourteous	6	17	14.49	.002	.174
Witnessed equestrian riders being discourteous	1	1	1.03	.596	.033

[a] Cell entries are percent of respondents who have observed the behavior; The comparison statistic is based on all ratings from "never" to "almost always"

At the South Trailhead, 83% of visitors reported "never" experiencing problem behaviors with hikers, bikers, and equestrians (Table 32). Perceived problems with other users were reported more at the North Trailhead than the South Trailhead. Fifty-two percent (52%) of visitors at the North Trailhead reported perceived problems with "Mountain bikers riding unsafely" and 48% of visitors reported they perceived problems with "Mountain bikers being discourteous".

Table 32. Perceived unsafe and discourteous behaviors with other visitors at DBOS[a]

	South Trailhead %	North Trailhead %	χ^2	*p*-value	Phi
Hikers hiking unsafely	15	20	7.01	.136	.122
Mountain bikers riding unsafely	17	52	65.49	<.001	.37
Equestrian riders riding unsafely	5	17	21.30	<.001	.22
Hikers being discourteous	15	32	20.68	<.001	.208
Mountain bikers being discourteous	15	48	55.40	<.001	.34
Equestrian riders being discourteous	5	17	18.27	.001	.204

[a] Percent of respondents who have perceived problems with each behavior

Combining the observed behaviors in Table 31 with the corresponding perceived problem behaviors in Table 32, resulted in the interpersonal and social values conflict distributions shown in Table 33. For both trailheads, between 48% and 95% reported no conflict. Between 5% and 41% expressed social values conflict. Less than 17% noted interpersonal conflicts with hikers, bikers, or horseback riders, which exceeds the standard that no more than 25% should report interpersonal conflict. A detailed description of perceived conflict indicator and standard is provided in the Visitor Survey Planning Framework and Background section.

Table 33. Perceived conflict at DBOS

	South Trailhead %	North Trailhead %	χ^2	*p*-value	Cramer's *V*
Hikers hiking unsafely			10.92	.004	.142
No conflict	85	80			
Interpersonal conflict	6	2			
Social values conflict	9	18			
Mountain bikers riding unsafely			58.65	< .001	.348
No conflict	83	48			
Interpersonal conflict	4	12			
Social values conflict	13	41			
Equestrian riders riding unsafely			17.85	< .001	.199
No conflict	95	83			
Interpersonal conflict	< 1	1			
Social values conflict	5	16			
Hikers being discourteous			27.83	< .001	.245
No conflict	85	68			
Interpersonal conflict	6	3			
Social values conflict	9	29			
Mountain bikers being discourteous			53.95	< .001	.336
No conflict	85	52			
Interpersonal conflict	4	17			
Social values conflict	11	31			
Equestrian riders being discourteous			14.50	.001	.178
No conflict	95	83			
Interpersonal conflict	< 1	1			
Social values conflict	5	16			

This study also compared perceived conflict based on primary activity (Table 34 and 35). Perceived conflict was observed more at the North Trailhead (Table 35). At the North Trailhead, mountain bikers perceived more social values conflict regarding *other* "Mountain bikers riding unsafely" (48%) and *other* "Mountain bikers being discourteous" (36%). Hikers perceived interpersonal conflict regarding *other* "Mountain bikers riding unsafely" (25%) and *other* "Mountain bikers being discourteous" (25%).

Previous research recommends that no more than 25% of the respondents should report interpersonal conflict. Although perceived interpersonal conflict by hikers is at the 25% threshold level (Table 35), when the survey was conducted, it may need attention in the future.

Table 34. Perceived conflicts by hikers and mountain bikers at the *South Trailhead*

	Primary activity				
	Hiking %	Mountain biking %	χ^2	*p*-value	Cramer's *V*
Hikers hiking unsafely			.67	.704	.047
No conflict	84	80			
Interpersonal conflict	7	9			
Social values conflict	10	12			
Mountain bikers riding unsafely					
No conflict	86	74	5.54	.049	.138
Interpersonal conflict	4	7			
Social values conflict	10	19			
Hikers being discourteous					
No conflict	88	77	4.73	.074	.128
Interpersonal conflict	6	9			
Social values conflict	7	15			
Mountain bikers being discourteous					
No conflict	89	77	6.31	.029	.15
Interpersonal conflict	3	4			
Social values conflict	8	19			

Table 35. Perceived conflicts by hikers and mountain bikers at the *North Trailhead*

	Primary activity				
	Hiking %	Mountain biking %	χ^2	*p*-value	Cramer's *V*
Hikers hiking unsafely			.57	.75	.057
No conflict	83	78			
Interpersonal conflict	0	2			
Social values conflict	17	20			
Mountain bikers riding unsafely					
No conflict	58	47	6.85	.033	.276
Interpersonal conflict	25	5			
Social values conflict	17	48			
Hikers being discourteous					
No conflict	75	65	1.62	.445	.126
Interpersonal conflict	8	3			
Social values conflict	17	32			
Mountain bikers being discourteous					
No conflict	75	51	10	.007	.25
Interpersonal conflict	25	13			
Social values conflict	0	36			

In addition, at both trailheads, perceived conflict did not vary by hikers and mountain bikers between weekdays (Monday-Friday) and weekends (Saturday-Sunday).

In terms of beliefs about different user behaviors, at the South Trailhead, two-thirds or more of the visitors disagreed with *there being* "Too many large groups of mountain bikers" (80%), hikers (69%), and equestrians (84%) (Table 36). Fifty-seven percent (57%) of respondents were neutral or disagreed with "hikers and mountain bikers should not be allowed on the same trails". Over half of visitors (55%) disagreed with "mountain bikers and equestrians should not be allowed on the same trails". Twelve percent (12%) of visitors agreed with "Encounters with dogs interfered with my enjoyment today".

Similarly, visitors at the North Trailhead disagreed that there are too many large groups of mountain bikers (68%), hikers (75%), and equestrians (83%). Eighty-five percent of respondents were neutral or disagreed with "hikers and mountain bikers should not be allowed on the same trails". Over half of visitors (63%) disagreed with "mountain bikers and equestrians should not be allowed on the same trails". Twelve percent (12%) of visitors agreed with "Encounters with dogs interfered with my enjoyment today".

Table 36. Beliefs about hikers, mountain bikers, and dogs at DBOS [a]

	South Trailhead %	North Trailhead %	χ^2	*p*-value	Cramer's *V*
Too many large groups of mountain bikers	20	32	22.65	<.001	.221
Too many large groups of hikers	31	25	12.88	.012	.133
Too many large groups of horseback riders	16	17	3.81	.283	.089
Hikers and mountain bikers should not be allowed to use the same trails	43	15	43.52	<.001	.255
Mountain bikers and horseback riders should not be allowed to use the same trails	45	37	3.85	.427	.084
Encounters with dogs interfered with my enjoyment today	12	12	1.19	.880	.046

[a] Cell entries are the percent of respondents who selected "agree" to "strongly agree".

Encounters with Others and Perceived Crowding

At the South Trailhead, visitors reported seeing an average of 13.43 hikers at the trailhead and 20.2 hikers on the trail (Table 37). They also reported seeing an average of 3.99 mountain bikers at the trailhead and 6.04 mountain bikers on the trail. At the North Trailhead, visitors reported seeing an average of 4.2 hikers at the trailhead and 7.53 hikers on the trail. They also reported seeing an average of 6.46 mountain bikers at the trailhead and 11.83 mountain bikers on the trail.

Visitors reported seeing significantly more hikers at the trailhead (M = 13.43) at the South Trailhead than the North Trailhead (M = 4.2). They also reported seeing significantly more hikers on the trail (M = 20.2) at the South Trailhead than the North Trailhead (M = 7.53). However, visitors reported seeking more mountain bikers both at the trailhead (M = 6.46) and on the trail (M = 11.83) at the North Trailhead. In these cases, the differences in these means were statistically significant and effect sizes were in the typical to substantial range.

Table 37. Reported number of other visitors seen at DBOS [a]

	South Trailhead	North Trailhead	*t*-value	*p*-value	Eta
Number seen at the trailhead					
Hikers	13.43[1]	4.20	10.69	< .001	.312
Mountain bikers	3.99	6.46	3.52	< .001	.177
Horseback riders	.1	.06	0.83	.405	.036
Number seen on the trail					
Hikers	20.2	7.53	12.36	< .001	.349
Mountain bikers	6.04	11.83	6.33	< .001	.321
Horseback riders	.14	.21	0.70	.486	.040

[a] Cell entries are means.

The percent of South Trailhead visitors reporting any level of crowding (feel slightly crowded to extremely crowded) ranged from 6 to 50 percent (Table 38). At the North Trailhead, these percentages were between 10 to 37 percent. All differences between the South and the North Trailhead percentages were statistically significant ($p < .05$). Visitors at the South Trailhead perceived a higher level of crowding by other hikers on the trail (50%). Visitors at the North Trailhead perceived a higher level of crowding by other mountain bikers on the trail (37%).

According to Vaske and Shelby (2008) (Table 1), when ≤ 35% of the visitors feel crowded, density levels in the area were not a problem. When 36-50% of visitors feel crowded, the location reaches a low normal capacity and low-density. Access, displacement, or crowding problems are not likely to exist currently. When 50 and 60% of visitors feel crowded, the location was approaching is carrying capacity, and visitors start to experience access and displacement problems. When over 65% of the visitors feel crowded, the location is considered over carrying capacity. The trails at the South Trailhead may start experiencing overuse problems and carrying capacity issues by the number of hikers.

