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# Visitor Behaviors and Resource Impacts at Cadillac Mountain, Acadia National Park

Rex Turner

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**VISITOR BEHAVIORS AND RESOURCE IMPACTS AT CADILLAC  
MOUNTAIN, ACADIA NATIONAL PARK**

By

Rex Turner

B.S. University of Maine, 1998

A THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

(in Forestry)

The Graduate School

The University of Maine

August, 2001

Advisory Committee:


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

By  
Rex Turner

Thesis Advisor: Wilbur LaPage

An Abstract of the Thesis Presented  
in Partial Fulfillment of the Requirements for the  
Degree of Master of Science  
(in Forestry)  
August, 2001

The summit of Cadillac Mountain, 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 (pyramid shaped 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 young children. Findings identified numerous factors influencing off-trail travel (e.g. personal space, photography, picnicking, etc.). Furthermore, insight was gained about 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.

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## **CHAPTER 1**

### **INTRODUCTION**

Acadia National Park, located primarily on Mt. Dessert Island, is a stunning example of Maine's rock-bound coast. The National Park Service manages approximately 35,000 acres within Acadia National Park (ANP). There are 147 miles of hiking trails (NPS, 2000), two campgrounds, historic sites and architecture (including scenic carriage roads), diverse wildlife habitat, miles of lake and seashore, and scenic auto roads. There are wonderful opportunities to explore coastal and mountain environments. In addition to natural beauty and historic features, Mount Dessert Island also harbors quaint coastal towns.

The attractiveness of Mt. Dessert Island and Acadia National Park 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 the first point in the United States hit by the rising sun. Cadillac, with its dome-like granite form, recent 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.

#### **STUDY SITE-CADILLAC MOUNTAIN SUMMIT**

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.

The drive up the Cadillac summit auto road is a visual feast, as long as one isn't too bothered by asphalt and other vehicles being close at hand. As the road slithers its way up the Northwest flank of Cadillac, expansive views of Maine's Downeast coastline emerge. Rounded granite mountains change color as the sun rolls across the sky. The Atlantic Ocean and scattered freshwater ponds shine in riveting shades of blue. The scenery is sublime.

Along the road, there are several pullout-parking areas accommodating anywhere from one to four vehicles. Within a quarter mile of the summit, facing west, is the Blue Hill Overlook, a relatively large parking area that is quite popular for viewing the sunset. While impacts are a concern at the Blue Hill Overlook site, it was not a part of this study.

The last portion of the summit road, leading from the Blue Hill Overlook turnout to the summit parking area, passes through a swath of spruce and fir. The thick forest limits views as visitors approach the summit parking lot. When motorists reach the parking lot, they are funneled to the right, past a single story gift shop clad in gray shingles. This building also houses the restrooms. There are parking spaces beginning at the gift shop. Beyond the gift shop, the road again splits. By bearing left, visitors enter the main parking lot, which accommodates approximately 65 cars. If visitors do not bear left, they pass a few spaces on the right and loop around the teardrop shaped parking lot. They then can either park on the right in designated slots or they can continue on and return down the summit road. Of course, they can also loop around the summit parking area again if they didn't find an open parking space. Together, the

parking lot and summit auto road surround an "island" of vegetation. Figure 1, an oblique aerial view of the immediate summit area, shows these features and others discussed below.

Winding around the open summit area is the 2118 foot long Cadillac Summit Trail. This short, paved trail is, for all practical purposes, a rough-grained sidewalk draped like a necklace around the round-shouldered summit. It is constructed out of grainy, pinkish concrete. In a few spots, the trail uses granite steps that gently rise and fall. The trail's color blends well with the pink granite summit. The trail has two very short spurs leading to the two parking lot entry points. On the side of the looping trail closest to the southern parking lot access point, there are two "summit circles". These "circles" are paved viewing pads connected to the trail. One of the pads has two interpretive panels on it. One of these panels discusses Cadillac's notoriety for being the first place in the U.S. to receive the dawn's light. Both panels identify prevalent land forms visible from the summit. On the northern side of the trail, the trail tread spreads into a wide crescent shape. Here, there is an interpretive panel detailing life in Bar Harbor at the turn of the century. Adjacent to this panel is the trailhead for the Gorge Path. Further down (south) the trail, there is another interpretive panel discussing the ancient geological forces responsible for Cadillac's formation. The southwestern portion of the trail, looping back up towards the summit circles, is the steepest portion of the trail.

While the summit loop area was the major focus of this research, time was also spent on the upper portion of the Gorge Path and on the upper portion of the South Ridge Trail. The Gorge Path area, encompassing an area of roughly the size of a football field, is adjacent to the northeast portion of the Summit Trail. The Gorge Path area was delineated by shrubs and small trees on its northern flank, a conspicuous ridge running east (down slope), a southern slope falling off towards the gorge between Dorr Mt. and Cadillac, and the Summit

**Figure 1. Oblique aerial photo of Cadillac Mountain's summit**



A. Gift Shop

B. South Ridge Trail  
Trailhead

C. Vegetation  
"Island"

D. Parking Lot

E. Summit Trail

F. Gorge Path  
Trailhead

G. Section of  
Parking Lot  
Overlooking Bar  
Harbor

H. North Ridge  
Trail Trailhead

Trail above and to the west. Physically, the Gorge Path area is heavily impacted in that it too has patches of bare ground, though not as severe as within the Summit Trail's confines. The trail winds down the northern portion of the area where cairns should mark the trail, though they are often in shambles. This area, like the summit area, is open with a mosaic of low vegetation, bare soil, smooth rock faces, and boulders of various sizes. Figure 2 shows this area.

The South Ridge Trail was a lower priority and, as such, received far less attention. The portion of the South Ridge Trail that I observed was located less than half a mile from the Summit Trail, at the junction with the West Face Trail. This area too was very open, with low shrub vegetation and a lot of loose rocks and gently sloping exposed bedrock.

Off of the northern side of the parking lot, in the section overlooking Bar Harbor, there is a curious feature. Two stone stairways lead down to an area where there is no trail or other officially designated use. These stairs are commonly referred to as "the stairs to nowhere."

The dominant vegetation community, in relation to the developed/semi-developed summit area is "Heath Summit Dwarf Shrubland Mosaic Complex" or "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 shrub vegetation amongst areas of exposed granitic bedrock (that are frequently covered with crustose lichen). Sub-alpine plant communities such as this one are considered rare by the Maine Natural Heritage Program and are state critical areas (NPS, 1998b). Appendix B covers the species composition of this community in more detail. 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 formed, on the surface, by tiny granite pebbles and grains of sand.

**Figure 2**

**The Gorge Path area looking up towards Cadillac's summit**





## **RESEARCH INITIATION- A BACKGROUND**

Acadia National Park accommodates millions of visitors each year. Cadillac Mountain, with its inspirational views and easy access, is an enormously popular feature within the Park. With Cadillac's summit being so highly visited, it is no surprise that visitors have heavily impacted the sub-alpine environment atop the mountain. These impacts have not gone unnoticed by park managers. The Resource Management Plan for Acadia National Park (1998b) 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 natural area and a heavily visited front country site. The Resource Management Plan specifically cites Cadillac as a site where social trails have caused soil erosion.

In the Resource Management Plan for Acadia (1998b), the resource management program focuses on nine fundamental tasks. Three of those nine tasks are at least partially addressed by this research. They are: "develop and

institutionalize a long-term visitor monitoring program sufficient to detect and understand changes in numbers and patterns of visitor use and visitor behaviors, and identify changes that are inappropriate or degrade visitor experiences; establish an active research program that characterizes the function and structure of Park ecosystems, identifies threats to natural processes and visitor experiences, and evaluates alternative management actions to resolve natural and recreational issues; implement and institutionalize a resource protection and education program to reduce visitor impacts on Park natural and cultural resources." This research does not institutionalize any programs, but it does provide insight that can be incorporated into future programs.

### **Current Management**

Park resource protection efforts at Cadillac during the 2000 season included two rangers (summit stewards) whose duties included presenting interpretive programs at the summit and keeping a journal of visitor behaviors (for summit stewards' findings, see appendix A). Separately and simultaneously, a collaborative agreement between the Park Service and the University of Maine provided funding for the research being discussed in this report. Thus, the two rangers and one U.Maine graduate student independently conducted observational research on the summit in 2000.

Park managers also engaged in non-research initiatives. Exclosures, barriers, and signs promoting low impact behaviors were placed at the summit in early August. New signs were erected in September. All of these signs were erected as management tools, not as research mechanisms (i.e., these physical structures and signs, intended to reduce impacts, were not incorporated into any type of experimental testing procedure).

In the near future, Park managers plan to undertake a few additional initiatives at the summit, including the development of a new, large-scale interpretive sign, revegetation efforts, and continuation of the summit stewards.

### **Park resource protection messages – Leave No Trace**

Prior to the 2000 summer season, managers at Acadia National Park did not use any forms of non-personal media to address resource impacts on the summit of Cadillac Mountain. There were no signs or brochures specifically on the summit area, although several interpretive programs on the summit discussed impacts to the summit. Though an emphasis to educate visitors about the impact concerns on Cadillac's summit did not exist, managers did use various media to inform visitors about Park-wide resource impact issues. The Park did urge visitors to participate with Park-wide stewardship efforts. Segments of the Beaver Log, the Park newspaper, expressed the need for visitors to help protect resources by adopting a low-impact ethic and following low-impact guidelines. Several interpretive programs incorporated elements of low-impact skill education into their content. Finally, signs at various trailheads throughout the park mentioned low-impact behavior considerations. All of these communication media (programs, signs, the park paper) promoted behaviors associated with the Leave No Trace (LNT) outdoor skills and ethics program.

The following excerpt from the LNT Northeast Mountains and Forests handbook (created by the National Outdoor Leadership School) provides a history of the LNT program:

The Leave No Trace program establishes a nationwide code of outdoor ethics to shape a sustainable future for wild lands. Originating in the 1970s with the United States Forest Service, LNT was developed to help recreationists minimize their impacts while enjoying the outdoors. In 1991, the Forest Service teamed with the National Outdoor Leadership School (NOLS) and the Bureau of Land Management as partners in the Leave No Trace program. NOLS, a recognized leader in developing and promoting minimum-impact practices, began developing and distributing LNT educational materials and training.

Today, the non-profit organization Leave No Trace, Inc. (LNT), established in 1994, manages the national program. LNT unites four federal land management agencies-the U.S. Forest Service, National Park Service, Bureau of Land Management, and the U.S. Fish and Wildlife Service, with manufacturers, outdoor retailers, user groups, educators, and individuals who share a commitment to maintaining and protecting our natural lands for future enjoyment.

LNT focuses on both skills and ethics. Its guidelines, based on recreation ecology research, are currently organized around seven principles. These are:

- 1) Plan ahead and prepare
- 2) Travel and camp on durable surfaces
- 3) Dispose of wastes properly
- 4) Leave what you find
- 5) Minimize campfire impacts
- 6) Respect wildlife
- 7) Be considerate of other visitors.

