

VISITOR BEHAVIOR AND RESOURCE IMPACTS AT CADILLAC MOUNTAIN, ACADIA NATIONAL PARK

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Abstract: The summit of Cadillac Mt., located in Maine's Acadia National Park, can be reached via three hiking trails and a scenic auto road. This site attracts over an estimated two million visitors per year. Most of this visitation is concentrated from Memorial Day to Labor Day. The sensitive sub-alpine nature of the site, coupled with high visitation rates, has created a scenario where significant vegetation and soil damage occurs. Additionally, Acadia National Park has experienced chronic problems at this site stemming from visitors altering, destroying, or constructing cairns (piles of rocks built by trail crews to mark trails and guide hikers).

In an attempt to describe visitor behaviors and the context in which those behaviors occur, an unobtrusive, observational study was conducted on the summit of Cadillac from June 19, 2000, through October 4, 2000. Field observation periods totaled 219 hours and were performed on 31 weekdays and 9 weekend days. The primary observer's researcher role was concealed by appearing to look like a hiker, nature enthusiast, reader, or tourist. Observations of visitors' actions and comments, recorded during stationary and roving observation periods, were subtly recorded in a small, inconspicuous journal.

To analyze the data, field note entries were organized into general categories. Individual entries were coded for specific themes or patterns identified by constantly comparing and analyzing the entries. Emerging theories/hypotheses, which were borne out of (or grounded in) recorded data, are discussed in relation to potential management approaches.

Most impacts to the site occur in a positive social atmosphere. Damaging behaviors such as cairn building and trampling did not appear to show malicious or even rebellious intent. Cairn building was most attributable to families with preadolescent children. Findings identified numerous factors influencing off-trail travel (e.g. personal space, photography, picnicking, etc.). Furthermore, insight was gained regarding how visitors react to low-impact messages (on signs) and to physical barriers erected to protect damaged areas.

Future research and management considerations are put forth based on the results of this study. Particular emphasis

is given to persuasive communication. The influence of high visitation rates on several potential management strategies is discussed.

Introduction

The attractiveness of Acadia National Park, located primarily on Maine's Mount Desert Island, has led to an extremely high level of visitation. Acadia National Park is within a day's drive of roughly twenty-five percent of the United State's population. In 1999, Acadia National Park received 2,602,227 recreation visits, the 8th highest visitation level of all National Parks in the U.S. (NPS, 2001). According to the 1998 Visitor Services Project (NPS, 1998a), 76% of visitors to Acadia National Park visited the summit of Cadillac Mountain. Cadillac Mountain, the location of this study, is the highest point along the eastern coastline of North America. At 1530 feet high, it is claimed by some to be the first point in the United States hit by the rising sun. Cadillac, with its dome-like granite form, glacial history, shrub vegetation, magnificent views, and open summit, draws millions of visitors per year. Furthermore, the bulk of these visits come during the 100 days from Memorial Day to Labor Day.

In looking at visitation to Cadillac's summit, it is important to understand the access routes leading to the summit. An extremely popular scenic auto road accessing the summit is open to the public for approximately six months a year. Also, there are three hiking trails leading to the summit. The North Ridge Trail is a 2.2-mile (one-way) hiking trail. The South Ridge Trail, approaching the summit from the opposite direction, is 3.7 miles (one-way). Finally, the Gorge Path Trail approaches the summit from the north, with the final approach being a steep climb out of the Gorge between Cadillac Mountain and Dorr Mountain.

There is a day-use parking area atop Cadillac. This lot, connected to the summit auto road, has space for approximately 70 cars. There are also designated spaces for visiting tour buses and commercial tour companies. A gift shop is located on Cadillac's summit. This shop, run by the non-profit Eastern National Corporation, houses a set of public restrooms.

The Cadillac Summit Trail is a 2118-foot long paved trail that loops around the immediate summit of Cadillac. There are four interpretive panels and two paved viewing pads located along the trail. None of the current panels discuss vegetation impacts to the summit area.

The dominant vegetation type, in relation to the developed/semi-developed summit area, is "Blueberry Bald-Summit Shrubland Complex." One of the characteristics of areas falling into this community category is openness. On the summit of Cadillac, areas within this community boundary are open, with patches of low or shrubby vegetation amongst areas of exposed granite bedrock (that are frequently covered with crustose lichen). Sub-alpine plant communities such as this are considered rare by the Maine Natural Heritage Program and are state critical areas (NPS, 1998b). On Cadillac's summit, there is

a profusion of areas where vegetation has been worn away by foot traffic and only soil remains. The soil resembles grape-nuts cereal; it is composed of tiny granite pebbles and grains of sand. The sand and pebble soil patches, in some cases, are underlain by peat-based soil.