Table 38. Perceived crowding by visitors at DBOS [a]

Did you feel crowded by:	South Trailhead %	North Trailhead %	χ^2	*p*-value	Cramer's *V*
Hikers					
At the trailhead	27	10	20.96	<.001	.184
On the trail	50	14	53.94	<.001	.301
Mountain bikers					
At the trailhead	6	13	5.29	.021	.105
On the trail	16	37	23.44	<.001	.219

[a] Cell entries are percent of respondents who feel slightly crowded to extremely crowded

At the South Trailhead, more hikers reported perceived crowding by other hikers on the trail (55%), compared to 39% of mountain bikers. Based on the standards established in Vaske and Shelby (2008) (Table 1), mountain bikers perceived a low normal capacity of South Trailhead while hikers perceived a high normal capacity. (Table 39 and Table 40).

Table 39. Perceived crowding by hikers and mountain bikers at the *South Trailhead* [a]

Did you feel crowded by:	Hikers % [b]	Mountain bikers %	χ^2	*p*-value	Cramer's *V*
Hikers					
At the trailhead	29	30	0.05	.821	.013
On the trail	55	39	5.64	.018	.133
Mountain bikers					
At the trailhead	7	12	1.86	.173	.08
On the trail	17	12	1.07	.302	.056

[a] This table only contains respondents who rated hiking or mountain biking as the primary activity at South Trailhead (*n* = 317)
[b] Percent of respondents who feel slightly crowded to extremely crowded

At the North Trailhead, more hikers reported perceived crowding by other mountain bikers on the trail (42%), compared to 34% of mountain bikers. These levels fall within the "low normal" threshold of crowding.

Table 40. Perceived crowding by hikers and mountain bikers at the *North Trailhead* [a]

Did you feel crowded by:	Hikers % [b]	Mountain bikers %	χ^2	*p*-value	Cramer's *V*
Hikers					
At the trailhead	0	11	2.59	.108	.118
On the trail	8	15	0.46	.497	.063
Mountain bikers					
At the trailhead	8	15	0.46	.497	.063
On the trail	42	34	0.29	.590	.054

[a] This table only contains respondents who rated hiking or mountain biking as the primary activity at North Trailhead (*n* = 104).
[b] Percent of respondents who feel slightly crowded to extremely crowded.

At the South Trailhead, significantly more visitors reported crowding by hikers at the trailhead (43%) and hikers on the trail (66%) on weekends, compared to weekdays by hikers at the trailhead (5%) and hikers on the trail (22%) (Table 41). Based on the standards established in Vaske and Shelby (2008) (Table 1), the South Trailhead is over capacity (66-80%) on weekends by hikers on the trail.

Table 41. Perceived crowdedness reported by visitors at the *South Trailhead* weekdays (Monday – Friday) and weekends (Saturday – Sunday)

Did you feel crowded by:	Mon – Fri %	Sat – Sun %	χ^2	*p*-value	Cramer's *V*
Hikers					
At the trailhead	5	43	78.46	<.001	.398
On the trail	22	66	75.02	<.001	.416
Mountain bikers					
At the trailhead	1	10	17.97	<.001	.18
On the trail	2	24	45.33	<.001	.292

[a] Cell entries are percent of respondents who feel slightly crowded to extremely crowded

Sixty percent (60%) of visitors at the South Trailhead felt the most crowded by other hikers on the trail in the mornings between 9:00 a.m. and 11:30 a.m., followed by 44% of visitors between 1:00 – 3:30 p.m. (Table 42). Based on Vaske and Shelby (2008) (Table 1), South Trailhead is considered in the high normal range (51-60%) in the mornings by the number of hikers on the trail.

Table 42. Perceived crowding by visitors at the *South Trailhead* by survey shift times [a]

Did you feel crowded by:	9:00 am – 11.30 am %	1:00 pm – 3:30 pm %	4:00 pm – 6:30 pm %	χ^2	*p*-value	Cramer's *V*
Hikers						
At the trailhead	38	23	8	27.46	<.001	.237
On the trail	60	44	19	28.10	<.001	.254
Mountain bikers						
At the trailhead	10	3	0	12.60	.002	.154
On the trail	25	6	5	32.54	<.001	.268

[a] Cell entries are percent of respondents who feel slightly crowded to extremely crowded

At the North Trailhead, visitors felt most crowded by mountain bikers on the trail in the mornings (40%) and evenings (42%). Based on Vaske and Shelby (2008) (Table 1), visitors experienced a low normal carrying capacity in the morning and evenings by mountain bikers.

Table 43. Perceived crowding by visitors at the *North Trailhead* by survey shift times

Did you feel crowded by:	9:00 am – 12:00 pm %[1]	1:00 pm – 4:00 pm %	4:00 pm – 7:00 pm %	χ^2	*p*-value	Cramer's V
Hikers						
At the trailhead	12	0[1]	8	2.09	.351	.104
On the trail	19	0	4	6.80	.033	.204
Mountain bikers						
At the trailhead	8	0	35	12.17	.002	.335
On the trail	40	0	42	7.92	.019	.208

[a] Cell entries are percent of respondents who feel slightly crowded to extremely crowded, the 0 value means people who were interviewed at this time didn't feel crowded.

Fifty-eight percent (58%) and 51% of users felt crowded by hikers on the Keyhole Trail and Wild Loop Trail, respectively (Table 44). This percentage was 41% for Hidden Valley users, and 20% for Blue Sky Trail users. At the Blue Sky Trail, 30% of users reported feeling crowded by mountain bikers on the trail. Based on Vaske and Shelby (2008) (Table 1), both of the Keyhole and Wild Loop trails were experiencing capacity issues at the time of data collection.

Table 44. Perceived crowding at most used trails of Devil's Backbone Open Space for all users

Did you feel crowded by:	Wild Loop Trail *n* = 269 %	Keyhole Trail *n* = 218 %	Hidden Valley Trail *n* = 92 %	Blue Sky Trail *n* = 167 %
Hikers				
At the trailhead	28	31	27	16
On the trail	51	58	41	20
Mountain bikers				
At the trailhead	6	6	8	10
On the trail	16	18	23	30

Visitor Survey Conclusions

Devil's Backbone Open Space was selected for this study by Larimer County Department of Natural Resources due to increased episodes of high visitation, to coincide with a six-month electric motorized bike study, to gather and collect baseline information against which future results can be compared and to inform management decisions. Findings here are from a 2020 survey of DBOS visitors in terms of their demographics, prior visitation rates and trip characteristics, visitor satisfaction, e-bike familiarity and support, perceived conflicts, and perceived crowding.

The results for visitor satisfaction, perceived conflict, and perceived crowding were expressed in terms of indicators and standards of quality, as recommended by existing literature. An indicator is a specific variable that reflects the current situation. A standard of quality is the minimum acceptable condition for each indicator. Standards identify desirable conditions, and conditions that managers are trying to achieve. The indicators and standards of quality for visitor satisfaction, perceived conflict, and perceived crowding have received them most attention in the natural resource literature.

Key Findings

Devil's Backbone Open Space visitors were (on average) in their early-40's, were more likely to visit in a group (two or more) rather than alone and were not likely to check trail conditions prior to their visit (83%). Exercise was the primary feature that attracted visitors to the open space; "trails" received the highest facility ratings. Over half of the visitors did not change their frequency of visits to the open space due to COVID-19; 22% decreased visitation and 20% increased visitation. Greeley was the top origin city by non-residents and Loveland and Fort Collins were the top origin cities by residents. Approximately half of all visitors expressed opposition to e-bikes ranging from slightly opposed to strongly opposed.

Other survey results varied by North versus South trailhead:

- **North Trailhead –** Visitors were more likely to be male (76%) and residents of Larimer County (82%). The primary activities reported by visitors varied between weekdays and weekends. Quality of trails (57%) was important to visitors followed by natural resource values (23%). Thirty-seven percent (37%) of non-residents made their first or second visit to the North Trailhead in 2020, compared to 14% of residents. Over half of the visitors reported that they were familiar with e-bikes (57%).

- **South Trailhead –** Visitors were 49% male and nearly half were non-residents (42%). Hiking was the primary activity on weekdays and weekends (60%). Natural resources values (34%) were important to visitors followed by the quality of trails (30%). Sixty-four percent (64%) of non-residents made their first or second visit to the South Trailhead in 2020 compared to 27% of residents. Nearly half of all the visitors were not familiar with e-bikes (48%).

The following summarizes the indicators and standards of quality for DBOS:

1. **Visitor Satisfaction**

    - Based on the literature (e.g., Vaske et al., 1982; Vaske & Roemer, 2013), a satisfaction standard for Larimer County natural areas was set at 80% or more of visitors should be satisfied with their experience or the services they received.

    - Ninety-nine percent (98.7%) of survey respondents rated their overall experience at Devil's Backbone Open Space as "good" or "excellent," exceeding the 80% standard.

2. **Perceived Conflict**:

    - Interpersonal conflict occurs when the physical presence or behavior of an individual or group interferes with the goals of another individual or group. The literature suggests a standard of no more than 25% of visitors should feel interpersonal conflict.