While all of these items are frequently relevant to protection efforts across the entire park, principles two and four (travel and camp on durable surfaces, and leave what you find) are the principles that seem to hold the greatest promise for the summit vegetation. Principle two, travel and camp on durable surfaces, is the key component of Acadia's approach to reducing trampling impacts at this site. Feeling that they cannot require visitors to walk only on established trails, managers are attempting to change the way visitors behave off-trail. Through communication efforts with visitors, managers are encouraging visitors to "walk on rocks" (durable surfaces) if they go off-trail. Camping is not allowed on Cadillac's summit, and is not an issue. Principle four, leave what you find, applies to cairn building primarily, though rock theft and

occasional flower/plant picking occurs as well. This principle encompasses concerns about biophysical as well as social impacts of theft and/or site alteration. The signs placed on site in September all displayed the LNT logo, and some prominently displayed the phrase "LEAVE NO TRACE ON CADILLAC MOUNTAIN".

## **PHYSICAL IMPACTS-HIGHLIGHTS OF CURRENT LITERATURE**

In 1916, the United States Congress passed the National Parks Organic Act. The language of the Organic Act states that the National Park Service's fundamental purpose is "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment for the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations". Providing for enjoyment and leaving resources unimpaired for future generations have been difficult tasks. The summit of Cadillac Mountain serves as an example of enjoyment impairing the resource. Specifically, fragile sub-alpine plant communities are being reduced and stressed as millions of visitors trample across this site each year.

A great deal of research has documented the effects of recreation on natural resources. Recreational activities have the potential to negatively impact vegetation and soils, water resources, and wildlife. The purpose of this study is to identify and describe factors that likely influence visitor behaviors leading to vegetation and soil impacts on the summit of Cadillac Mountain, in Acadia National Park. The site, atop a coastal mountain, doesn't suffer from water resource impacts because there are no significant water resources within the study area. While wildlife, including ravens, gulls, juncos, other small birds, and insects do inhabit the site, wildlife was not a major concern of this research.

The most serious visitor-generated impacts on Cadillac are vegetation and soil impacts. The sensitive sub-alpine nature of the site, coupled with extremely high visitation rates, has led to the proliferation of large barren areas where

vegetation formerly existed. Before further discussing the site and visitor behaviors, it is worthwhile to briefly review some of the literature on soil and vegetation impacts.

Recreational activities almost always have an impact on biophysical resources. Of course, there are numerous factors affecting the severity of impacts. Kuss, Graefe, and Vaske (1990) identify five principles relating to recreation impacts on soils and vegetation.

- 1) Recreational use of natural areas results in direct and indirect forms of impact to plants and soils. The changed environment resulting from direct and indirect impacts selects for species best adapted to change.
- 2) Responses to impacts show both strong and weak relationships to amount of use.
- 3) Plants and soils vary in their sensitivities or resistance to impacts.
- 4) Site-specific factors influence change and rate of change resulting from recreational impacts.
- 5) Impacts vary by type of use.

Two of the major recreational impacts on areas such as Cadillac's summit are mechanical injury to plants and changes in the soil (Kuss, Graefe, and Vaske, 1990). Additionally, impacts can alter microhabitats. For example, if visitors move rocks in alpine/sub-alpine areas, they can damage or even kill plants by eliminating the sheltering effect of the rock (Hampton and Cole, 1995). In the following excerpt, Kuss, Graefe, and Vaske (1990) provide a useful summary of the variety of impacts potentially caused by recreational use:

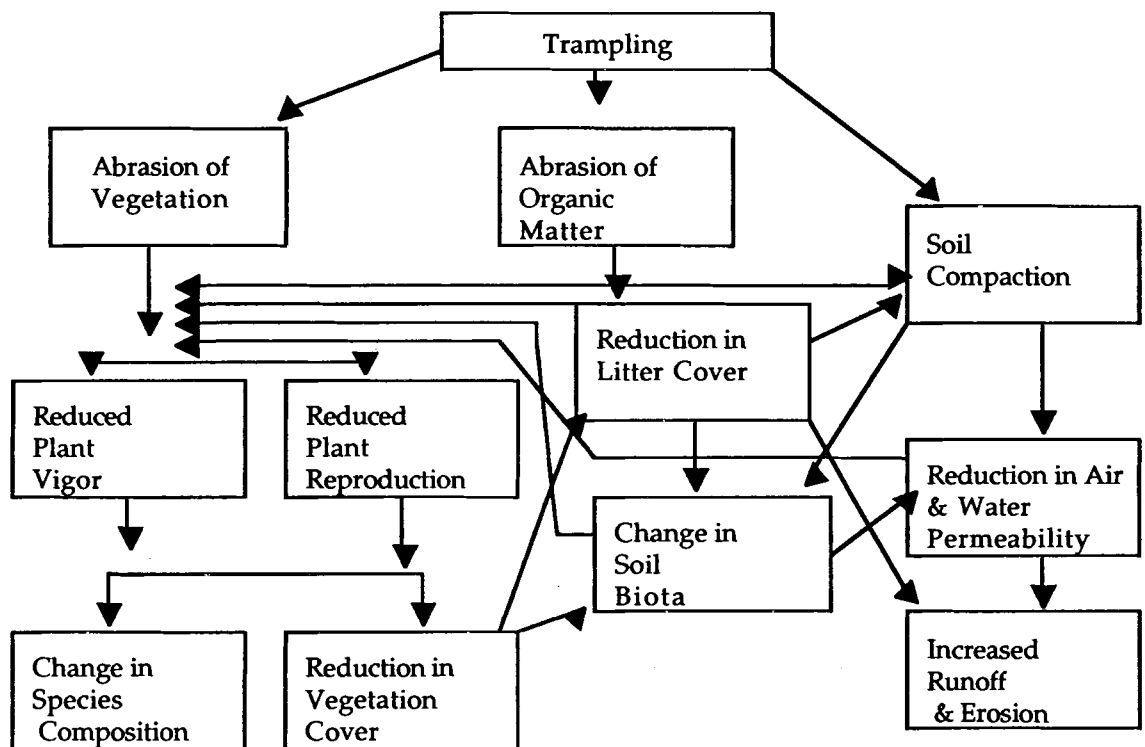
Vegetation trampled by recreational use is subjected to debilitating effects of physical breakage and wounding, and also to changes in the soil medium that frequently are detrimental to plant growth. The primary effects of trampling on soils are increased compaction and bulk density, increased soil penetration and resistance, changes in water balance and

moisture relationships, and reduced nutrient and oxygen availability. The effects of trampling on plant cover are manifested by wilted and defoliated plants, reduced photosynthetic surfaces, changes in physiologic function, impaired energy flow, loss of vigor, reduction in flowering and seed set, and greatly diminished biomass produced per unit area of impacted surfaces.

Yet another aspect of vegetation impacts is recolonization. In a perfect world, impacted areas, once protected, would quickly recover to a plant community identical to the pre-impact community. However, this is often not the case. First, impacted areas can be extremely slow to recover. In looking at estimated recovery times for disturbed alpine tundra areas within Rocky Mountain National Park, numerous researchers (Griggs, 1956; Osburn, 1958; Willard, 1960,1963; Willard and Marr, 1971) indicated that it would be hundreds if not a thousand years before the areas recovered to a "climax" stage. Additionally, recolonization is often performed not by the pre-impact plant species, but by pioneering species adapted to exploit the disturbed area. On Mt. Ranier, in Washington State, research indicated that impacted heather meadows were unable to vegetatively spread to cover disturbed areas (Hampton and Cole, 1995). This allowed the harsh alpine climate to undermine sensitive heather roots and thereby lead to the expansion of the initially impacted area. In this scenario, no recolonization was occurring at all, regardless of whether or not it was the pre-impact species.

Figure 3 charts the potential effects of trampling. While all of the components of the model do not necessarily apply to the summit of Cadillac, the model is useful for conceptualizing the "pathways" through which behaviors (e.g., trampling) lead to site degradation (e.g., vegetation cover loss).

**Figure 3**  
**Impacts of trampling**  
*Source: (Hammitt & Cole, 1998)*





## **RESEARCH PERSPECTIVES ON MANAGING VISITOR IMPACTS**

Recreation researchers have long been interested in tools for better managing visitor behaviors that damage natural and cultural resources. In studying management approaches, researchers have separated two distinct categories of techniques. The first category is direct management. This involves "legal prescriptions of appropriate and inappropriate behaviors accompanied by formalized sanctions, such as penalties or fines" (McCool and Christensen, 1996). The other category, indirect management, involves "management actions that change the factors recreationists use to make decisions about appropriate behavior in recreation settings" (Peterson and Lime, 1979). The research being discussed in this report was designed with the expectation that results could provide baseline understanding to help guide both direct and indirect management techniques on Cadillac.

### **Direct Management**

Direct management of human behaviors directly addresses the problem behavior itself. This is often accomplished through regulation (Hammitt and Cole, 1998). Traditionally, direct management has been thought to be effective, though more burdensome to visitors (Hammitt and Cole, 1998). An example of a direct management tool used on Cadillac was the establishment of physical barriers. While the signs on the barrier did urge visitors not to enter the areas the barriers were protecting, they did not mention any formal regulations. McCool and Christensen (1996) list reduction of visitor impacts, reduction of vandalism, and efficient movement of people through a site as benefits of using barriers as a direct management tool. They list reduction of visitor freedom, construction and maintenance costs, and visual intrusion into the experience as costs.

## **Indirect Management- Implications for Persuasive Communication**

"Persuasive communication involves the use of verbal messages to influence attitudes and behavior" (Ajzen, 1992). This is the major strategy used by managers at ANP to reduce vegetation trampling, cairn building, cairn destruction, and cairn alteration on Cadillac. Interpretive programs, columns in the Park newspaper, and signs on site all serve as media through which persuasive messages are sent.

Roggenbuck (1992) describes three "conceptual routes" to persuasion. The first, applied behavior analysis, uses prompts, manipulations of the environment, rewarding appropriate behavior, and punishing inappropriate behavior. This approach was applied only minimally to cairn issues and vegetation trampling on Cadillac. For example, when the trail crew rebuilt the cairns along the Gorge Path (June 20th), they also placed "iceberg" (half-buried) stones in sensitive areas to deter foot traffic. Another approach, the central route to persuasion, was employed more extensively. The third approach, the peripheral route to persuasion, was not used extensively, though it has potential applications for the site. These two approaches are discussed below.

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). This approach attempts to inspire visitors to make resource stewardship an ethic that they carry with them throughout the Park and possibly even throughout life. Messages designed to follow the central route to persuasion are evaluated by the receiver(s) (Roggenbuck, 1992). These messages are weighed based on their merit and the strength of their arguments.

The central route was the primary communication strategy used by park managers to address visitor-generated impact on Cadillac. The incorporation of LNT principles into signs aligns perfectly with the central route's tenets. Again,

LNT is largely based on recreationists personally adopting an outdoor ethic that protects natural and cultural resources along with social values of recreation lands. LNT's skills component (walk on durable surfaces, in this case) also requires individuals to deliberately process the message(s).