Resource impacts to Cadillac's summit have not gone unnoticed by park managers. The Resource Management Plan for Acadia National Park (1998) makes the following statements about visitor use and resource impacts:

Increasing visitor use in the Park is impacting vegetation. Plants in sub-alpine habitats on mountain summits and offshore islands and Park bogs and wetlands are particularly sensitive to trampling. Soil compaction and/or erosion, destruction of vegetation, and development of social trails have all been observed in these fragile habitats. Habitat restoration, long term monitoring and visitor management is needed to protect these areas.

Concentrated visitor use in the front country is also having a negative impact on vegetation. Trampling of soils and plants is occurring along roadside and parking areas due to crowded overflow conditions in summer. Social trails have also developed at many heavily visited sites. Habitat restoration and visitor management is critically needed to repair degraded conditions.

The summit of Cadillac is especially impacted due to the fact that it is both a sensitive sub-alpine area and a heavily visited front country site. The Resource Management Plan specifically cites Cadillac's summit as a site where social trails have caused erosion. However, due to the limited size of the summit area and the high number of visitors, visitors to Cadillac's summit are not asked to stay on trail. Instead, visitors are encouraged to use low-impact off-trail skills (i.e., walk only on rocks) if they choose to venture off-trail.

Cairns, pyramid shaped piles of rocks built by trail crew to mark trails and guide hikers, are another resource concern at Cadillac. Park managers have continually had to deal with cairns at Cadillac being altered by visitors. Specifically, some cairns would be destroyed, others would have rocks added to them, and visitors would inappropriately construct others. As a result of visitors inappropriately interacting with cairns, it is, in places, difficult to follow the actual trails. This in turn leads to trampling impacts and safety concerns (e.g., visitors potentially getting off-trail and lost, especially in fog). Inappropriate cairn building can "clutter" scenic vistas. Additionally, removing stones from the soil to build or add to cairns can lead to soil erosion and loss of plant "micro-habitat" (Hampton & Cole, 1995).

Resource protection efforts on Cadillac during the 2000 season consisted of ranger-led interpretive walks and area closures defined by "exclosures," wooden fence-like structures encircling three areas. The exclosures, erected in early August, were complimented by generic (i.e., not site

specific) revegetation signs. Later, in September, new signs specifically designed for Cadillac were placed on site. In a few locations, the barriers, which cumulatively made up exclosures, were used individually. These barriers, that looked somewhat like saw horses, were placed in locations where visitors frequently ventured off-trail. Exclosure designs varied slightly. One exclosure had relatively large "gaps" between the individual barriers that made up the exclosure. The other two exclosures were created in such a way that the barriers were either contiguous or closely spaced.

The interpretive programs were not specifically centered on low-impact education, though visitors were made aware of impacts and were asked not to step on vegetation and bare soil. It should also be noted that the park promoted park-wide low-impact behavior by communicating the principles of the Leave No Trace program in some trailhead signs and in the Beaver Log, the Park newspaper. The signs placed on site in September also used Leave No Trace messages (e.g., walk on rocks) and logos.

The objective of this research is to increase understanding of visitor impacts on summit area resources using observational research methods. Two initial concerns, visitor manipulation of cairns and trampling of vegetation and bare soil, guided observations. Research findings were intended to help park managers better understand visitor use and how damaging visitor behaviors might be managed.

Methods

This study used unobtrusive observation as a tool for gathering qualitative (non-metric) data. An observer, whose identity was concealed by appearing to look like a tourist or hiker, recorded visitor behaviors. The observer did not purposefully interact with visitors. Observation periods ranged in length from 2 hours to ten hours (with periodic breaks). Total observation hours, logged during 31 weekdays and 9 weekend days from June 19, 2000, to October 4, 2000, equaled 219 hours.

Field notes were recorded in a small sketchbook. Note taking occurred during stationary observation periods. Observations collected while roving around the site were recorded later, either during stationary observation periods or in a vehicle shortly after a day's observations. At the close of each day, a summary sheet was filled out. Summary sheets helped organize data for retrieval during later periods of data analysis.