- Less than eighteen percent (18%) of hikers and mountain bikers indicated having interpersonal conflicts with other hikers and mountain bikers, such as acting unsafely or discourteous, at Devil's Backbone Open Space, meeting the 25% standard.
- At the North Trailhead, twenty-five percent (25%) of the hikers indicated interpersonal conflict with mountain bikers riding unsafely and being discourteous.

3. **Perceived Crowding**:

- The crowding literature (Shelby et al., 1989; Vaske & Shelby, 2008) has suggested a standard of $\leq$ 35% of visitors should not feel any level of crowding. This report examined this standard for hikers and mountain bikers at the trailhead and on the trail.
- Overall, the 35% level of perceived crowding standard was met at Devil's Backbone Open Space, however, there were some exceptions:

  North Trailhead:

  - Thirty seven percent (37%) of visitors felt slightly to extremely crowded by mountain bikers on the trail.
  - Forty-two percent (42%) of hikers felt slightly to extremely crowded by mountain bikers on the trail.
  - Over forty percent (40%) of visitors felt slightly to extremely crowded by other mountain bikers in the mornings when taking the survey between 9:00 a.m. – Noon and evenings between 4:00 – 7:00 p.m.

  South Trailhead:

  - Fifty percent (50%) of **visitors** crowded by hikers on the trail.
  - On weekends, sixty-six percent (66%) of **visitors** felt crowded by hikers on the trail and hikers at the trailhead (43%)
  - Fifty-five percent (55%) of **hikers** felt crowded by other hikers on the trail
  - Thirty-nine percent (39%) of **mountain bikers** felt crowded by hikers on the trail.
  - Forty-one percent (41%) of **visitors** who recreated on Hidden Valley Trail, 58% on the Keyhole Trail, and 51% on the Wild Loop Trail felt crowded by hikers on the trail.
  - Sixty-percent (60%) of visitors felt crowded by other hikers on the trail in the mornings when taking the survey between 9:00 – 11:30 a.m. and 44% in the afternoons between 1:00-3:30 p.m.

Overall, the findings suggested that the standards of quality for visitor satisfaction, perceived conflict, and perceived crowding were met at Devil's Backbone Open Space with a few exceptions. Visitors were extremely happy with their overall experience at the open space. Perceived conflict by visitors also met the standard, however 25% of hikers at the north trailhead indicated interpersonal conflict with mountain bikers riding unsafely and being discourteous. While no immediate action is needed at this time, perceived conflict should be monitored in the future. Relative to perceived crowding, the North Trailhead experienced low normal carrying capacity (36%-50%) by other mountain bikers on the trail. The South Trailhead is experienced high normal carrying capacity by other hikers on the trail (51%-65%). On weekends this percentage increased to 66%. While visitors were extremely satisfied with their overall experience, these findings suggest that management should consider ways to reduce crowding at the open space, particularly during peak days and times. Appendix B provides general criteria for choosing additional indicators and standards if expanded research in the future is warranted.

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Appendix A

Devil's Backbone Open Space Survey

LARIMER COUNTY

Devil's Backbone Open Space (DBBOS) / Blue Sky Trail Visitor Survey (2020-2021)

This survey will help the Larimer County Department of Natural Resources better understand visitors' views and improve service.
Your participation is completely voluntary, and your answers will remain anonymous.
Thank you for your assistance – your input is greatly appreciated!

1. About how many visits have you made to **Devil's Backbone Open Space** in the past 12 months?
(If this is your first visit or you come here less than once per year, write 0) _____ Number of visits

2. During your visit to Devil's Backbone Open Space **TODAY**, what was your **Primary Activity**?
(*Check the **ONE** activity that best applies.)*
___ Hiking
___ Mountain Biking
___ Electric motorized bicycling
___ Trail running
___ Walking Dogs
___ Horseback riding
___ Wildlife viewing
___ Other: _____

3. Which of the following best describes **WHO** traveled here with you today?
(Check one and write in the number of people in your group, if more than just you today.)
___ Just me
___ Group (___ Number of adults your group, ___ Number of children in your group)

4. In the past 12 months, have you **NOT** been able to recreate at Devil's Backbone Open Space because the parking lot was **FULL**?
___ No
___ Yes *If Yes*, approximately how many times? _____

5. Did you check the trail conditions for this open space before you came out TODAY?
___ No
___ Yes *If Yes*, check all that apply
___ Larimer County Natural Resources website
___ Trailhead webcam
___ Other: _____
___ COTREX (trails app)
___ Social Media

6. Which trail(s) at Devil's Backbone Open Space did you use TODAY?
Please refer to the laminated trails map included. (*Check all that Apply).*
___ Wild Loop Trail
___ Keyhole Trail
___ Hidden Valley Trail
___ Blue Sky Trail
___ Indian Summer Trail
___ Laughing Horse Loop
___ Hunter Loop Trail
___ Rimrock Trail
___ Morrison Trail

7. What is the ***primary feature*** that attracted you to this open space **TODAY**?
(Check the ONE feature that best applies)

___ Natural Resource ___Quality of Trails ___ Exercise ___ Solitude ___Wildlife ___Other _____

8. For the facilities that you used today during your visit, please rate their quality by circling the appropriate number for each facility.

	Did Not Use	Very Poor	Poor	Average	Good	Very Good
Restrooms	0	1	2	3	4	5
Parking Areas	0	1	2	3	4	5
Drinking Fountains	0	1	2	3	4	5
Picnic Areas	0	1	2	3	4	5
Trash Receptacles	0	1	2	3	4	5
Kiosk & Sign Information	0	1	2	3	4	5
Trails	0	1	2	3	4	5

9. How would you rate your overall experience at Devil's Backbone Open Space? *(Circle one number)*

Poor		Neutral		Excellent
1	2	3	4	5

Please explain why you rated it this way: _____

11. How often **did each** of the following happened to you personally during **THIS VISIT** to Devil's Backbone Open Space? *(Circle one for each statement)*

	Never	1 or 2 times	3 to 5 times	Many times	Almost always
Saw hikers behaving unsafely	0	1	2	3	4
Saw mountain bikers behaving unsafely	0	1	2	3	4
Saw horseback riders behaving unsafely	0	1	2	3	4
Witnessed hikers being discourteous	0	1	2	3	4
Witnessed mountain bikers being discourteous	0	1	2	3	4
Witnessed horseback riders being discourteous	0	1	2	3	4

12. In general, to what extent do you **think each** of the **following is a problem** at Devil's Backbone Open Space?

	Never	1 or 2 times	3 to 5 times	Many times	Almost always
Hikers hiking unsafely	0	1	2	3	4
Mountain bikers riding unsafely	0	1	2	3	4
Horseback riders riding unsafely	0	1	2	3	4
Hikers being discourteous	0	1	2	3	4
Mountain bikers being discourteous	0	1	2	3	4
Horseback riders being discourteous	0	1	2	3	4

13. In general, to what extent do you agree or disagree with each of the following statements?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
There are too many large groups of *mountain bikers*	1	2	3	4	5
There are too many large groups of *hikers*	1	2	3	4	5
There are too many large groups of *horseback riders*	1	2	3	4	5
Hikers and *mountain bikers* should not be allowed on the same trails	1	2	3	4	5
Mountain bikers and *horses* should not be allowed on the same trails.	1	2	3	4	5
Encounters with *dogs* interfered with my enjoyment today.	1	2	3	4	5

14. Please **estimate** the number of visitors you saw **TODAY** at the trailhead and on the trail.

	Number seen at the trailhead	Number seen on the trail
Hikers		
Mountain bikers		
Horseback riders		

15. Did you feel crowded **TODAY** by the number of other visitors at each of the following locations?

Did you feel crowded by:	Not at all Crowded		Slightly Crowded		Moderately Crowded			Extremely Crowded	
Hikers									
At the trailhead	1	2	3	4	5	6	7	8	9
On the trail	1	2	3	4	5	6	7	8	9
Mountain bikers									
At the trailhead	1	2	3	4	5	6	7	8	9
On the trail	1	2	3	4	5	6	7	8	9

Electric Motorized Bike Study *(July 2020 – February 2021)*

Larimer County Department of Natural Resources has implemented a permit-only electric motorized bike study on designated natural (soft) surface trails at DBBOS. **A limited number of Class 1, two-wheel electric motorized bikes (E-bikes) are allowed, defined as an assisted bicycle equipped with a motor that provides help only when the rider is pedaling and ceases to aid at 20 mph.** ***Electric motorized bicycles are not currently allowed at DBBOS except by special permit for this study.***

16. Overall, how familiar are you with electric motorized bicycles?

Not Familiar	Somewhat Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
1	2	3	4	5	6

17. Currently motorized vehicles (except by permit for this study) are not allowed on Larimer County **natural surface** trails. **Please rate your level of opposition or support toward expanding natural (soft) surface trail uses to include Class 1 electric motorized bicycles.**

	Strongly opposed	Moderately opposed	Slightly opposed	Neither Support nor Oppose	Slightly support	Moderately support	Strongly support	Not Sure
Class 1 E-bikes	1	2	3	4	5	6	7	8

Please briefly explain why you answered this way:

_____

Visitor Information

18. Please rate the level of impact of the COVID-19 pandemic on the frequency of your visits to Devil's Backbone Open Space in 2020.