The peripheral route to persuasion, on the other hand, 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). This approach to communication abandons the content of a message and instead focuses on the context. If, for example, park managers erected a sign using an image of a uniformed ranger and the words "Do your part, stay on the trail", that would be a peripheral route to persuasion. Assuming that the reason for staying on trail was not stated, the power of the message is in its source (the image of a ranger) and not in its content.

### **Effective Signage**

On Cadillac, signs were the main message transmission medium used to communicate with visitors. In looking into the literature surrounding signage in natural/recreation areas, it becomes clear that researchers are divided over the effectiveness of message content on park signs. While some research supports sanction signs, such as threats of fines, other research posits that more positive, prescriptive messaging is needed. In a study examining the number of visitors traveling off-trail and the influence of various styles of signs asking visitors not to go off-trail, Johnston and Swearingen (1992) found that a sanction sign was the most effective at reducing off-trail hiking. The sign stating "OFF-TRAIL HIKERS MAY BE FINED" reduced off-trail hiking by 75%. The next most effective sign was a prescriptive ethical appeal stating, "STAY ON PAVED

TRAILS" and "PRESERVE THE MEADOW"; this sign reduced off-trail hiking by 52%(Johnson and Swearingen, 1992). Another study, this time looking at the removal of pumice by visitors to Mount St. Helens, also found a sanction sign to be the most effective in reducing problem behaviors; the sanction sign reduced the pumice removal rate by 97% (Martin, 1992).

Researchers such as Patricia Winter however, argue that more prescriptive, positively worded signs are needed in recreation areas. Winter et al., (2000) randomly surveyed members of the National Association for Interpretation and found that most members believed positively worded prescriptive messages (e.g., Please Park in Designated Areas) outperformed negatively worded proscriptive messages (e.g., Please Don't Park Outside Restricted Areas). However, in an earlier study, Winter et al., (1998) found that the vast majority of signs in Arizona and California recreation and/or wild lands utilized proscriptive behavioral commands (injunctive norms).

In a study at Shiloh National Military Park, James Gramann (2000) found that three treatments, an awareness of consequences message delivered by a uniformed interpreter (AC), the awareness of consequences message plus participation in a "heritage guardian program" (AC+HP), and the (AC+HP) treatments with the incentives of a banner and certificate (AC +HP+1), all significantly reduced damaging actions when compared to the control condition. However, the three treatments were not significantly different from one another.

Vander Stoep and Roggenbuck (1996) state that studies evaluating the relative effectiveness of various communication channels (brochures, signs, slide shows, etc.), show mixed results, though many researchers feel that personal contacts with visitors outperform other channels. In fact, the mere presence of uniformed rangers can increase compliant behaviors (Swearingen and Johnson). Oliver et al., (1985) found contact with a ranger and exposure to a brochure was

much more effective at improving campground behavior than was the brochure exposure alone. Concessionaires and others frequently in contact with visitors may also serve as an effective communication arm of the park (Vander Stoep and Roggenbuck, 1996).

It needs to be mentioned that visitors do not always receive messages. For example, Marler (1971), found that only one-third of campers receiving an anti-littering brochure actually read the brochure. Additionally, visitors often have a limited capacity for retaining information. Cole, Hammond, and McCool (1997) found that visitors gained the same amount of knowledge when two messages were posted on trail side bulletin board and when eight messages were posted on the board. The higher number of messages exceeded visitors' retention capacity.

## **RESEARCH OBJECTIVES**

Park management actions atop Cadillac included ranger programs, limited restrictive/protective physical barriers, signage, and research projects. The objective of this research is to increase understanding of visitor impacts on summit area resources using observational research methods. This translated into an effort to describe the "sub-culture" of Cadillac visitors, and to shed light on who engages in what behaviors, and why. Describing a sub-culture is a large undertaking, but this goal was guided by two specific concerns. First, managers had for years been dealing with the effects of visitors tampering with cairns. Cairns are pyramid-shaped piles of rock built by trail crews to mark trails and guide hikers (see figure 4). Throughout the park, but especially on Cadillac, cairns had been altered (stones added), destroyed, or constructed by visitors in inappropriate locations. All the while, very little data existed regarding who engages in these actions. The second concern related to the trampling of vegetation and soil and the resulting loss of vegetation cover.

**Figure 4**  
**A typical cairn**



## CHAPTER 2

### METHODS

#### METHODOLOGY

The purpose of this research was to provide Acadia National Park (ANP) with information about how visitor behaviors atop Cadillac Mountain related to resource impacts. To gain insight, I chose to use non-intrusive methods of inquiry. The data gathering approach involved observing visitors as they engaged in leisure activities. One of this research's goals was to observe visitor use without influencing actual visitor behaviors. This study falls into the category of "naturalistic inquiry." Naturalistic inquiry focuses on how people behave in genuine life situations in natural settings (Frey et al., 2000).

The desire to observe "natural" behaviors stemmed from concern for obtaining data that was not influenced by the researcher. In particular, this research aimed to avoid the "Hawthorne Effect", in which research subjects alter their behavior if they know they are subjects. While Berg (2001) contends that this effect is short lived, so are visits to Cadillac's summit.

Geoffrey Godbey (1984) provides another "benefit" of unobtrusive measures. He argues that not only are unobtrusive methods likely to more accurately measure or describe behaviors in a park setting, but they also do not violate and temporarily destroy the playful essence of park experiences. In looking at how to gain knowledge about Cadillac's visitors' behaviors, the impacts that intrusive methods would have on visitors were also considered.

The primary research objective was to increase Park management's knowledge about visitors to Cadillac and resource impacts. Although the impacts, such as ground cover loss, had been well recognized by park staff, minimal information was available about visitor behaviors. Furthermore, the site is a busy, complex place where a lot of behaviors occur at the same time.

Therefore, this research was designed to be exploratory. Babbie (1992) writes that:

Exploratory studies are most typically done for three purposes; (1) to satisfy the researcher's curiosity and desire for better understanding, (2) to test the feasibility of undertaking a more careful study, and (3) to develop the methods to be employed in a more careful study.

While the word "focused" might be exchanged for "careful", Babbie's statement parallels the objectives of this research. This research strives to (1) increase understanding of visitor behaviors and resource impacts and pass that information on to Park managers, (2) learn the strengths and challenges of researching visitor use at this site, and (3) develop recommendations for future research at this site and other busy park areas like it.

The research plan entailed going into the field with "open eyes". The only limits on observations were derived from the problems expressed by Park management. As Thomas More (1984) writes, "What you observe is spelled out in the definition of the problem". The problems were known, and were investigated through a responsive, cyclical process. This process involved inductively recognizing patterns, deductively "testing" those patterns, and refining how those patterns are conceptualized.

This study produced qualitative (non-metric) data. Limited measuring was done (e.g., counting visitors off-trail), but these measurements were not designed to allow rigorous experimental procedures and data analysis. Instead of statistically tested results, this study produced interpreted findings. Such findings are admittedly subjective. The researcher is the primary research "instrument" (Erlandson et al., 1993). Observations were recorded through the researcher's subjective "lens".



In acknowledging the subjective nature of this study, I am not intending to suggest that this work is less reliable. First, it should be made clear that the objective of this study was to gain insight about visitor behaviors and resource impacts at Cadillac Mountain at one point in time. The goal was not to generate findings that would be generalizable to other outdoor areas or even to Cadillac at other times. Procedurally, the study employed several strategies that Guba and Lincoln (1989) have associated with building reliable data. The strategies used included: prolonged engagement (I spent 219 hours in the field-including weekdays, holidays, and weekend days), referential adequacy materials (the inclusion of supportive materials such as videos or photographs), and peer debriefing (e.g., checking with professionals who are familiar with the subject but not actively engaged in the specific context).

One last technique for establishing reliability needs to be mentioned. As part of acknowledging subjectivity, researchers are encouraged to keep a researcher's journal and note the progression of their attitudes and feelings (Glesne, 1999; Erlandson et. al., 1993). Though I am philosophically predisposed against vehicular access to remarkable resources (such as Cadillac), I found myself vacillating between empathy for visitors who might not get to the site if not for the auto road and frustration that so many people were on site and that so much damage was occurring. I tried to bracket my feelings as I recorded and interpreted observations. All the while, I recognized that I could not completely escape my subjectivity. Berg's (2001) statement that, "This reflective characteristic implies that the researcher understands that he or she is part of the social world(s) that he or she investigates" was openly acknowledged.

Throughout the entire research process, I strived to observe and interpret relevant behaviors. Part of this effort involved placing behaviors in context. For as Downing and Clark (1985) express, "The naturalistic model relies on field study and emphasizes the discovery of information about human behavior as it

is affected by the context within which it occurs." Together, behaviors and context provided insight about the general "culture" of visitor use at the summit. This perspective, examining visitor use at the site as if it were a sub-culture, is a rather ethnographic approach to studying the site. Ethnography, which originated the field of anthropology, is "the use of direct observation and extended field research to produce a thick, naturalistic description of a people and their culture" (Gephart, 1988). Though this study may not be a traditional ethnography, ideas were borrowed from some of the perspectives of ethnography. For example, James Spradley (1972) writes:

Ethnography...is a systematic attempt to discover the knowledge a group of people have learned and are using to organize their behavior. This is a radical change in the way many scientists see their work. Instead of asking, "What do I see these people doing? We must ask, "What do these people see themselves as doing?"

In the case of this study, I could not "ask" people what they thought. However, I could overhear their unsolicited comments, which proved to be very insightful. Also, Spradley's phrase "the knowledge a group of people have learned and are using to organize their behavior" is applicable to this study. As Machlis (1984) writes: "The ethnographic profile then serves as a "natural history" of a particular cultural scene within the park." This is ultimately what this report looks to do. After observing, recording, and analyzing field data, I am putting forth a description of the "cultural scene" atop Cadillac as it relates to resource impacts. This description aims to aid park managers and spur future research.

Berg (2001) expresses that ethnographic research can demonstrate plausible hypotheses, but it cannot prove validity. This aspect of ethnography also aligns with the design of this research; the research for this project has always been

intended to identify possible relationships between and/or influences on behavior and resource impacts. This research's methods involved inductively processing field data. Hypotheses were borne through collecting and analyzing data. Again, this enabled the study to react responsively to emerging trends uncovered through field observation.

## **DATA GATHERING PROCEDURES**

This investigation of visitor behaviors and related resource impacts used unobtrusive observation as the primary data gathering technique. An unobtrusive technique is "a research technique that can be used without the awareness of the subjects being studied" (Theodorson and Theodorson, 1969). Numerous techniques can be used unobtrusively. In his 1966 book, *Unobtrusive Measures: Non-reactive Research in the Social Sciences*, Eugene Webb lists the following measures in the chapter on simple observation: participant observation, exterior physical signs, expressive movement, physical location, conversation sampling, time duration, time sampling, and observation (Webb, 1966). Elements of most of these measures were used in this study.