The primary sampling approach used was purposive sampling. Purposive sampling is explained by Erlandson et al. (1993) in the following excerpt:

Central to naturalistic research is purposive sampling. Random or representative sampling is not preferred because the researcher's major concern is not to generalize the findings of the study to a broad population or universe but to maximize discovery of the heterogeneous patterns and problems that occur in the particular

context under study. Purposive and directed sampling through human instrumentation increases the range of data exposed and maximizes the researcher's ability to identify emerging themes that take adequate account of contextual conditions and cultural norms.

The observer chose to record behaviors and overheard comments based on the problems initiating the research. As More (1984) writes, "What you observe is spelled out in the definition of the problem." Kellehear (1993) uses the term *ad libitum* sampling to describe sampling that is "impressionistic and non-systematic" where "the observer simply records what is of interest." This research employed *ad libitum* sampling.

Data Analysis

The data analysis approach used in this study was based on the principles of grounded theory. Grounded theory requires that researchers discover concepts and hypotheses through an inductive process involving constantly comparing exhaustive categories that explain the data (Frey et al., 2000; Glesne, 1993). As part of this process, notes were "openly" coded. Coding is the task of discovering or discerning themes and giving those themes names (Kellehear, 1993). Coding can take two forms; closed coding creates predetermined categories before data gathering while open coding creates categories during or after data gathering (Frey et al., 2000). In keeping with this study's exploratory, grounded theory approach, open coding was used. Once the data was organized by topical categories and a hard copy was printed, the hard copy was analyzed by reading and rereading groups of entries. Numerous notes and markings were made in the margins of the hard copy print out. New codes were created to represent emerging themes, patterns, and ideas. Entries had evolved from being organized by topic (e.g., photography, cairn comments) to theme (e.g., "disconnect"-entries that displayed a disconnect between a visitor's comments and actions). These new thematically organized entries were compared to entries within their category and to entries placed in other thematic categories. With data organized first around topics and then around themes, the data was examined and interpreted findings that were of importance to park management were pulled out.

Results

Patterns emerged from the data and were constantly evaluated. Downing and Clark (1985) claim that naturalistic, grounded methods are capable of rapidly developing and refining hypotheses that are likely to survive the rigors of verification. This capability stems from grounded hypotheses being borne from analysis of new data. With this in mind, the following list of summarized findings is put forth. These bulleted items are working hypotheses generated and evaluated through data collection and analysis. They are the stronger findings relating to the problems that initiated this research.

Cairns

- Young children (pre-adolescents) are the predominant group responsible for building and destroying cairns.
- Family members support children who engage in cairn building. Cairn building occurs in a positive family context.
- Children are NOT the only group observed adding stones to cairns; adults also add stones to cairns.
- The effects of visitors building and/or destroying cairns leads to some other visitors being confused and/or having trail experiences diminished.
- Understanding the role cairns play decreases the likelihood of cairn modification (adding stones was the activity that data from this study identified, though it is plausible that understanding also influences the likelihood of cairn building and destroying as well).
- Cairns are intrinsically attractive in that they have an allure to those who are seeing them for the first time (irrespective of who built them).
- By building cairns atop Cadillac and not explaining their purpose *on-site*, park managers actually instigate additional cairn building by visitors.

Trampling and Off-trail Travel

- Trampling acts off-trail far outweigh low-impact off-trail acts (walking only on rocks), even after signs are placed on site.
- Reasons for visitors going off-trail include: gaining personal space, visiting attractions such as interpretive panels and rock formations, returning to their vehicles via the shortest path, taking photographs, picking blueberries, generally exploring.
- Some visitors prefer to be off-trail, regardless of how much space is available on the Summit Trail (including the paved viewing pads).
- A number of visitors do not understand the layout of the site. In particular, many visitors do not recognize that the Summit Trail is a loop. This lack of understanding may influence their decision-making process about going off-trail.

Impact Perceptions

- Visitors do not often recognize that patches of barren soil are the result of foot traffic.
- Visitors occasionally refer to social trails as "paths" or "trails", apparently identifying social trails as sanctioned.

Physical Barriers

- Lone barriers are ineffective in protecting significant areas of vegetation, even when signed.
- "Tightly" designed enclosures are very effective in reducing impacts *within* their perimeters.