Definitely decreased	Somewhat decreased	No Change	Somewhat increased	Definitely increased
1	2	3	4	5

19. What is your gender? ____ Male ____ Female

20. What is your age? _____ (Years)

21. Please indicate whether you are of Hispanic or Latino ethnicity.

___ Hispanic or Latino ___ Not Hispanic or Latino

22. Choose the race with which you most closely identify (Check all that apply)

___ White ___ American Indian or Alaska Native ___ Asian
___African American ___ Native Hawaiian/Pacific Islander ___ Other

23. What is your Zip Code for your PRIMARY residence? _____

24. If you live in Larimer County, how long have you lived here? _____ (Years)

Appendix B

Criteria for Choosing Indicators

Before standards can be developed, appropriate impact indicators must be selected. As used in other sciences (e.g., medicine, agriculture, forestry), indicators are variables that reflect the "health" of something (Ott, 1978). Indicators identify what conditions will be monitored (e.g., a person's blood pressure), while the standards define when those conditions are acceptable or unacceptable. For example, the American Heart Association defines high blood pressure (an indicator) as greater than or equal to 140 mm HG systolic pressure (a standard) or greater than or equal to 90 mm Hg diastolic pressure (a standard).

Although any number of variables could be monitored, it is important to identify those indicators that are most linked to issues of concern (Graefe et al., 1990). Thus, while a physician could monitor a stroke victim's kidney functions, it is more efficient to focus on the individual's blood pressure. The same logic applies to selecting indicators for natural area recreation opportunities. A manager could count the number of vehicles at trailhead parking lots, but past research suggests that monitoring how individuals distribute themselves in time and space throughout a natural area, or how they interact with other visitors, are better indicators of recreation-opportunity differences (Kuss et al., 1990; Shelby & Heberlein, 1986).

It is also important to recognize that there is no single "best" indicator or set of indicators. The choice of indicators and standards depends on the particular impact under consideration and the specific characteristics of the site. In other words, indicators and standards should be specific to the resource and opportunities provided at the site. The key is to select those impact indicators that matter the most for a given experience. Although indicators and standards are site specific, it is possible to identify criteria for choosing indicators.

Criteria for Choosing Indicators

- Specificity and responsiveness
- Sensitivity
- Measurability
- Integration with management objectives
- Impact importance

Specificity and Responsiveness. Indicators are only useful if they refer to specific conditions created by human use. For example, an overall measure of human density in an area is too vague unless it is linked to the impact conditions associated with that level of use (e.g., encounters with others, loss of solitude-oriented wildlife-viewing opportunities). Specific indicators might focus on the cleanliness of restrooms or trash receptacles.

Indicators should reflect impact changes related to impacts caused by human activity rather than those caused by natural events. Unfortunately, disentangling human from natural impacts is complex. Wall and Wright (1977) suggest four factors that limit ecological studies and introduce difficulties in identifying human impacts: (1) there are often no baseline data for comparison to natural conditions; (2) it is difficult to disentangle the roles of humans and nature; (3) there are spatial and temporal discontinuities between cause and effect; and (4) in light of complex ecosystem interactions, it is difficult to isolate individual components. Some impacts take the form of naturally occurring processes that have been speeded up by human interference. Even without human activity, however, severe impacts can occur due to natural causes that render the impacts associated with recreational use insignificant.

Sensitivity. The indicator needs to be sensitive to changes in conditions during relatively short time periods; Merigliano (1989) suggests within one year. Such changes may be reflected in biological conditions (e.g., the amount of erosion on a given trail) or the human experience (e.g., the frequency of encounters with others). If the indicator only changes after impacts are substantial or never changes, the variable lacks the early warning signs that allow managers to be proactive.

General measures of overall visitor satisfaction, for example, is often a major management objective and has been one of the most commonly used indicators of recreation quality. If, as traditionally assumed, enjoyment from a recreation experience is inversely correlated with the number of people present, reported overall satisfaction ratings should provide the basis for setting standards. Studies in a variety of settings, however, have consistently found that recreationists are generally satisfied with their experience independent of the use intensities they experienced (Kuss et al., 1990).

A variety of explanations have been offered to account for these findings. For example, to cope with the negative consequences of increasing numbers of visitors (e.g., loss of solitude), some individuals modify their standards for what is acceptable. The end result is a "product shift" or change in the character of the experience at a given area. Other people who are more sensitive to user densities may stop visiting an area all together if adjustments, either attitudinal (product shift) or behavioral (e.g., visiting during off peak times, visiting less frequently), fail to bring about the desired experience. With all of these explanations, the current visitors to a heavily used area may be as satisfied as visitors 5 or 10 years ago when use levels were much lower but are receiving a different type of experience.

While overall satisfaction measures are not always sensitive to changing use conditions, other measures of recreation quality do show the requisite variation. Perceived crowding, for example, combines the descriptive information (the density or encounter level experienced by the individual) with evaluative information (the individual's negative evaluation of that density or encounter level). When people evaluate an area as crowded, they have at least implicitly compared the impact they experienced with their perception of a standard. Findings from the comparative analysis of 181 crowding studies and 615 different settings and activities indicated that crowding varied across recreational settings and activities, time or season of use, resource availability, accessibility, or convenience, and management strategies designed to limit visitor numbers (Vaske & Shelby, 2008). This variability has allowed recreation researchers and managers to use crowding as a useful indicator.

Measurability. Indicators should be easily and reliably measurable in the field. When choosing impact indicators, it is important to specify the level of detail at which selected indicators will be measured and evaluated. The scale of measurement may range from sophisticated indices using quantitative measurements to subjective visual rating schemes. The choice of an appropriate level of measurement depends on such factors as the availability of funding and personnel, number of sites that must be evaluated, and frequency of measurement and site evaluation.

To illustrate, early crowding studies employed multiple-item scales (Shelby et al. 1989). While such scales consider a concept from different points of view and provide the data necessary for estimating reliability coefficients, the mathematical calculations involved in combining survey items into a single scale score sometimes make it difficult to compare results and can render the findings less understandable to managers (Vaske & Shelby, 2008). To overcome these problems, the single item crowding indicator discussed here that asks people to indicate how crowded the area was at the time of their visit overcomes these problems.

The crowding measure alone is not a perfect substitute for information about use levels, impacts, and evaluative standards that a more complete study can provide. Nevertheless, one can easily collect data with a single crowding item, thereby providing considerable insight about a study site. The single-item crowding measure is easy to interpret and compare across studies and has been widely used in outdoor-recreation research (Shelby et al. 1989; Vaske & Shelby, 2008). The consistency of these findings makes the crowding measure a good indicator for addressing social impacts.

Integration with Management Objectives. Indicators need to be linked to the management objectives that specify the type of experience to be provided. For example, if a management objective is to provide a low-density backcountry experience, the indicators should focus on the number of encounters between visitors, perceptions of crowding, and encounter norm tolerances. Alternatively, if a management objective involves frontcountry opportunities, the indicators might be linked to visitor safety and the cleanliness of facilities.

Useful impact indicators are those that can be treated by management prescriptions. A seemingly eloquent solution to a human-caused impact that cannot be addressed by management actions does not resolve the problem condition. The most useful indicators reflect multiple impact conditions. Because managers typically have small monitoring budgets, indicators that can be used to represent several different impacts allow managers to focus their attention and efforts while being reasonably assured that the overall quality of a given experience is maintained. Crowding or norm tolerances are examples that often reflect several other interaction-type indicators such as encounters with others.

The concept of norms provides a theoretical framework for collecting and organizing information about users' evaluations of conditions and has proven to be sensitive to changing use conditions. As defined by one research tradition, norms are standards that people use to evaluate behavior or the conditions created by behavior as acceptable or unacceptable (see Vaske & Whittaker, 2004 for a review). Norms define what behavior or conditions should be, and can apply to individuals, collective behavior, or management actions designed to constrain collective behavior. This normative approach allows researchers to define social norms, describe a range of acceptable behavior or conditions, explore agreement about the norm, and characterize the type of norm (e.g., no tolerance, single tolerance, or multiple tolerance norms; Whittaker & Shelby, 1988).

Normative concepts in natural-resource settings were initially applied to encounter impacts in backcountry settings (encounter norms measure tolerances for the number of contacts with other users). The focus on encounters in backcountry worked because encounter levels were generally low, survey respondents could count and remember them, and encounters have important effects on the quality of experiences when solitude is a feature. Most studies showed that encounter norms across these backcountry settings were stable and strongly agreed upon, usually averaging about four encounters per day (Vaske. Shelby, Graefe, & Heberlein, 1986).

More recently, norm concepts and methods have been applied to a greater diversity of impacts and settings. Research on encounter norms in higher-density frontcountry settings, for example, has demonstrated more variation in visitors' tolerances for others as well as lower levels of agreement (Donnelly et al., 2000). This led some researchers to examine norms for interaction impacts other than encounters (Vaske & Whittaker, 2004). Norms for recreationist proximity, percentage of time within sight of others, incidents of discourteous behavior, competition for specific resources, and waiting times at access areas have all been examined. These alternative interaction impacts are often more salient than encounters in higher-use settings. Taken together, this work suggests that normative data are sensitive to changing use conditions, can facilitate understanding visitors' evaluations of social and environmental conditions, and have proven helpful to managers.

Normative standards may also provide a gauge for estimating benefits to society. If, for example, a management objective is to enhance the flow of dollars into a community's economy by creating more recreation opportunities, one indicator might be the occupancy rate at local motels. The standard in this situation might be 50% occupancy.