### **Sampling**

In the previous section I narrated how my daily field routine unfolded and why I chose specific observation tactics. In this next section I intend to describe my sampling techniques. The sampling plan employed by this study used two main techniques and two ancillary techniques. These techniques, especially the first two to be discussed, were not used separately, but in an overlapping, collaborative fashion.

The specific sampling techniques employed in this study mainly fall under the umbrella of purposive sampling. Erlandson et al., (1993) outline the central ideas of purposive sampling 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 first specific sampling technique that I will discuss is what Kelleher refers to as *ad libitum* sampling. He states that *ad libitum* sampling is "impressionistic and non-systematic" and that "the observer simply records what is of interest" (Kelleher, 1993). Specifically, I was interested in what factors influenced visitors' behavior regarding going off-trail, behavior once off-trail, cairn building, cairn destruction, and other issues pertaining to resource protection efforts on the summit.

Another sampling technique employed was behavior sampling. Kelleher defines behavior sampling as involving "simply choosing a behavior and noting who does it and when it is displayed" (Kelleher, 1993). While *ad libitum* sampling was the predominant technique for the study, behavior sampling was useful in that one of the major goals was to examine who was engaging in three particular behaviors: cairn building, cairn destroying and cairn altering. Again, these two techniques were not distinctly separated, but were instead intertwined into the daily data-gathering scheme.

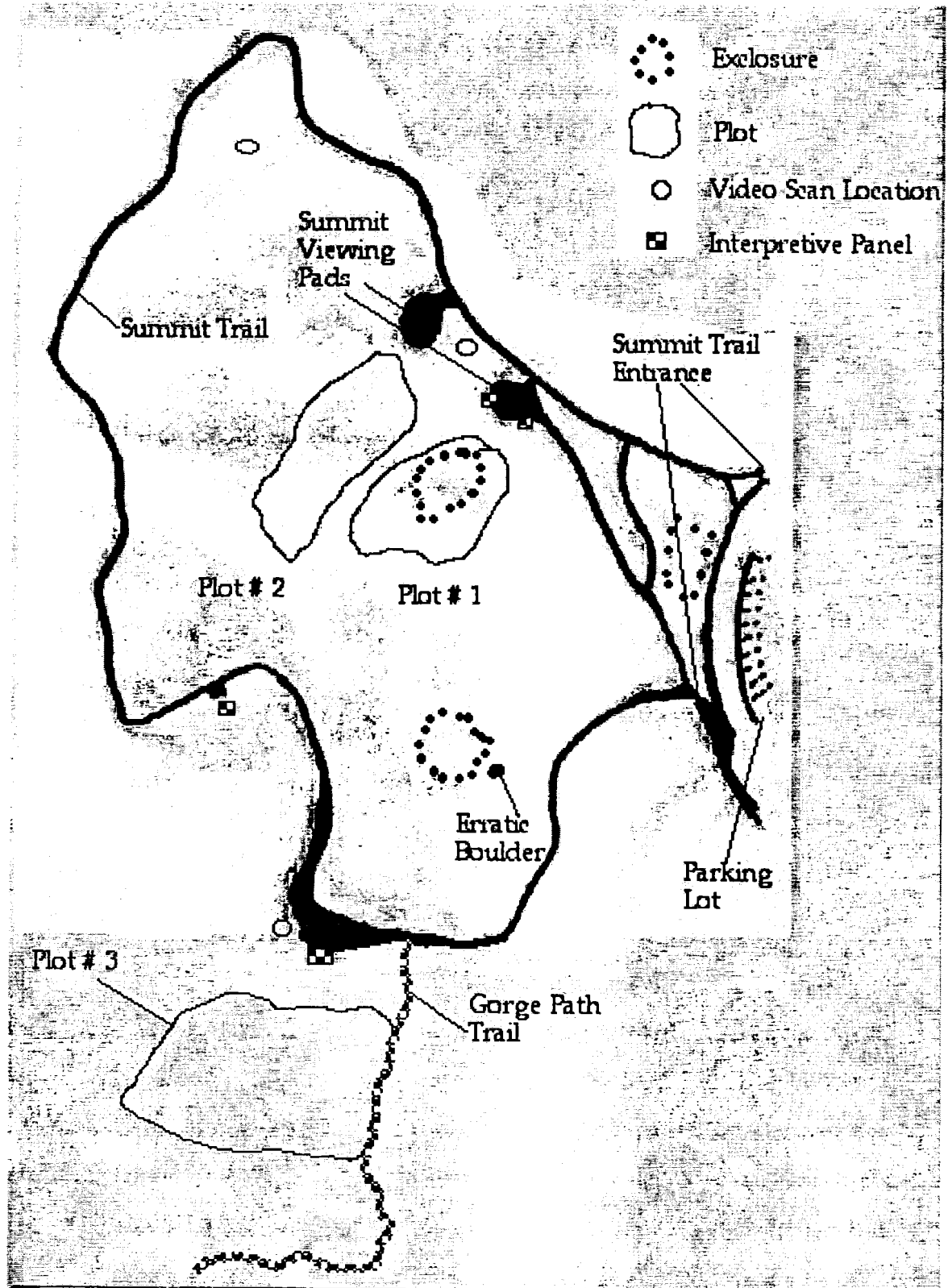
There were two more sampling techniques used to unobtrusively gather data. These techniques, while not quantitative, leaned towards the quantitative end of the spectrum. They were not designed before entering the field but were instead developed on-site. They were not a major "focus" or "priority" of the study, although they did provide a few pieces of useful data. One of these

"ancillary" sampling techniques was scan sampling. At various times throughout the field season, I would stand just off the Summit Trail north of the summit circle and slowly pan around the summit with a video recorder. As soon as the initial pan was completed, I would move east, down the loop path, and videotape the southern portion of the loop trail. This portion, due to its topographical placement, is just out of sight from the initial video scan location. Next, I would move northeast to the Gorge Path area and scan that area. Figure 5 identifies videotaping locations, along with other Summit Trail area features. This recording process essentially provided a "moment in time at the summit area." Later these video scans were analyzed for additional insights. Over the course of the field season 31 scans were performed. The times when the scans were conducted ranged from 4:30 a.m. to 8:00 p.m. and covered all days of the week. However, the sampling regime was not truly random. As with all of the approaches to sampling, I was looking for meaningful data that would be applied to understanding this site and its specific problems; obtaining a representative random sample was not a research concern at this point in time.

An offshoot of behavior sampling was plot sampling. This ancillary technique was alluded to earlier in the context of stationary observations. This technique involved counting the number of individuals who trampled soil or vegetation in defined plots, which were defined in my notebook by landmarks and delineating sketches. As with the video scans, this technique was not conceived or intended to be the crux of the study. Rather, it was simply an attempt to record the number of visitors trampling soil or vegetation within established areas. The numbers recorded were compared to my overall impressions of trampling. While this technique was not developed thoroughly enough to stand alone, it was useful for "calibrating" my interpretation of trampling levels. Appendix E lists the data recorded through plot sampling.

Figure 5

Locations of summit features



## Daily Field Routine

Each observation period would begin as I arrived at the summit parking area. If the weather were poor (i.e., rainy, foggy,) I would be certain to park in a space facing the Summit Trail entrances. Parking in such a position maximized my ability to view at least portions of the main study area while remaining in my vehicle. This ability to work from my vehicle was helpful during fair weather observation periods and it was vital during inclement weather conditions. The importance of being able to use a vehicle as a viewing location during poor weather had less to do with comfort and more to do with unobtrusiveness. My usual observation routine had to be abandoned when weather conditions made my presence on the summit obvious to other visitors. This personal impression was supported by an incident where a non-uniformed ranger noticed my presence on the summit during a preliminary observation period that was markedly rain and clouds. In this instance, the park employee, whom I had not yet met, later confessed that she had seen me on the summit during inclement weather and that my behavior (remaining stationary) had drawn her attention. I quickly concluded that poor weather days would require a distinct approach. Specifically, I would make limited stationary observations from my vehicle and I would also periodically make roving observations on the Summit Trail.

When the weather was at least fair, I would get as good a parking space as I could. Next I would prepare to enter the field. In effect, I began observation as soon as I arrived at the parking area.

In an attempt to draw as little attention as possible, I was careful not to carry a clipboard or any other official looking gear. As with other park-centered covert research (e.g., Mullins, 1984) dress was kept casual but appropriate (hiking boots or sneakers, shorts, T-shirt, occasionally a jacket, etc.). I generally went for the day-hiker look. By dressing casually, I strongly believe that I attracted very little attention.

Dressed casually and saddled with a fanny pack or day pack, I would begin by roving around the paved loop, pausing here and there to take in the sights. I also casually pretended to examine various wayside exhibits. The initial jaunt around the loop often served as an opportunity to take photos and record video segments.

The busy nature of the site allowed me to use a video camera and still camera to record visual data without being obvious. I attempted to avoid blatantly photographing individuals, partly because I did not want to influence their actions. The second and more important factor concerned ethics. At a busy site such as Cadillac Mountain summit, strangers inevitably end up in visitors' photos and videotapes. However, blatantly photographing others without their permission is unacceptable. While I did photograph select moments where an individual/group was involved in a particularly interesting action, I always kept the focus at a distance. I was there to learn from visitors, not to enforce laws or communicate with visitors.

After a slow initial trip around the loop path, I would choose a location to remain stationary, observe behaviors and listen to comments. Stationary observation locations varied, but they generally shared several characteristics. Locations needed to either give me a wide viewshed or a direct view of a particularly interesting feature, such as a cairn, enclosure, or a sign. Several locations, such as below the Bar Harbor interpretation sign, were chosen because they allowed me to listen to visitor comments without drawing attention. In the case of the Bar Harbor interpretation sign location, I could sit on a relatively steep rock slope below the popular viewing area at the sign. At this location, I could hear visitors' comments as they stood at the overlook. Stationary locations were often located adjacent to particularly relevant physical features. As mentioned above, signs, cairns, enclosures, etc., were all targeted as stationary location sites. Targeted features also included sensitive patches of



vegetation, popular attractions such as the erratic boulder and split rock nooks (small cave like openings between frost cracked boulders) and areas where visitors frequently left the Summit Trail to venture off-trail.

Stationary observation periods ranged from 5 to 45 minutes, but 30 minutes was the most common duration. In an attempt to count trampling actions, I constructed three visual plots in which I counted the number of individuals who ventured into a plot and stepped on vegetation and/or soil. These plots were delineated only by landmarks and sketches noted in my notebook. Each observation period in which I counted trampling individuals lasted for 30 minutes. During these 30-minute observation periods, I was able to simultaneously count individuals and make other interpretive observations.

Observations were rarely, if ever, recorded while making roving observations. Instead, I would wait until I was in my vehicle or at a stationary observation site. Observations made during roving periods, which were usually less than 10 minutes in length, were always recorded shortly after the roving observation period ended.