- Exclosures push impacts around their perimeters.
- Visitor experiences at the summit do not appear to be diminished by the exclosures.
- Many visitors "narrowly" conceptualize the purpose of exclosures. These visitors perceive that the exclosures were placed on site to protect the specific areas within their perimeter, and that other areas do not merit concern.
- Many visitors either do not read the signs on the exclosures at all, or they only briefly glance at the sign.
- Some visitors ascribe meaning to the exclosures without reading the sign.

Low-impact Skills and Knowledge

- Some visitors do not recognize the difference between gravelly soil and true rock surfaces, thereby misunderstanding the "walk on rocks" message.
- Many visitors have a threshold for low-impact techniques; they will follow low-impact guidelines up to a point at which they abandon the techniques in favor of personal needs or wants.
- Some visitors are physically unable to follow the "walk on rocks" guideline.

Creativity and Play

- Playful, tactile interactions with the physical resources on site are a significant component of youths' experiences at the summit.

Discussion

The findings of this study provide valuable insight for persuasive communication efforts on Cadillac. One major pattern to emerge from the data is that willfully depreciative behaviors, those actions that visitors engage in knowing full well that they are causing significant damage, were rarely seen. Therefore, most damaging behaviors are not malicious or flagrant but rather unskilled, uninformed, careless, or unavoidable. Hendee et al. (1990) assert that unskilled actions and uninformed actions are (correspondingly) highly and very highly receptive to change through persuasion. Many problem behaviors seen at Cadillac's summit fit into one of these two categories. Thus, in August and again in September, when the park established signs on-site detailing the need for low-impact behaviors, observations of positive behaviors should have gone up. However, they did not. Comments about, for example, "walking on rocks if off-trail" did become more frequent, but the actual behaviors were not seen more than before the signs went up (or much at all for that matter). Furthermore, the exclosures seemed to influence some visitors to think that only specific areas were impacted and in need of delicate treatment (in fact, all of the summit, except paved surfaces and exposed bedrock, is delicate, vulnerable, and impacted).

One possible reason why low-impact messages on signs were not extremely successful relates to the atmosphere at the summit. The summit is a busy place with a lot of visitors, natural attractions, and non-natural "curiosities" (e.g., visitors with unique cars, marriage ceremonies, a gift shop, etc.). And placed within this atmosphere were signs that required visitors to read them, digest the information, accept the sign's ethical appeal, and start following the sign's low-impact guidelines. The signs, then, used a central route to persuasion. The central route to persuasion requires the receiver of the message to attentively receive the message, elaborate on its content, and integrate the message into his or her belief system (Roggenbuck, 1992). The signs themselves, especially the signs used after September 7, were not poorly designed. However, they use a conceptual route to persuasion that requires significant personal attention in a location that is often extremely distracting.

It could be recommended that park managers employ more communication efforts that use the peripheral route to persuasion, a conceptual route that focuses on the message source, not its content (Roggenbuck, 1992). This route is based on the notion that in many situations people make quick decisions by spontaneously responding to a cue. That cue may take the form of an environmental prompt, the characteristic of a message (instead of its content), the source of a message, or the communication channel (Roggenbuck, 1992). While utilizing the peripheral route, perhaps through images such as international signage, could help reduce visitor impacts, a broader remedy may be needed.

The extremely high visitation rate at Cadillac Mountain likely confounds resource protection efforts, including efforts to educate visitors about low-impact ethics and techniques. Some site management alternatives, such as locating use on resistant sites, site hardening and shielding, and site rehabilitation are made next to impossible by current visitation rates. Similarly, visitor management alternatives such as dispersal or concentration of use are also difficult to use with visitation being so high. Reducing visitation rates may be only way to effectively protect and restore the summit vegetation on Cadillac. By limiting visitation, the site would most likely become more manageable. Visitor and site management alternatives would become more practical and effective. Education messages could be delivered in a less distracting atmosphere. Finally, with current visitation levels, even a statistically dramatic drop in damaging behaviors would leave a high level of impact. If 99 percent of visitors stayed off sensitive vegetation, then approximately 20,000 visitors would trample sensitive sub-alpine vegetation on this relatively small summit.

It would be beneficial if future research and management efforts examined potential management scenarios in a process investigating both resource protection and visitors' experiences. Management scenarios, such as closing the auto road to private vehicles (not including tour vehicles), should be examined to see how well they could protect the summit's natural resources, as well as how they would restrict and/or enhance specific visitor experiences.

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