Impact Importance. Finally, and most importantly, indicators should represent important impacts. For example, if managers, stakeholders, and visitors are not concerned about a social impact or researchers are not able to show how an impact negatively influences environment, developing standards is difficult to justify. If wildlife viewers are more interested in photographing elk than the number of people standing next to them, frequency of seeing elk becomes a better indicator of quality experiences than social-interaction variables. Alternatively, if visitors consider solitude in viewing experiences as more important than number of animals seen, encounters with other visitors becomes an important quality indicator.

Characteristics of Good Standards

Specific standards are established for each impact indicator and define an acceptable level of impact for each indicator. Just as impact indicators reflect management goals and objectives, standards are quantifiable value judgments concerning what the agency is attempting to achieve. Based on previous work (Graefe et al., 1990), the following discusses several important characteristics of good standards.

- Quantifiable
- Time Bounded
- Attainable
- Output Oriented

Quantifiable. Standards restate management objectives in quantitative terms. A good standard unequivocally states the level of acceptable impact. Such statements define how much is acceptable in quantitative terms. For example, a good standard might specify that visitors should be able to watch wildlife with fewer than 10 other people present. Specifying that there should only be "a few other people present" is not a good standard because it does not define how many constitutes "a few."

Time Bounded. "Time-boundedness" complements the quantifiable component of a good standard. Quantifiable standards only state "how much" is appropriate. Time-bounded standards specify "how much, how often" or "how much by when." This is especially important for impacts that have a seasonal component. Seeing 500 elk in Rocky Mountain National Park (ROMO) is a common occurrence for a fall evening, but a rare event during the summer when the elk are at higher elevations. Such seasonal differences in viewable wildlife often correlate with fluctuations in visitor numbers. The number of day visitors to ROMO who are explicitly interested in viewing and photographing elk, for example, is substantially greater in the fall than other seasons. Time-bounded standards recognize such variation.

Attainable. Management standards need to be reasonably attainable. When standards are too easy, little is accomplished. If they are too difficult to achieve, both managers and visitors are likely to become frustrated. Good objectives and standards should "moderately challenge" the manager and staff.

For each important indicator, standards should be set at levels that reflect management's intent for resource or experiential outcomes in the area. While standards that are difficult to attain are generally undesirable, they may still be necessary. A "no litter" standard, for example, may not be attainable, but is still correct. The cynical excuse for not setting appropriate standards is that managing for some conditions is "too hard." On the other hand, management strategies designed to meet a standard may produce sufficient positive change to warrant the effort. Without standards, it is too easy to do nothing (management by default).

Output Oriented. Standards should be "output" rather than "input" oriented. This distinction suggests that managers should focus on the conditions to be achieved rather than the way the standard is met. For example, a standard that specifies "150 people per day in a wildlife-viewing area" is not a good standard because it refers to an action (use limits) rather than an acceptable impact. "Less than 10 encounters per day" or "no more that 35% of the visitors feeling some level of crowding" are better standards because they emphasize the acceptability of different impact conditions.

Sources for Selecting Indicators/Developing Standards

Identifying characteristics of good standards is a useful exercise, but it does not provide much information about what standards should be (see inset – Different Experiences—Different Indicators and Standards), or where they should come from. Many different management and research efforts have developed or recommended various standards, utilizing a variety of techniques or sources of information. A review of the most common sources and techniques follows.

- Laws and policy mandates
- Manager's professional judgment
- Biological research
- Public involvement
- Visitor or population surveys

Laws and Policy Mandates. Laws and policy mandates may provide guidelines for selecting specific impact indicators and developing appropriate standards for desirable wildlife-viewing experiences. Most laws, however, are written in broad and often vague language. Directives such as "provide high-quality viewing experiences" or "minimize conflict" lack the specificity necessary to set quantitative standards.

Manager's Professional Judgment. Managers often develop standards based on their interpretation of laws and policy mandates, their knowledge of the area, their understanding of the recreation opportunities, and their knowledge of conditions that define those opportunities. By imposing their idea of what is appropriate, or even their own personal values, in the decision-making process, managers have implicitly been setting standards for years. An argument can be made, however, for setting standards more explicitly. First, although management standards have traditionally been based solely on professional judgment and biological expertise, the increasingly political nature of all natural-resource actions implies that decisions made in isolation are likely to generate considerable public scrutiny. Second, although it has been assumed that managers understand the acceptability of different resource and experiential conditions, empirical evidence suggests considerable differences between the views of managers, visitors, and organized interest groups (Magill, 1988; Gill, 1996). By formalizing the process for developing standards and including different points of view, managers gain a greater understanding of their objectives, have more justification for their actions, and are able to be more proactive when potential problem situations arise.

Biological Research. Science-based research has been and always will be an important component in developing standards. Data help clarify what management goals are biologically possible and describe how management actions affect wildlife impacts. Biological research by itself, however, cannot predict which alternatives are more or less desirable. For example, scientists are often assumed to be the most appropriate individuals to set standards for acceptable air- and water-pollution levels. When viewed from the larger societal perspective, however, this assumption is invalid. The scientific data describe the consequences of allowing a certain number of pollutants per volume of air or water (e.g., X number of people will die at contamination level Y). Whether this risk level is considered acceptable depends on legislation or other government functions. Even at extremely low levels of water pollution, some people are likely to become ill. It is impossible to set a standard until the acceptability of various risk levels has been identified.

Public Involvement. Traditional public involvement (e.g., focus groups, public meetings) represent another important strategy for developing standards, especially for social-impact indicators and standards. Recreationists are experts in identifying the characteristics of an experience they find most important. When given the opportunity to communicate their preferences, individuals are typically willing to express their views. Small focus-group meetings with different interest groups, for example, provide a useful starting point for identifying which impacts matter more. Standards can be developed from input provided by participants at larger public meetings, but it is often difficult to focus discussion on specific issues at these meetings. Moreover, individuals who attend public hearings and voice the loudest concerns may not represent all constituents.

Although these traditional techniques for soliciting citizen participation provide useful information, managers are increasingly adopting a stakeholder approach to involving public interests. Approaches such as transactive planning and co-management bring diverse interests and stakeholders in direct communication with one another and with agency decision makers to fashion collaborative solutions to management challenges. For example, agencies now routinely form citizen task forces, roundtables, advisory councils, and stakeholder planning teams to assist agency personnel with planning tasks and decisions. When multiple stakeholders have a voice in developing standards, polarized views about acceptable conditions and experiences are likely to emerge. Under these conditions, some negotiation and compromise must occur to develop standards that will be supported by the different publics and interest groups.

Visitor or Population Surveys. As this report has tried to demonstrate, perhaps the most useful source for developing standards involves visitor or population surveys. Even the best public-involvement efforts tend to neglect the "general public" in favor of special-interest groups who voice strong opinions on a topic. When surveys adhere to scientific principles (e.g., reliability, validity, representativeness, generalizability), the approach is especially useful for developing standards for social indicators (Vaske, 2008).

First, the survey should include a range of impact conditions and gauge which of those impacts are more important. Managers may ultimately establish standards for only a few key impact indicators. However, because surveys are usually conducted before this decision is made, asking about several different types of impact (e.g., human-interaction impacts) allows some flexibility in choosing different indicators. If respondents are asked to consider the relative importance of different impacts, the survey can facilitate the indicator selection process.

Second, questions about users' personal standards should be direct, involve quantitative response categories, and be easy to understand. As noted previously, extensive research has failed to demonstrate a consistent relationship between impact variables (e.g., encounters with others) and general evaluative measures (e.g., satisfaction). Most researchers recommend focusing on the evaluation of impacts themselves (Shelby & Heberlein, 1986). For example, surveys might ask respondents to report the number of encounters they are willing to have per day or to rate acceptable encounter levels for different experiences. An effective technique used in several studies involves parallel questions about the amount of impact individuals experienced and the amount of impact they are willing to tolerate. Statistical comparisons of such results provide data about where to set standards and allow definition of an impact problem.

Third, when asking about quantitative estimates of acceptable impact levels, respondents should be allowed to specify that "this impact does not matter to me" or that "the impact matters but I cannot give a number" (Hall, Shelby, & Rolloff, 1996; Roggenbuck, Williams, Bange, & Dean, 1991). Some wildlife viewers, especially those with little experience, may not have opinions about acceptable impact levels or may not even be aware of the impact situation (Donnelly et al., 2000). Finally, analysis of survey data should go beyond simple frequencies or measures of central tendency. Such measures are useful starting points, but closer examination of the response distributions reported by different groups or the level of group agreement are also important for developing standards.