My outward demeanor during the stationary periods was very relaxed. I almost always remained seated or prone during the stationary periods. I generally did what other people, especially hikers did; I enjoyed the view, rested my legs, sipped water, ate snacks, and relaxed. The major difference, of course, was that I was expressly trying to observe how visitors related to the physical environment, norms, and to each other.

In order to record data as soon as possible after observing it, I recorded notes in a small journal. Of all my field behaviors, taking notes in the field was potentially the most attention getting. To lessen the likelihood of a visitor noticing my note taking and, as a result, possibly changing his or her behavior, I recorded notes in a small bound sketch journal. Further, I tried not to write constantly. Rather, I would mentally collect several key observations and wait to

write them down all at once. This collection period usually did not last longer than 15 minutes, especially if there was a lot of meaningful action.

While guarded note taking reduced the blatancy of my recording, writing was not a common activity engaged in by visitors to the summit. During all of my hours on the summit I saw only one individual actively writing. I did see a few artists painting or sketching. However, and this is admittedly intuitive, I feel that I did not receive undue attention for writing. In fact, individuals quite often would sit, stand or pass close by me while I wrote. I even had a few tagged sketch pages that served as my safety pages; I would flip to them so that a close passerby would glimpse artwork on my pages instead of hastily written notes.

A visitor would once in a while notice my writing habit. Once, two girls in their early teens were overheard commenting, "I think he's writing in his journal." Obviously, they noticed me. Hopefully, they simply thought that I was recording a passage for a personal journal and continued their activities essentially unaltered. Another approach to reducing visitors' suspicion of my stationary routine was to act as though I were reading a book. I always carried at least one book, ranging from a bird field guide to a paperback novel. On most days I really didn't read the book, though I did get some reading done on slower days (usually early or late in the day). Reading was observed to be a relatively infrequent, but, nonetheless, occurring visitor behavior. This observation, coupled with the nature of my stationary routine, made my portrayal of a reader a useful tactic. Once, I heard a woman rather loudly comment to her companions that, "that's what I'd like to do, come up here and just enjoy a good book." It appeared to me that she accepted my actions without suspicion.

More unusual than either note taking or remaining in one place was being alone. After a few field sessions and reviewing visitation data for the whole of Acadia National Park, it became clear that I, as a lone visitor, was in the minority. Observations indicated that family groups and couples dominated the site. This

is collaborated by park wide data from August, 1998, indicating that 71% of park visitors were family groups and 39% were groups of two (Visitor Service Project, 1998). Solo recreationists do not seem to be that common at Cadillac during the peak season. Acknowledging this, I frequently recruited my wife to come along with me to visit the site. Her presence, I believe, helped me draw as little attention as possible. I bring this up a future consideration for observational research within Acadia National Park and possibly at other popular recreation sites.

It should be becoming clear that one main strategy of the study was to reduce the potential for drawing visitors' attention. As part of the strategy, I needed to be cognizant of any temporal patterns I might develop, for example how frequently I ventured around the loop path. Visitors generally do not continually circle the summit area. Some visitors don't flow in any type of circular fashion. The important point is that if I roamed around too frequently, then I would run the risk of continually passing by the same visitors, especially slow-moving or stationary people near the Summit Trail. By spacing out the frequency of my roving observations, I reduced the risk of drawing attention. Most visitors did not stay at the site long enough to witness that I was there roving and sitting, roving and sitting, all day long.

At the end of each field day, I would examine my daily notes, pick out the most insightful entries, and write them down on a daily summary sheet. I would also record general patterns seen that day and over time. Filling out summary sheets helped organize the field notes for further review and analysis. Appendix C shows a typically daily summary sheet.

## **DATA ANALYSIS**

"Formal" data analysis began after field observations, or data gathering, was completed. However, all the time I was gathering data I was also noting

patterns and themes that guided my observations. In this sense, I was “informally” analyzing data while simultaneously observing and gathering data.

The approach we used to formally analyze data is referred to as grounded theory. This theory, developed by sociologists Barney Glaser and Anselm Strauss, calls for generalizations to be grounded in or inferred from the data collected for the study (Frey et al., 2000). This method 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).

Formal (post-field) data analysis began with reviewing daily summary sheets. General topic categories were created based on these sheets. These initial categories were used to organize data into workable “chunks” or sets. After the organizational categories were established, entries from the field notes and summary sheets were sorted into one or more categories. This was done by hand writing entries on note cards and sorting the cards into categories. If an entry seemed to fit into multiple categories, then multiple copies of that entry were written. Next, the data organized with note cards was transcribed onto a word processing program. This electronic version of note cards, with entries grouped into organizational categories, was printed out for further analysis. This process organized data by reducing it. Berg (2001) expresses the need for data reduction when he states, “Qualitative data needs to be reduced and transformed in order to make it more readily accessible, understandable, and to draw out various themes and patterns.” This initial phase of data reduction reduces data but does not interpret it. That function was performed through coding.

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 the exploratory, grounded theory approach, open coding was used. Once the data was organized by topical categories and a hard copy was printed, I started analyzing the hard copy by reading and rereading groups of entries. I made numerous notes and markings 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) 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, I was able to examine the data and pull out interpreted findings that I felt were of importance to park management.

A separate form of data analysis was used for data obtained through scan and plot sampling techniques. Data obtained through scan sampling proved to be valuable in a number of ways. First, recording video on a small home video recorder turned out to be a good way to obtain images that could later be used for analysis and in presentations/figures. Next, it enabled me to plot the locations of visitors. This process, involving looking at still frames of video clips and recording individuals' locations on a two dimensional map of the area within the Summit Trail loop, allowed spatial visitor use patterns to be recorded. To record the location of each individual, I would place a dot on a layout of the summit area. For each scan recorded on video, I would map a new sheet. I was also able to separate children from adults, and pre-exclosure periods from post-exclosure periods. The results that I had "maps" of where people were during different times of day, where people were before and after the exclosures and signs were erected, where adults were, and where children were (see appendix D).

Perhaps more importantly than mapping, I was able to count the number of people off-trail versus the number of people on-trail at specific times throughout the season. There were a total of 31 video scans ranging from 4:30 a.m. to 8:00 p.m., although most scans occurred during the mid-day hours (10 a.m. – 2:00 p.m.).

## **CHAPTER 3**

### **RESULTS & DISCUSSION**

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.

#### **KEY FINDINGS**

##### **Cairns**

- Young children (preadolescents) 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.

### **Creativity and Play**

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

### **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 exclosures 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.

#### **CAIRNS**

After initial meetings with ANP staff, it became clear that the park had several concerns regarding visitors’ interaction with cairns. While park staff regularly observed the effects of cairn destruction, cairn alteration, and cairn construction, they did not have a lot of documented information pertaining to who engaged in cairn activities. In addition to the “who” question, questions of “when” and “why” also existed. Through this observational study, I have gathered data that provides insight as to who engages in various cairn activities on the summit of Cadillac Mountain and under what context those activities occur.

Again, as throughout all of this paper, the goal is not to deduce the truth, but to offer points to consider. These points, such as who builds cairns and the context in which they build them are grounded in lengthy observations. These

points, emerging through sensitive observation and analysis, are interpreted as patterns and, as such, are not meant to imply certitude or exclusivity (e.g., children are not the only ones who build cairns). That being said, significant cairn findings did emerge from observations that lend confidence to the conclusions.

By the end of the field season it was clear that a specific set of visitors were largely responsible for cairn building and destruction. Specifically, children under the age of approximately 16 were the dominant builders and destroyers of cairns. In all seven instances of observed cairn building activity, children instigated and conducted the cairn building. In all seven instances, parents or adults with the children occasionally assisted with moving rocks, took photographs, offered congratulations, gave advice or did all of the above. In not one instance of cairn building was a negative adult reaction evident. It is noteworthy that all observed building instances occurred before ANP staff placed signs on site to interpret the role of cairns and how visitors should treat cairns.

It needs to be made clear that children are probably not the exclusive builders of cairns on Cadillac. All observed building instances involved children, but that does not equate to children being viewed as the sole source of cairn building. In fact, cairns themselves can hint at the inappropriateness of that concept. A cairn found near the junction of the South Ridge and West Face Trails had several very heavy slabs of granite incorporated into its design. The sheer mass of the stones in this cairn suggested that children may not have been the primary builders of this particular cairn.

While children are not the exclusive builders of cairns, they can be thought of as the major group of cairn builders. Furthermore, I argue that children are usually in a family group context when they build, and within this context adults do not discourage their actions. Instead, they all seem to at least condone, if not

encourage, their children's actions. Based on body movements such as a pat on the child's back, the taking of photographs and adult participation, it appears as if children received positive feedback from their adult group members. I sense that these building actions generated positive experiences for the visitors who engaged in them.

The first instance of observed cairn building occurred on June 28th. In this case two boys aged approximately eleven to thirteen and two younger girls, aged eight to ten, built a low but significant cairn in the Gorge Path area. The adult woman (presumably the mother) with them watched their progress and eventually took a photograph of the children posing with their cairn. Adults' photographing the product of children's cairn building efforts was a fairly common sight. In fact, three of the seven observed building incidents involved women photographing the group and its completed cairn.

It is interesting to note that in all but one of the seven observed incidents more than one child constructed a cairn or set of cairns. The largest group of cairn builders was four children actively collaborating to construct a cairn. It is also interesting and somewhat disturbing from a resource protection perspective to note how much impact a few active children can have on the resource. On July 12th, two boys between the ages of four and six years build one cairn, carrying quite large rocks over 40 yards uphill, and bushwhacking through relatively dense vegetation. The two boys, who together probably weighed less than a 100 pounds, had a rather substantial impact on the site (i.e., they built a cairn, moved rocks around and possibly helped contribute to new social trails within previously untrammed vegetation).

In some respects cairn building on Cadillac summit is analogous to the building of sand castles at the beach. Both activities seem to primarily involve children and to a lesser degree their parents, though adults without children probably will occasionally build as well. Both activities involve a participant

creatively interacting with the physical environment. The two activities can, in my opinion, generate fond memories and feelings of accomplishment. While cairn building and sand castle building have similarities, they also have important differences. First of all, sand castles are destroyed, often on purpose, by the builders. Sand castles are probably quite well understood by beach goers. They know that they are generally built as creative fun projects. With cairn building, observations indicate that their true purpose is often misunderstood.

Furthermore, none of the cairn builders I observed deconstructed their own cairns. Rather, the cairns remained unless a visitor destroyed them. Perhaps the greatest difference between cairn building and sand castle building is the impact of the activity itself. While building sand castles has a relative benign impact (sand is scooped out and will eventually be returned via tidal action) cairn building has the potential to have negative ecological and social impacts. The ecological impacts include damage resulting from removal of stones from the soil and the subsequent plant/soil vulnerability to wind and water (Hampton and Cole, 1995). Social impacts can range from esthetic degradation to safety concerns (e.g., views dominated by cairns and getting lost due to misleading, inappropriate cairns).