Appendix C

Ranking of Perceived Crowding in Colorado

Table C1. Ranking of perceived crowding for Colorado resources and evaluation contexts

		Evaluation context		
Study site	Date	Evaluation by:	Evaluation for:	Crowding Scale 3-9 %
Mesa Verde National Park	2001	Visitors at Cliff Palace	Other visitors	76
Rocky Mountain National Park	2001	Tourists	Visitors at Alpine Visitor Center	74
Mt Evans	1994	Deer Hunter	Other Deer Hunters	72
Mt Evans	1994	Tourists	Regional Survey	70
Rocky Mountain National Park	2001	Hikers	Longs Peak Hikers on the Trail	69
Rocky Mountain National Park	2001	Hikers	Longs Peak Hikers at the Summit	69
Rocky Mountain National Park	2001	Tourists	Trails near Bear Lake	68
Mesa Verde National Park	2001	Visitors at Museum	Other visitors - overall	67
Mesa Verde National Park	2001	Visitors at Spruce Tree House	Visitors at Spruce Tree House	67
Mesa Verde National Park	2001	Visitors at Museum	Other visitors at Museum	66
Rocky Mountain National Park	2001	Tourists	Bear Lake by Kiosk	66
Rocky Mountain National Park	2001	Tourists	Trail around Bear Lake	65
Mesa Verde National Park	2001	Visitors at Spruce Tree House	Other visitors - overall	64
Mesa Verde National Park	2001	Visitors at Step House	Other visitors - overall	63
Mt Evans	1994	Tourists	Other Tourist	61
Mesa Verde National Park	2001	Visitors at Cliff Palace	Other visitors - overall	60
City of Fort Collins – Maxwell	2018	Mountain bikers	Hikers on trail	58
Vail Pass White River NF	2003	Nonmotorized Users	snowmobilers at trailhead	57
Vail Pass White River NF	2003	Nonmotorized Users	snowmobilers on trail	57
Rocky Mountain National Park	2001	Tourists	Bear Lake Glacier Basin Shuttle Lot	55
Devil's Backbone OS South Trailhead	**2020**	**Hikers**	**Hikers on Trail**	**55**
City of Fort Collins – Maxwell	2018	Mountain bikers	Mountain bikers on trail	49
Mesa Verde National Park	2001	Visitors at Sun Point Overlook	Other visitors	48
Appalachian National Scenic Trail	1999	Non-Thru hiker	Other hikers	47
Gunnison Gorge Natl Conserv Area	2002	Gunnison Gorge Wilderness	All users	47
Gunnison Gorge Natl Conserv Area	2002	Gunnison River non-wilderness	All users	42
City of Fort Collins – Reservoir Ridge	2018	Mountain bikers	Hikers on trail	41
Cache la Poudre River	1993	Anglers	Other anglers	40
Colorado Reservoirs	1998	Anglers	Other anglers	39
Gunnison Gorge Natl Conserv. Area	2002	Flat Top & Peach Valley - OHVs	All users	39
Rocky Mountain National Park	2001	Hikers	Longs Peak hikers at trailhead	37
City of Fort Collins – Maxwell	2018	Mountain bikers	Hikers at trailhead	37
Devil's Backbone OS North Trailhead	**2020**	**Mountain bikers**	**Mountain bikers on trail**	**37**
Colorado Reservoirs	1998	Anglers	South Catamount Reservoir anglers	35

		Evaluation context		
Study site	Date	Evaluation by:	Evaluation for:	Crowding Scale 3-9 %
Wolf Creek Pass	2003	Nonmotorized Users	Snowmobilers at trailhead	35
Cache la Poudre River	1993	Anglers	Evaluations of rafters	34
City of Fort Collins – Coyote Ridge	2018	Mountain bikers	Hikers on trail	33
Cache la Poudre River	1993	Kayakers	Rafters at the put-in	31
Vail Pass - White River NF	2003	Motorized Users	skiers/snowboarders at trailhead	31
Jefferson County	1996	Hikers	Bikers	30
Vail Pass - White River NF	2003	Motorized users	snowmobilers at trailhead	30
Horsetooth Mountain Open Space	2018	Visitors	Hikers on trail	30
City of Fort Collins – Maxwell	2018	Hikers	Mountain bikers on trail	30
City of Fort Collins – Pineridge	2018	Mountain bikers	Mountain bikers on trail	30
Cache la Poudre River	1993	Anglers	Kayakers	29
Vail Pass White River NF	2003	Nonmotorized Users	skiers/snowboarders at trailhead	29
Wolf Creek Pass	2003	Nonmotorized Users	snowmobilers on trail	29
Vail Pass White River NF	2003	Nonmotorized Users	skiers/snowboarders on trail	28
Wolf Creek Pass	2003	Nonmotorized Users	skiers/snowboarders on trailhead	27
City of Fort Collins – Coyote Ridge	2018	Mountain bikers	Mountain bikers on trail	26
City of Fort Collins – Maxwell	2018	Hikers	Hikers on trail	25
City of Fort Collins – Pineridge	2018	Hikers	Mountain bikers on trail	25
City of Fort Collins – Pineridge	2018	Mountain bikers	Hikers on trail	25
Horsetooth Mountain Open Space	2018	Visitors	Hikers at trailhead	24
City of Fort Collins – Maxwell	2018	Mountain bikers	Mountain bikers at trailhead	23
City of Fort Collins – Pineridge	2018	Mountain bikers	Mountain bikers at trailhead	23
Cache la Poudre River	1993	Rafters	Other rafters at the put-in	22
Jefferson County	1996	Bikers and hikers (Dual sport)	Bikers	22
Cache la Poudre River	1993	Kayakers	Rafters at the take-out	21
City of Fort Collins – Coyote Ridge	2018	Mountain bikers	Hikers at trailhead	21
City of Fort Collins – Coyote Ridge	2018	Hikers	Mountain bikers on trail	20
Jefferson County	1996	bikers	Other bikers	19
City of Fort Collins – Reservoir Ridge	2018	Hikers	Mountain bikers on trail	19
Colorado Reservoirs	1998	Anglers	Crystall Reservoir anglers	18
Vail Pass White River NF	2003	Motorized Users	skiers/snowboarders on trail	18
City of Fort Collins – Maxwell	2018	Hikers	Hikers at trailhead	18
City of Fort Collins – Reservoir Ridge	2018	Hikers	Hikers on trail	18

		Evaluation context		
Study site	Date	Evaluation by:	Evaluation for:	Crowding Scale 3-9 %
City of Fort Collins – Coyote Ridge	2018	Hikers	Hikers on trail	16
City of Fort Collins – Pineridge	2018	Hikers	Hikers on trail	14
City of Fort Collins – Coyote Ridge	2018	Mountain bikers	Mountain bikers at trailhead	14
City of Fort Collins – Pineridge	2018	Mountain bikers	Hikers at trailhead	14
Cache la Poudre River	1993	Rafters	Other rafters on river	13
Cache la Poudre River	1993	Rafters	Other rafters at the take-out	13
Mesa Verde National Park	2001	Visitors at Step House	Other visitors - at Step House	13
Vail Pass White River NF	2003	Motorized Users	snowmobilers on trail	13
Wolf Creek Pass	2003	Motorized Users	snowmobilers at trailhead	13
City of Fort Collins – Reservoir Ridge	2018	Mountain bikers	Hikers at trailhead	13
Jefferson County	1996	Bikers	Hikers	12
Jefferson County	1996	Hikers & bikers (Dual-sport)	Hikers	12
Wolf Creek Pass	2003	Nonmotorized Users	skiers/snowboarders on trail	12
Wolf Creek Pass	2003	Motorized Users	skiers/snowboarders on trail	12
City of Fort Collins – Reservoir Ridge	2018	Mountain bikers	Mountain bikers on trail	12
Mesa Verde National Park	2001	Visitors at Sun Point Overlook	Visitors at Sun Point Overlook	11
Horsetooth Mountain Open Space	2018	Visitors	Mountain bikers on trail	11
City of Fort Collins – Reservoir Ridge	2018	Hikers	Hikers at trailhead	11
City of Fort Collins – Maxwell	2018	Hikers	Mountain bikers at trailhead	10
Cache la Poudre River	1993	Kayakers	Other kayakers at the take-out	9
Jefferson County	1996	Hikers	Other Hikers	9
Wolf Creek Pass	2003	Motorized Users	Snowmobilers on trail	9
City of Fort Collins – Coyote Ridge	2018	Hikers	Hikers at trailhead	9
City of Fort Collins – Reservoir Ridge	2018	Hikers	Mountain bikers at trailhead	9
Wolf Creek Pass	2003	Motorized Users	Skiers/snowboarders at trailhead	8
Cache la Poudre River	1993	Kayakers	Kayakers at the put-in	7
Horsetooth Mountain Open Space	2018	Visitors	Mountain bikers at trailhead	7
Cache la Poudre River	1993	Rafters	Kayakers on river	7
City of Fort Collins – Coyote Ridge	2018	Hikers	Mountain bikers at trailhead	7
Cacvhe la Poudre River	1993	Rafters	Kayakers at the put-in	6
Cache la Poudre River	1993	Rafters	Kayakers at the take-out	4
Red Mountain Open Space	2018	Visitors	Hikers at trailhead	4
Red Mountain Open Space	2018	Visitors	Hikers on trail	4

		Evaluation context		Crowding Scale 3-9
Study site	Date	Evaluation by:	Evaluation for:	%
City of Fort Collins – Pineridge	2018	Hikers	Mountain bikers at trailhead	4
City of Fort Collins	2018	Soapstone visitors	Hikers at trailhead	3
Red Mountain Open Space	2018	Visitors	Mountain bikers on trail	2
City of Fort Collins	2018	Soapstone visitors	Mountain bikers at trailhead	2
City of Fort Collins	2018	Soapstone visitors	Mountain bikers on trail	2
City of Fort Collins – Pineridge	2018	Hikers	Hikers at trailhead	2
Red Mountain Open Space	2018	Visitors	Mountain bikers at trailhead	1
City of Fort Collins	2018	Soapstone visitors	Hikers on trail	1
City of Fort Collins	2018	Soapstone visitors	Horseback riders at trailhead	1
City of Fort Collins	2018	Soapstone visitors	Horseback riders on trail	1
City of Fort Collins – Reservoir Ridge	2018	Mountain bikers	Mountain bikers at trailhead	0

Appendix D

Survey Comments - Overall Experience

Devil's Backbone Open Space Survey Comments - Overall Experience
1st time was great
5 miles from home. Great trail experience. Like to see dogs on trail!
A bit busy otherwise good
Accessible well maintained
Accessible/Polite users
Always fun (x 2)
Always nice to get out
Amazing trail we're lucky to have
Amazing trails, good access
Any day on a bike is a good day
Awesome for mountain biking
Awesome trail
Awesome views!
Beautiful (x 7)
Beautiful and great trails
Beautiful and open
Beautiful and safe
Beautiful and well kept
Beautiful area (x 2)
Beautiful area, very well maintained
Beautiful but crowded
Beautiful colors
Beautiful day
Beautiful day, great easy trail
Beautiful hike! Pretty busy
Beautiful nature
Beautiful scenery and trails w/not too many people or crowds
Beautiful scenery!
Beautiful single track!
Beautiful trail, beautiful day
Beautiful trail, terrific weather
Beautiful view
Beautiful views (x 4)
Beautiful weather
Beautiful well marked
Beautiful, clean, well kept
Beautiful, closer to home, some challenge
Beautiful, easily accessible
Beautiful, quiet, allows dogs
Beautiful, well kept trails

Beautiful with fun trails
Beauty, accessibility
Because Blue Sky is the BOMB
Because everything! Great!
Best fit trail
Blue Sky = great mtb trail!
Blue Sky is one of the best
Busy
Calm and light trails
Came to hike and see sights
Challenge, well laid out
Challenging
Clean and well maintained
Clean facilities and well-marked trails
Clean trail, well maintained
Clean trails with clear signs.
Clean, spacious
Clean, well kept
Clean/cool/collected
Close to home
Conditions were perfect
Convenient area to recreate with small kiddos
Could be better, could be worse
Could be more trails to spread people out
Could use more trails
Crowded - would love more trails to disperse people
Crowded with people not wearing masks (Covid). Need more mask/distance strategy
Day was perfect, trail is fine
Dry conditions
Easy walk for my dogs
Easy well maintained
Easy, beautiful hike
Enjoy this trail
Enjoyable trail
Enjoyed the scenery
Enjoyed the view
Enjoyed time in nature with family
Everything I like for MTB
Everything was in good shape
Everything was wonderful
First time and will be back
First time, definitely will come back
Fun (x 7)
Fun and easy access

Fun morning
Fun MTB trails
Fun outdoor activity
Fun place to take family
Fun ride
Fun ride interesting trails
Good but busy
Good exercise, fun trails, and beautiful
Good ride
Good shape, well grounded
Good smooth trails!
Good trail, could use separate out and back loop for less user conflict
Good trails (x 3)
Good trails, was hoping for more wildlife
Good views. No hand sanitizer in the restrooms.
Good workout, minimal crowd for weekend
Gorgeous trail, views perfect for running
Great biking
Great conditions (x 2)
Great conditions/trail maintenance
Great everything
great hike
Great hike, got a little crowed at the end
Great if you know when to come- I don't like so many people but everyone should enjoy it
Great mountain bike trail
Great trail - need more like it
Great trail and close to home
Great trail but a lot of mtn bikers Do Not Yield
Great trail conditions (x 2)
Great trail space
Great trail, location, free
Great trail, perfect weather
Great trail/fun
Great trails
Great trails but too busy
Great trails for bikes
Great trails, a little crowded
Great trails, friendly people
Great trails, good experience
Great trails, great scenery
Great trails, not too busy
Great trails, well-kept park
Great trails, well maintained
Great trails. A bit crowded

Great trails-no crowds this early
Great views, good trail
Great weather
Great weather and clean air!
Great weather and trail quality
Great weather, good conditions
Great, local hike
Great day, fun with family, great views
Groovy. A nice hike :)
Had a great experience!
Had a great time
Has everything I need
Have been here a few times. Very clean.
I enjoy the trails/good int. level
I enjoyed a great hike with great weather
I frequently use this trail one of my favorite spots :)
I had a blast on the bike, horse running trail!! So fun. Restroom seat had graffiti
I had a great time, very pretty and clean!
I had a lot of fun
I liked it :)
I live close and love coming here
I love all the open space to exercise and enjoy nature
I Love Devil's!
I love it here
I Love the challenging MTB trails
I love this trail - great exercise
I love this trail!
I only wish there wasn't so much development nearby.
I was with friend. Beautiful day
It could use expanded mountain bike trails
It is fun, not extremely challenging
It is just an amazing place
It is wonderful! Just too busy, because it is great.
It was a good hike
It was a great happy trail
It was a nice trail that fit my abilities
It was beautiful and very well made / preserved
It was beautiful and not crowded
It was great!
It's a beautiful area
It's close to home and challenging
Like split path for bikers/hikers!
Lots of people
Love being here

Love coming here
Love coming here. Saw a deer also
Love it (x 2)
Love it here but everything can always be improved
Love it here!
Love the beauty and solitude
Love the natural beauty
Love the new single track for bikes!!!
Love the terrain
Love these trails for biking
Love these trails!
Love this area (x 2)
Love this trail (x 2)
Love this trail when it's less crowded like today
Lovely
Lovely trail! Beautiful scenery
Maintained trails
Met expectations - very good
Mountain bikers acting entitled (riding off trail)
New to area, happy to bring dog
Nice bike (mountain) trail, i.e., banked curves, relatively well maintained
Nice day good trail
Nice day, not many people, no mud
Nice open space, good views
Nice place
Nice quality hike, low morning traffic
Nice trails (x 2)
Nice trails convenient
Nice trails, ease of use
Nice trails, enjoyed the view
Nice trails, not too crowded
nice up and down
Nice views
nice views, no trash, well maintained trails, not too busy in morning
Nice visit
No complaints/everything was as advertised
No smoke, Blue Sky
No trash. Well kept
Not a lot of users today
Not busy, open space
Not crowded, trails excellent
Not enough parking
Not enough shade
Not many people for a change

Not overly crowded, scenic, good/dedicated bike trail
Not too crowded
Not too crowded and saw a couple of bucks
Not very busy (started at 7 am)
Not very busy, cool day
Not very crowded
Number 5 alive
Only downside is the number of people and smoke
Only drawback was smoke/visibility
Only social dogs should be on trail - not aggressive
Open, well-marked
Overall, it was beautiful, though crowded
Parking could hold more. Trails could be expanded
Parking to expensive
Peaceful
Peaceful & nature & moderate solitude
People forgot their doggy bags that I had to clean up
Perfect family time on a cool day
Picturesque, well-maintained trail
Pretty, no trash
Quality
Quality overall
Quiet and open!
Quiet and scenic
quiet, (clean restrooms)
Quiet, other hikers polite, good workout, scenic
Quiet, perfect day
Radical Day! Trails good as always
Relaxing and quiet
Scenery, trail, and facilities were excellent
Signage on trail could be be better; Restroom sanitizer?
Smoke was heavy
Smoky
So pretty (x 2)
So well maintained
Sometimes very busy but awesome
Stunning views
Super fun
Sweet single track
The addition of directional trails would be great
The trails and scenery are beautiful
The trails were well kept and clearly marked, and facilities looked clean
This place is amazing
This was my first time here and I loved it!

Too many people to be excellent
Too much bike traffic that don't yield to pedestrians
Traffic relatively low, great weather
Trail conditions
Trail small for crowds
Trail well maintained
Trails in good condition
Trails need maintenance
Trails well maintained
Trails were excellent today
Trails were in great condition - No Snakes!
Very beautiful! (x 2)
Very challenging for me
Very clean trail
Very nice people and trails
Very pleasant trails
Very pretty area, nicely maintained
Very quiet today. Trails in good shape
Very well maintained/lots of options
Very well taken care of full of Adventure!
Views
Views, great workout, close to Ft. Collins
Water and great trails
We didn't go that far
We had fun
We love DBB it's so close!
Well kept
well maintained / wide
Well maintained trails (x 6)
Well maintained, beautiful day, time with friends
Well maintained, great hike
Well taken care of
Well-tended
Why not
Wildlife and view
Wish there was more trails
Wonderfully kept!
Would like to see trash receptacles for dog poo, etc.