Further cairn observations involve the destruction and/or alteration of cairns, what visitors were heard saying about cairns, and how visitors generally interacted with cairns and with interpretive signs discussing cairns. As with cairn building children emerged as the major group seen destroying cairns. Of seven observed instances of cairn dismantling/destruction, all seven instances involved children under 16 years old (boys and girls). Destructive style ranged from careful, systematic dismantling to aggressive kicking and pulling. Actions ranged from complete annihilation of a specific cairn to individual kicks at successive cairns. For example, on August 8th, a boy in his early teens

dislodged stones from cairns as he gave one kick each to of three successive cairns along the South Ridge Trail.

Adult reactions to children damaging cairns varied from non-reaction to intervention. In only one instance did parents intervene. On August 4th a boy pulled a rock out of one cairn and later kicked over a low cairn. After seeing his son (?) kick over the low cairn, the father (?) spoke to him and got him to stop. The father postured sternly as he spoke with the boy and the boy did not engage in any further destruction. However, they did not attempt to repair his damage.

In six of the seven instances no parental action seemed to be taken. In at least two of these cases, the adults with the children were observed watching their children's actions. In one case, an adult was photographing a child who was posing with a cairn. The child inadvertently knocked the top off from the cairn. After that accident, the boy purposefully knocked off a few more. Again, no parental action was taken.

Another cairn phenomenon that was looked at was cairn alteration (notably the addition of stones to cairns). This phenomenon differed markedly from cairn destruction and building in that neither adults nor children emerged as being primarily responsible for adding stones to cairns. In fact, children, adults with children, and adults without children, were all observed adding stones to cairns. One interesting alteration incident involved a family touching up a dilapidated cairn. The group carefully reshaped the jumbled pile of rocks into a rather correct, well-built cairn. The cairn was appropriate in that park staff originally placed it. I could infer no motivation for their action, and was not close enough to hear any comments.

The ability to hear visitor comments about cairns proved to be invaluable. By listening to visitor comments as they interacted with cairns, I gained a deeper level of understanding about how visitors viewed cairns. One of the strongest ways in which comments enriched observations involved insight into visitors'

understanding of cairns and the addition of stones to cairns. For example, on June 24th and again on July 4th, roughly the same incident occurred. In each case a young girl asked the adults with her what the cairns were and who built them. On the 24th of June, the mother (?) replied, "I don't know, but I think you're supposed to leave them alone." In this case the child complied with the mother and left the cairn alone. On July 4th, I overheard a young girl asking her parents (?) what the "piles of rock" were. When they gave no answer, she added a rock to the cairn. Similarly, a man added a rock to the cairn after discussing cairns with his female companion. In this case, which occurred on June 24th, the woman asked, "Is this the recommended way up?" To this the man replied, "I guess people add a rock to these [cairns] on the way up." He then added a pebble and they both laughed.

While this research did not specifically seek the relationship between visitor understanding of cairns' purpose and the addition of stones to these cairns, observations indicate that understanding plays a role in shaping visitors' behavior. A set of specific actions taken by the park staff helped form the theory that visitor understanding of the purpose of cairns translated into decreased cairn building, destruction, and alteration. These actions involved the reestablishment of cairns along the Gorge Path Trail. On June 20th, Park staff created a series of cairns delineating the Gorge Path. Additionally, they demolished inappropriate cairns built off-trail by visitors and scattered their stones throughout the area. They also placed some stones within worn patches of soil. These "iceberg" stones (placed into the soil so that their tops protruded awkwardly from the soil) were placed in an attempt to subtly deter visitors from trampling on these sensitive areas. All of these efforts were undertaken to guide visitors and protect the physical resources at the site. The byproduct, however, was that I had a clean slate to observe (i.e., I now could observe visitor reactions

to the newly constructed cairns and I could also record the physical traces of visitor impacts on cairns).

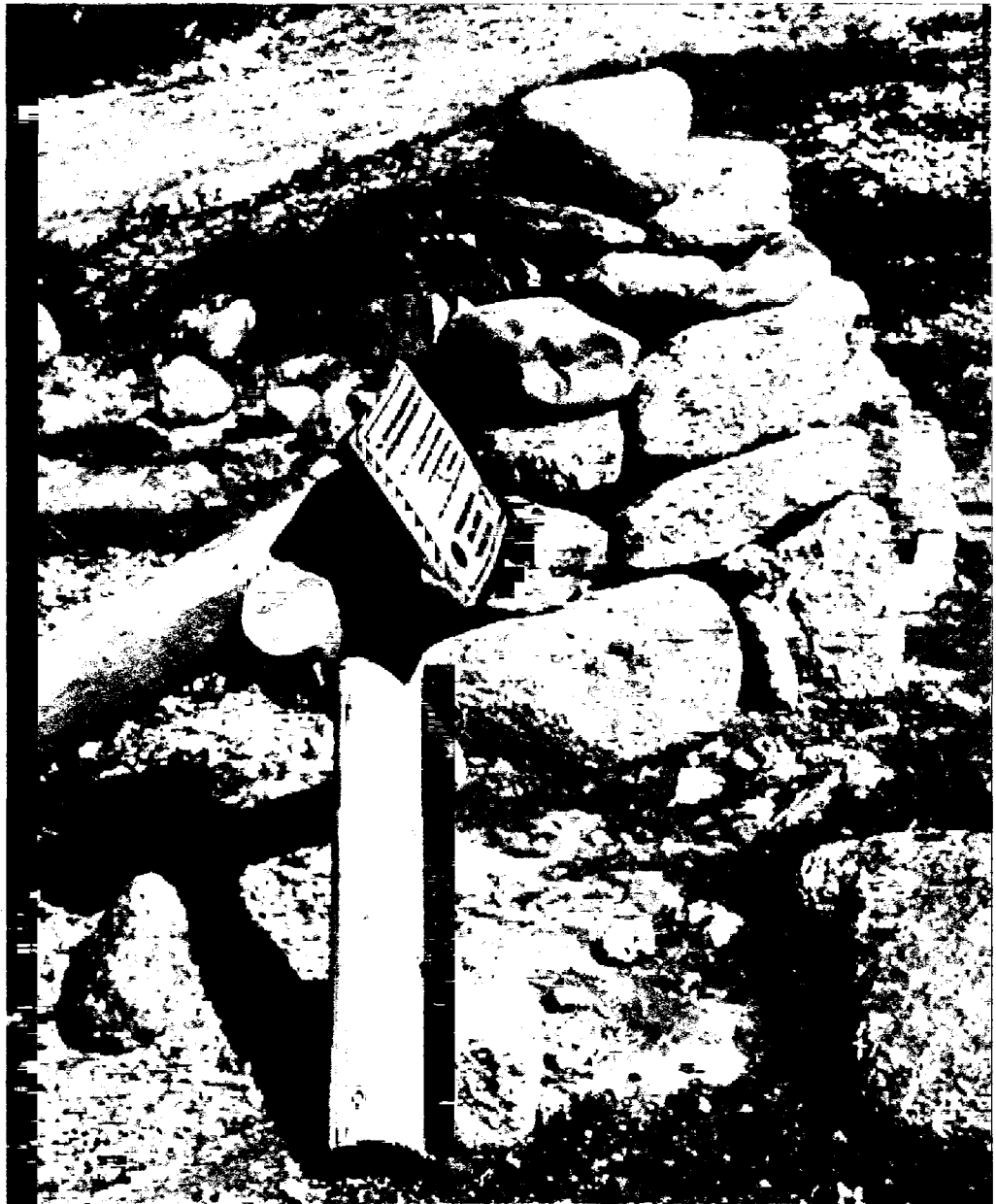
It is important to note that, before the park worked on the area, the area was characterized by the cairns being basically destroyed. There was no clear set of cairns. In fact, most previous cairns were no more than a loose low jumble of rocks. On June 20th, the park effectively reestablished the Gorge Path cairns as they felt they should be. There were no signs explaining the function of cairns and how they should be treated. This is an important distinction between this rebuilding effort and a later effort, September 7th. On September 7th, a similar effort was made to clean up the Gorge Path and reestablish a proper set of cairns. A part of this effort included the placement of two signs mounted on wooden tripods indicating what the piles of rocks (cairns) were and how one should treat them (figure 6). These signs were placed next to the cairn immediately below the paved loop trail and next to the first cairn above the low ridge in the Gorge Path area (the ridge delineating one boundary of this study). These two separate building efforts allowed me to observe visitors' interactions with cairns both with and without explanatory signs. As will be discussed, however, the two efforts occurred in rather different seasonal periods, which may confound any attempt to draw conclusions about the effect of signs on cairn activity.

The rebuilding effort of June 20th proved valuable not only because it cleaned the physical slate, but also because it allowed for observations of interactions between visitors and cairns, and between visitors and Park staff. For example, while the park staff worked on a cairn lower down the trail, a young boy ran full speed downhill towards the cairn. He never slowed as he scampered up the cairn like a mountain goat. He stopped precisely on top of the roughly three-foot high cairn and posed with his arms outstretched as his mother took a photo. Two other boys were seen picking and kicking at a cairn.

**Figure 6**

**Cairn with sign**

(signs were only used after September 7)





All of this occurred while at least one uniformed park employee was in the general vicinity of these actions.

Behavioral observations were not the only source of data on the first rebuilding day. Several visitors were heard conversing with park staff as they worked on cairns. One visitor asked, "Does everyone here build these things?". The park employee explained the role cairns play and why they should be left alone. In another exchange a woman sarcastically commented, "Is this what you went to college for, to play with rocks?"

Actions observed and comments overheard on June 20th would be repeated in various forms throughout much of the summer and fall. The main difference between the 20th and subsequent field days was that on most other days, there were no park employees present near the cairns. The aspect of exchange between park employees and visitors was limited to interpretive programs on the Summit Trail.

The Park's rebuilding of the cairns on the Gorge Path provided an opportunity to record how quickly cairn activity can occur. I left the site on the 20th at 4:00 p.m. Upon arriving on site at 11:30 a.m. the next day, six of the ten Gorge Path cairns within the study area had been altered (rocks were either added or removed). Within eight days, only one of the ten rebuilt cairns remained fundamentally unchanged. Visitors had built nine more cairns in that same period, while during the five days before the cairns were rebuilt, visitors hadn't created any new cairns.

Trace evidence of cairn building, alteration, and destruction far outweighed actual observations of the acts being performed. While observing the act itself provided more insight, the resulting trace evidence also provides understanding. For example, while I did not observe the September 7th rebuilding effort, I still could use trace evidence to make judgments. Figure 6 shows a park-built cairn with an explanatory sign next to it. Park staff probably

did not place the smaller stones and pebbles on the cairn. Park-employed cairn builders do not simply lay pebbles loosely on outer rocks of the cairn. These pebbles indicate that some visitors have placed stones on the cairns despite the sign's message asking visitors not to add rocks. Because I did not witness the September 7th rebuilding, I could not record the traces of activity as precisely. However, the level of alteration and construction was much lower than after the 20th of June. I could not notice any cases of destruction after the 7th of September. That does not mean that it did not occur. Lower levels of visitation and a different composition of visitors began at approximately the same time as these signs were erected.