Appendix E

Survey Comments – E-Bikes on Natural Surface Trails

Devil's Backbone Open Space **Survey Comments - E-Bikes on Natural Surface Trails**
100% support for those who are impaired
Access to elderly or handicapped would be great
Accessibility for disabled riders
Accessibility all people and do not believe it will cause any disturbance
Adds another user
Allow more access to people that could use e-bike assistance
Allow people with health issues to enjoy
As long as same safety rules apply, I don't see them being more disruptive than mountain bikes
As long as they are courteous to others on the trail, I don't mind
As long as they are used similar to non-motorized bikes
As long as they operate safely, no problem
ATV have ruined my favorite spot
bad precedent
Because nothing else motorized is allowed
Bikers already are not courteous
bikes are for exercise
Can be dangerous for them and others
Certain e-bikes are equally powerful to motorcycles and can be too powerful for bike/hike trails
Cheating and too fast already issue w/o motors
Class 1 bikes can be easily converted to higher class
Climbing speed
Come to experience nature, not motor noise
Concern for increased traffic
Concerned about it being too busy at same time, concerned about disability access
Concerned with much more uphill traffic on routes mostly used downhill by bike
Could assist folks with physical difficulties, however, don't want to see a big spike in traffic
Crowding - they should earn the trail!
Curious to see the impact on trails
Danger
danger / uncontrolled speed
Danger of reckless riders
Dangerous speeds for typical e-bike user
Definitely not to mix e-bike with hikers
Depends on trail itself
destructive
Do it if you want
Do not care to add unnatural sounds
Doesn't affect me
Dogs may not like them

Don't believe they should be allowed on trail. Too much a safety issue.
Don't know much about their impact
Don't like the idea of e-bikes, but if it allows people to enjoy the trail when they couldn't otherwise, then good thing
Don't need motorized vehicles on trails
Don't really care one way or the other
Doubt it will change traffic much
E-bikers should be limited to 3-8 mph, i.e., no faster than pedaling
E-bikes allow many types of rider's access
E-bikes allow others to access the trail
E-bikes are evil!!
E-bikes are more for commuting and should be limited to paved/gravel trails
E-bikes can be difficult to hand for new folks.
E-bikes can go faster up and down trails making the trails more unsafe for other users.
E-bikes give access to folks that may not otherwise be able to enjoy the trails (my 8 year old daughter and 70 year old father)
E-bikes help people get outside
E-bikes should not be allowed
E-bikes will not hurt trails. Allows disabled people to enjoy same trails.
Electric bikes are quiet
Electric bikes help more people ride but they can get novices in over their head; and it is another thing other trail users can complain about
Enjoinment is earned!
Enough people traffic, not all at one
Erosion to the trail
Everyone deserves leisure
Everyone should enjoy
Except by disability
Expands biking to the less fit.
Expect it would make it too crowded
Experience with them on paved trails
Feels dangerous with how crowded the trails are.
For those who need it only. Trails would get more crowded with people who are appreciating nature without using their own body. There are other ways to do that.
For use of disabled
fun for all
Gives people a chance to recreate who otherwise wouldn't be able to. Would like to see a bigger trail etiquette education piece for new users.
Good bikers use them safely but too many new cyclists on them
Have witnessed e-bikes riding beyond ability
Hikers might get run over
Human (or horse) powered activity!
I am neutral
I believe trails are best purposed for hikers.
I can see where they are useful, but she doesn't ride them, so she didn't want to say

I can't see why not allow them as long as riders are courteous and careful.
I do not see them any different from pedal bikes
I don't know enough about them
I don't know the pros or cons
I don't mind if they are on the trail
I don't notice them, seem no different than regular bikes
I don't see what it would hurt to allow e-bikes. Little more traffic but no damage to trail
I don't think Colorado trails are a place for motors
I don't think there is a need for motorized vehicles on a hiking trail
I don't think they damage the trail any more than a mountain bike
I don't want to get mowed down by a bike
I feel like people should be able to do whatever they want as long as it doesn't disrupt the environment
I have kids, safety concern
I have no knowledge of pros/cons of electric bikes
I have no problem with them on trails as long as everyone is respectful
I have trouble getting out of the way with a regular bike
I haven't encountered any
I just feel like they will mess with the trail
I like the e-bikes
I personally own an ebike
I struggle with the lack of educations and the conflicts on the trails.
I support giving users access who would not be able to use the trails otherwise
I think as long as courteous, no issue
I think at some point there will be more e-bikes
I think it a great sport
I think motor bikes will add to crowding and noise
I will need to ride an e-bike someday
I would love MTB trails only
IDK (I don't know) this
If everyone is cautious it won't be a problem.
I'm indifferent (x 2)
I'm no expert
Increasing access for visitors to enjoy the area vs. the increased traffic/potential safety concerns
Inexperienced riders use them
Interferes with enjoyment of nature
It doesn't bother me either way
It helps keep older folks riding
It helps people keep up with their friends when they otherwise couldn't
It seems unsafe
It will attract people more interested in sightseeing and closing the trail. If you peddle your own bike, you'll come out for the right reasons.
It will create un-natural speed differences on the trails
It will increase accessibility to people with moderate disabilities

It will likely increase trail use and crowding and probably trail deterioration
It would give people opportunity that are ageing or have health conditions
It’s cheating IBO
It's just a bike that makes up hill more fun
It's nature - motors, etc. ruin it
I've seen mtn bikers who wouldn't otherwise be capable really wreaking havoc on/off trail
Just build more trail for all use
Keep it natural
Leave areas alone
Like e-bikes, but trails need expanding to support increased use (not just for e-bikes)
Live and let live baby!
May damage trails
More access for all levels and ages
More people can access e-bike only trails perhaps.
Most of the trails are overused...People who use them should be able to do it safely and 20 mph is too fast on these trails
Most people aren't familiar with them. My buddy has a knee problem and has a hard time on the climbs. An e-bike help him get back onto trails. They only increase speed climbing. They aren't a danger.
Motorized bikes would be disruptive
Motorized detracts from native; too fast
Motorized or energized vehicles don't belong on trails
Motorized vehicles of any sort inevitably destroy the area
motorized vehicles should be kept off trails
Motors on pavement, shoes on trail
Natural area shouldn't get ruined
Natural areas should not be disturbed by motorized vehicles.
Natural surfaces should be enjoyed in a natural way :) and I feel like it would increase traffic more
Need separate trail also if noisy - not desirable
Need to learn more about them first.
NO motorized. They have many other trails.
No need for motors on a trail
No need, enjoy nature.
No opinion
No way
Noise and some people are not that familiar (renting) on handling the motorized bike
Noise is my only issue
Noise may allow beginners onto trails they should not be on and cause safety concerns, emission? Increased crowding.
Noise pollution
Noise, different experience
noise, safety, trail damage
Noise, speed/safety
Noise/traffic
Not enough information

Not from here
Not getting any younger
Not loud like motorcycles, but assist those who would not otherwise ride, so I support it.
Not safe to allow these and hikers/dogs on same trail
Not what hiking is about
Older riders can access via bike
Older riders need some assist
Only if the trails were just for slow e-bikes and mountain bikes (without hikers)
Only on bike trails
Other's safety
Pedal power only
Poor speed control
Prefer how it is now
Quiet
Remote areas okay, crowded areas not ok
Removes barrier to entry, inexperienced riders going too fast
Ruins trails, dangerous
Safety (x 2)
Safety and enjoyment for hikers would be compromised
Safety of hikers? Pets?
Seems like an okay idea
Seems like more people would enjoy
Seems very unsafe and motors not needed on trials
Should be limited assist and only for older people or those with injuries or disabilities
Should be pedal power
Should only be used by those physically unable to walk or ride a bike non-motorized
Simply don't agree with motorized or e bikes on certain trails like this
Since they are quiet, I am okay with sharing the trail.
Some areas should be for motorized, while others non-motorized
Some people aren't strong enough
Some remote areas are fine for e-bikes, crowded areas not good
Speed
Speed and disruption when trails shared w/hikers. Ok on mountain bike trails.
Speed and noise
Speed and trail wear
Speed needs to be controlled
Super dangerous!
Takes away from nature
Tear up trails
the limit of 20 mph
The noise interferes with serenity. I think the trails would be adversely affected because it would be too "easy" to go out on the pristine back country trails
The point of hiking is to get exercise and not be assisted by a motor
The riders don't know the rules of the trails

There are already mountain bikes, why would e-bikes make a difference?
There's no sport to it, noise pollution
They are just like regular bikes
They are motor too fast
They are too destructive
They aren't loud but can be fast around people.
They can ride the bike path to keep this trail more natural and for our wildlife
They damage the trail because they weigh more
They do no harm whatsoever
They have no more impact than standard MTBs
They have to (undecipherable)
They make me feel slow! Can get up trail faster
They move too quickly for safety. I'm a proponent of exercise.
They seem similar to regular bikes
They're fast on the uphill and slow on the downhill
Too dangerous to mix
Too fast - prefer non-mixed use trails
Too fast and dangerous on already congested trails
Too fast and will put unskilled users on trails = possible injuries
Too fast, against the spirit of trails
Too fast, unsafe
Too fast; Noisy
Too much hassle
Too much traffic
Too risky
Tourist
Trail damage potential
Trail maintenance/damage
Trails already overused e-bikes don't belong
Trails are crowded as is
Trails are for people getting away from motors
Trails like these aren't meant for motorized vehicles!!!
Trails should only be used by hikers, runners, bikers, and horseback
Trails weren’t big enough
Unfamiliar
Uninformed
Unless the rider is incapacitated (cannot walk)
Unless this increase access for disabled to enjoy the open space, this should not be allowed.
Unsafe if there's no warning of them approaching
Unsafe! (x 2)
Visiting and not aware of local policy
Visiting and not enough information to comment
What's the point - exercise those legs my friend. Save the e-bike for commuting to work
Why not electric motorcycles, cars, etc.? Where does this stop?

Worried about speed and safety
Worried about trail erosion
Worried it would ruin the trail
Would enable too many unskilled bikers
Would encourage _____ behavior
You should put the work in for the enjoyment.
1) Wildlife 2) Too many bikes on the trail already 3) Destruction of trails - bikes are a huge impact on trails. I have used these trails for 35 years and the bikes have destroyed them. NOTE: I run with my dog - retracting leashes should NOT be allowed, loose dogs should be ticketed.