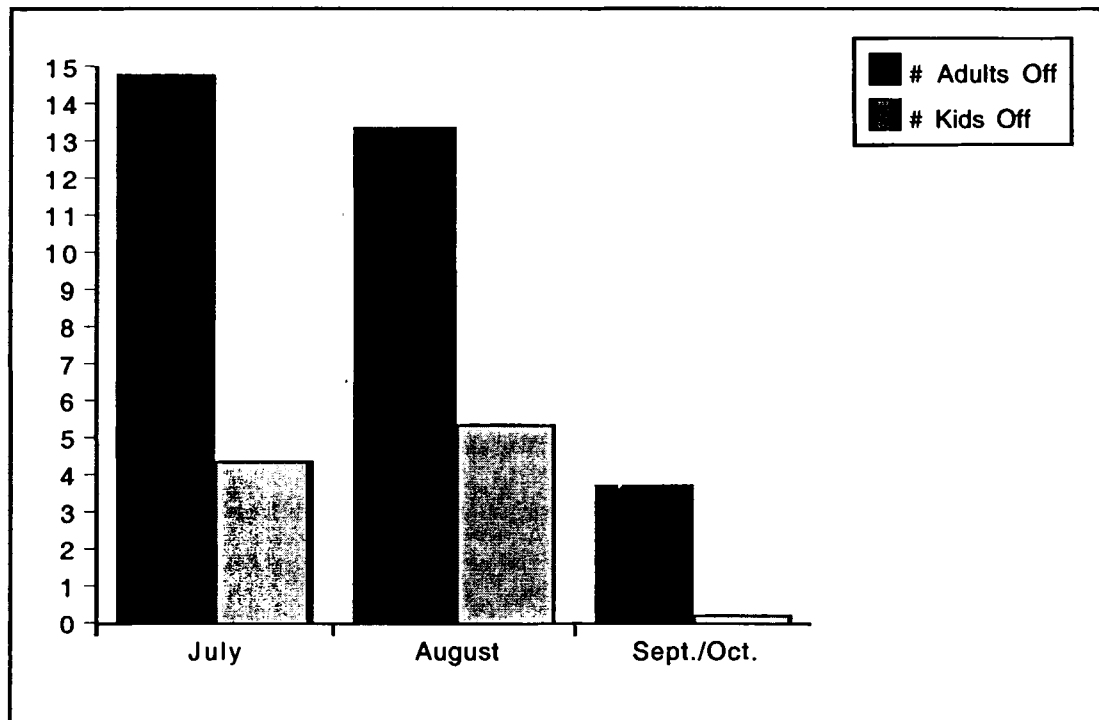
The effectiveness of the cairn-interpretive signs was difficult to assess. I didn't see how cleanly the slate was wiped on September 7th, and comparing the two periods (post June 20th and post September 7th) requires recognizing the change in visitor demographics. Field observations and video analysis of visitors indicate that not only do actual numbers of visitors drop off after August, but the types of visitor change as well. In late August and early September, the number of families with children visiting the summit seems to drop off (see figure 7).

Another observation concerning the cairn signs is that the placement of the signs below the Bar Harbor overlook may have actually led to more people venturing off the trail. Specifically, visitors at the Bar Harbor interpretive sign could see the first cairn on the Gorge Path, but they couldn't read it. Therefore, some visitors went down to the cairn simply to read the sign. They usually went down by the shortest route, not on the Gorge Path Trail.

Comments about cairns varied, though most served as good clues about how people's understanding of the cairns. Comments indicated that there was a wide spectrum of understanding across visitors. Some visitors understood that the park builds and maintains cairns as trail markers in rocky open sections of trail. Other comments suggest that the speakers knew that cairns were trail

**Figure 7**

**Monthly average number of adults off-trail within the loop of the Summit Trail versus the number of children simultaneously off-trail in the same area.**  
**Based on video scan data.**



markers but did not know that the park staff built them. Of course, some visitors knew nothing at all about the cairns. On September 17th, two older women at the Bar Harbor interpretive sign were overheard as they discussed the cairns. Their comments showed a level of unfamiliarity that many visitors may have shared. The first woman stated, "I think I saw those in Hawaii. I think they're supposed to bring you luck or something." The other woman stated that 'they're like Indian or something.' Similar unfamiliarity is expressed by the comments of a young woman viewing the Gorge Path. She stated, "Look at all the rock piles. On Mount Battie in Camden, those things are everywhere. Talk about weird human behavior."

The last few comments serve as examples of simple unfamiliarity with cairns. The next few comments serve to highlight how comments may be related to actions or decisions. One such comment came from a little girl on June 24th. She was overheard commenting on the "neat piles of rock." This phrase, or similar ones, was commonly heard coming from (primarily) children. The subtle implication is that many visitors, especially children, seem to not only be unfamiliar with cairns and their purpose, but they also find them to be extremely alluring. Cairns seem to have an intrinsic appeal to some visitors.

Actions and comments viewed together often were quite intriguing. For example, on June 25th, a teenage boy and an adult with him were right next to a cairn. The boy asked which way to go; they went off-trail. At this point in the season, the cairns still rather clearly defined the trail. Therefore, the questions arose: did they understand the role of cairns, and if they did, did they decide to willingly go off-trail? On a similar note, a man was overheard on September 9th talking about the purpose of cairns. He clearly expressed their purpose but was later seen off-trail (i.e., he knew where the path was, but seemed to choose to venture off-trail).

Occasionally visitors made comments about cairns that reflected some of the concerns park officials have. For instance, I watched a family of four head down the Gorge Path. When they got to a section of trail where visitors had built numerous cairns, they headed off-trail towards an inappropriate, misleading cairn. Upon reaching the cairn, they realized that there wasn't anything resembling a trail past this cairn. At this point one of them commented, "Where's the trail?" Observing this incident and others like it indicated that some people wished to stay on trail but were led off-trail by inappropriate cairns.

To further this point, I will briefly discuss a comment made by two older men hiking with their wives. One man responded to the other man's comment about the purpose of cairns by adding, "Until someone puts up one they're not supposed to, and you get lost off-trail, that's happened to me before." Overhearing this unsolicited testimonial solidified the idea that people really do experience negative impacts of cairn building. I suspected negative implications such as the one just documented, but I did not expect the seemingly positive nature of cairn building experiences.

Comments suggesting a negative reaction to cairn building were actually quite scarce. However, that does not imply that the general public either dislikes or enjoys the abundance of cairns. This study cannot posit an argument on that question. There is evidence supporting the notion that cairn building may largely occur within the positive context of youthful creativity and family experiences. Conversely, I observed individuals who appeared, based on behavioral observations and overhead comments, to want to stay on trail and who were led astray by inappropriate cairns.

Finally, cairn building very likely contributes to vegetation impacts (via rock removal and subsequent microhabitat exposure to wind and water impacts).

## CREATIVITY AND PLAY

One of the most powerful themes derived from field observations is that resource-damaging behaviors, while harmful to the resource, were in other respects quite positive. If, for example, one were looking at cairn building without the concern for resource impacts, one might well conclude that cairn building was a positive behavior in that it involved creativity and family bonding. Children arranged rocks to emulate the designs they saw on site. Children built cairns and "bowled" them over with smaller rocks. A small girl used rocks and pebbles of various sizes placed on top of one another to make rock "eyeballs" (as she called them). Parents looked on, took photos, helped out with moving stones, congratulated kids, or did any combination of the above behaviors. Cairn building entailed families interacting with the resource to produce a creative product. These families were probably also creating memories.

Cairn building was not the only tactile way in which children interacted with the summit environment. Children were quite frequently seen playing in bare soil patches. Young children, from toddlers up to children twelve years of age were seen picking and otherwise playing in the bare patches of soil. Usually, they would sit and simply pick small stones. Sometimes they would keep or throw stones or pebbles, but usually they would simply sift the soil. I have also seen where children have written with a stick in a patch of soil (this was on Dorr Mountain's summit, but it may occur on Cadillac as well).

Imagination is active among children at the summit. The natural rock formations and boulders at the summit sometimes appear to look like things such as chairs. This was not lost on visiting children. In addition to using their imaginations to, for example, sit on "rock chairs", children also sought out the rock crevices found on the summit. One visitor, a boy who had apparently been to the summit before, briefly worried that hiding spot had been "roped-off"

(exact words) by the exclosures. To his delight, he found his split-rock hiding spot in an unrestricted area.

More formal play was seen when children used kites or wooden airplanes on the summit. This was fairly rare to see, though on one day I did see three separate groups flying kites. Children usually had an adult or two help them fly their kite. I should note that I also saw a few adults without children flying kites. These visitors tended to have fancier "stunt" kites.

While the positive nature of these creative, playful, acts is a benefit to the visit, these actions do cause impacts. Hopefully, site management can promote stewardship while retaining creativity and play. An observed incident where a group of children were seen playing a game near the North Ridge Trailhead provides a glimmer of hope for the future. The game being played by the children involved their trying to stay only on the "big rocks". As I watched and listened the children, I became convinced that they were not just trying to follow the low-impact guidelines listed on signs. It was certainly a game that they were playing. This game incorporated the best of both worlds; the children were creatively interacting with the resource while simultaneously using low-impact techniques.

## **STATIONARY USES**

The most common activity on the summit was walking around the site and enjoying the scenery. However, stationary activities were common as well. In particular, eating was a popular stationary activity. Groups would usually sit on smooth, barren rock faces and casually enjoying a picnic lunch. While many visitors enjoyed a simple bag lunch or snack stowed within their pack, a lot of other visitors carried fairly large coolers.

Picnicking was very popular at the summit on any good weather day. I would see at least one group with a cooler each day. Picnicking occurred across a range of times. Of course, noontime was the dominant picnic time, but

suppertime and breakfast time (morning after sunrise) were popular as picnic hours too. Again, picnic "items" ranged from an apple to a small portable grill.

Picnicking locations also varied. Some visitors seemed to want to eat in privacy, while others chose to picnic within a few feet of the Summit Trail. This choice didn't seem to correspond to whether or not a group brought a cooler.

In general, picnickers were spread across the summit area. A few specific locations did stand out as popular areas though. It was common to see visitors picnicking within the "vegetative island". It was also common to see visitors picnicking below the "Stairs to nowhere" next to a large boulder. The boulder site was perhaps the single most popular area to picnic. Hikers coming up for the North Ridge Trail also frequently traverse this spot. Many hikers would bypass the last portion of the North Ridge Trail, the portion leading to the parking lot trailhead, and head off-trail, through this de-facto picnic spot and move either up the "stairs to nowhere" or straight ahead to the Summit Trail.

Other stationary activities, besides picnicking (or just resting to eat) included sitting in lightweight chairs and reading, painting, lying on the rocks and sunbathing, kite flying, writing, hawk-watching, and waiting for the sunrise. I observed five weddings over the summer (one included a large wedding party with a brass band, catering, flowers, metal chairs, and a fleet of antique cars). Some activities, such as writing, painting, kite flying, reading, were rare. Others, such as sunbathing, waiting for the sunrise, and hawk watching were common. Sunbathing usually involved visitors rolling up their shirtsleeves (or even taking off their shirts) as they laid on the smooth, warm rock faces. A few people brought towels and laid out in the sun. Hawk watching was an organized, seasonal activity. "Hawk-watching" is a ranger led activity, occurring during the fall raptor migration season at a location a few hundred yards down the South Ridge Trail, and is promoted through the Park's visitor information media.



## VISITOR BEHAVIORS AND VEGETATION/SOIL TRAMPLING

One of the primary tasks for this research project was to shed light on soil and vegetation trampling occurring on the summit of Cadillac. The goal was to gain insight about how, when, where, and why visitors trample on sensitive areas (i.e., non-paved, non-trail, non-rock surfaces). After initial pre-study site visits, it became clear that this task could be challenging. The major challenge in observing trampling behavior was not witnessing an incident but, rather, not being overwhelmed by the sheer magnitude of incidents. On an average summer day from late morning to late afternoon, trampling occurred constantly. On June 29th, for example, 26 visitors within half-an-hour walked on bare soil in one specific spot. This small, albeit popular, social trail, originating below the Stephen Mather plaque and ending in the center of the parking lot sidewalk, is only one of numerous visitor-generated social trails. In fact, the overall site is so worn that in many places (e.g., within the Summit Trail's loop) the social trails are less like narrow linear routes and more like sprawling, irregularly shaped barrens. This wear is not without cause; the trampling level is very high.

With trampling being such a common sight, I needed to focus on the most meaningful individually observed incidents while recognizing the overall impression of cumulative trampling events. Essentially, these two styles of observing events served to identify the dominant behavior patterns while illuminating why both dominant and less common behaviors may have occurred. The question of why visitors chose their individual trail behaviors was difficult to definitively answer. However, identifying the dominant off-trail behavior pattern was not. By definition, a person trampled off-trail if he or she stepped on either plant material or soil. Walking on exposed bedrock or boulders did not constitute trampling. Furthermore, stepping on soil that was along a park-sanctioned trail (e.g., Gorge Path, North and South Ridge Trails) did not constitute trampling. The vast majority of visitors who ventured off-trail

trampled. Very rarely would an off-trail visitor purposely and deliberately rock hop, that is, carefully avoid soil and plants by only walking on rock surfaces. While trampling soil was the most common type of trampling, I still routinely observed visitors trampling low vegetation.

Having established that trampling was the dominant off-trail behavior, What might be the possible reasons why visitors went off-trail, why they trampled, and why some did not trample? There are likely numerous likely for visitors venturing off-trail. One of the primary reasons why visitors go off-trail may be related to space. In fact, the reason why this study is looking at off-trail behavior instead of simply why people go off-trail is that park staff have decided that given, current visitation rates, the site (more specifically the paved loop path) cannot accommodate the crowds. This conclusion is supported by numerous observations in which visitors moved off-trail to give another visitor space. Frequently visitors were seen stepping off the side of the paved loop either to let another pass by or to pass someone themselves. The interpretive programs on the summit, for example, sometimes led to off-trail travel by forcing visitors around the interpretive program group. On July 17th, and at other times as well, I observed visitors trampling off-trail as a result of an interpretive program blocking a portion of the paved Summit Trail. In this case the visitors went off-trail, bypassed the program group, and returned to the trail. From speaking with rangers, I know that they consciously try to avoid blockages, but this is difficult to do.

Space is likely one influence on the decision to leave the trail. Space is almost certainly not the only factor though. Even during low-visitation periods such as periods of poor weather and early and late in the day, it was not uncommon to see visitors off-trail. Even though there may have been a relatively large amount of space available on the Summit Trail during low-use

periods, visitors quite commonly headed off-trail. The inference here is that other influences may have pulled them off-trail.

One logical idea is that something attracts people's attention and draws them off-trail. It seems that one of the biggest attractions drawing people off-trail was the great view from the top of Cadillac. The immediate summit area of Cadillac is extremely open. The vegetation is stunted and one can see far off in almost 360 degrees. As part of this view, visitors have straight-line views of interesting rock formations, interpretive wayside signs, and ledges where the mountain appears to drop off into the steep gorge. All of these attractions are clearly visible. What is sometimes less visible is the Summit Trail encircling the summit. Observations indicate that many visitors may have ventured off-trail to more closely examine interesting features found on the summit. Since these features were in clear view and since there were only a few clusters of dense vegetation to possibly deter a direct route to the feature, visitors often trampled over low vegetation and soil because they simply followed the direct line of site route to attractions.

The possibility that many visitors travel off-trail to reach attractive site features via the most direct route, which is often across sensitive areas, has obvious interpretive implications. Some examples of these attractive features are rock formations, perceived ledges, signs, viewpoints and other attractions. For the photographer, the slogan "Take Only Photographs, Leave Only Footprints" rings a little hollow when considered at the summit of Cadillac. At Cadillac's summit, thousands take photos and thousands leave footprints. I routinely observed groups in which one member would photograph the group with an attractive backdrop behind them or an interesting feature beside them. In order to get the ideal picture, visitors often trampled off-trail so that their photo would have desired attributes (focus, background, etc.). Additionally, visitors seemed to frequently go off-trail to take photographs because it was too difficult to take

photos on the Summit Trail without either having other visitors continually wait for them to take a picture or having strangers end up in their photo.

Another example of an attraction leading to off-trail trampling is blueberry picking. When the berries ripen, many visitors casually pick amidst the vegetation patches containing blueberry bushes. While berry picking may seem innocuous, it could actually lead to increased impact to the more robust patches of vegetation on Cadillac summit. Several relatively large patches of vegetation within the loop formed by the Summit Trail contain fruiting blueberry plants. If visitors' picking in these areas creates the slightest hint of a route through that patch, then other visitors may identify that path and use it as a direct route shortcut (as opposed to skirting the vegetation patch).

The rock formations on top of Cadillac are another attraction to visitors. I routinely observed visitors venturing off-trail to sit on rocks or exposed bedrock. Visitors seeking a windbreak or privacy utilized protected lees behind boulders or depressions. The large erratic boulder in the northern portion of the summit loop was enormously popular with visitors. Again, most of these attractions are in plain site and attracted visitors who often visited them via a straight line across sensitive areas.

Mentioning the erratic boulder segues a specific incident illustrating the straight-line attraction phenomenon. On July 7th, a ranger program moved to the erratic boulder. At this point 10 to 12 new participants were drawn to the program. All 10 to 12 individuals moved from the summit observation circle to the erratic by trampling straight across sensitive vegetation and soil. Again, visitors were attracted to something that they could clearly see and they moved to it via straight route instead of using the looping Summit Trail.

Throughout the foregoing discussion the emphasis was on adults and the features that seemed to lure them off-trail. While children undoubtedly were attracted by some of the same features, they also exhibited behaviors that

warrant being discussed separately. Children exhibited more outwardly adventurous behaviors than did adults. Children frequently used the words "adventure" and "explore" as they flitted around the summit. Children were quite commonly seen interacting with the site (rocks, etc.) in extremely creative ways. The elements of creativity and adventure may have served as an additional attractive force compelling children to leave the trail. The open summit environment may have been rather new to many families and their children may have been inspired to explore the area. As one woman was overheard saying, "With all these rocks, this is a kid's paradise." Kids truly seemed to enjoy the site. In fact, when the weather was poor (e.g., cool and rainy or foggy, with low visibility) children still would venture off-trail. Their parents, however, seemed much less likely to rove off-trail when the weather was poor.

If some visitors are drawn off-trail by attractive features, then examples of individuals openly expressing their desire to be off-trail might be expected. While overheard comments pertaining to venturing off-trail were not extremely common, some insight was gained through hearing select comments about being off-trail. One particularly vocal segment of visitors was children who wished to be off-trail, but whose parents didn't let them off the trail. The children often expressed frustration when they would see others doing what they wanted to be doing. A common argument used by restrained children was (paraphrased) "but they're doing it." In one specific incident a little girl approximately nine years old commented that instead of staying on the trail (as her mother was making her do), she wanted to be climbing. Occasionally I was fortunate enough to hear a member of a group urging another group member to get back on the trail. In several of these instances the person being asked to come back on the trail responded by either stating that they didn't want to find

and/or get back on the trail, or that they were having more fun off-trail. In one particular case, the individual who responded "it's more fun over here, off-trail" was not a child but a husband responding to his wife. Children may have enjoyed rambling off-trail, but they weren't the only group who did.

For many of those who leave the trail, there seems to be an attraction, either physically on sight, (such as a rock crevice) or an opportunity to experience something (such as a view or the opportunity to explore) leading them off-trail. Others, however, may venture off the trail out of confusion or misunderstanding.

One of the strongest themes emerging during this study was that a significant number of visitors did not know where certain summit features were located, such as trailheads or bathrooms. I quite frequently observed incidents where a group was looking for and/or discussing a feature that they could not find. Trailhead locations, particularly the Gorge Path Trail (located off the Summit Trail) seemed to confuse visitors the most. The location of the restrooms within the gift shop was not as confusing to most visitors, though I overheard a few individuals who were struggling to find them.

Along with the trailhead for the Gorge Path being hard for some to locate, the actual Gorge Path Trail itself was frequently a source of confusion. Even for those who found and chose to use the Gorge Path trailhead, staying on the trail sometimes proved difficult. Here again, the importance of cairns comes into play. For example, several incidents were observed where an individual or group appeared to be looking for cairns so that they could find the trail and stay on it. These parties had various degrees of success with their efforts to stay on the trail, highlighting how cairn disturbance can lead to resource degradation by visitors who wanted to stay on the trail.

One example of how confusion in trail locations can influence off-trail activity came from July 17th. A young boy explaining to his mother that his

father and he had walked on “stuff like this” (he pointed to rocks, soil and vegetation) “for half an hour and then we realized that there was an easy trail all the way down.” The boy was talking about the Gorge Path. Now, if this group had identified the Gorge Path, all of their impacts would have been concentrated on the trail.

Knowing the location of a trail may not necessarily lead individuals to use that trail. An incident on the summit emphasized this point when a slightly confused looking couple in their 20s asked me if I knew how to get to Dorr Mountain. I’m not sure why they chose to ask me, but I obligingly pointed to Dorr Mountain and then explained where the trailhead for the Gorge Path was located. This conversation was taking place on the Summit Trail, just below (south of) the magma interpretation panel. The couple could see a straight route off-trail leading to the ledge where the Gorge Path drops out of sight and heads towards Dorr. They could also see that the trailhead was in the opposite direction from Dorr and about 60 yards up the trail. They then asked me, “but can’t you go right down there?” “Down there” was a straight-line off-trail. Being a little sensitive about my researcher role, I replied, “I guess you could do that”. I think this incident expresses quite well the idea that helping visitors better understand the locations of site features is only one small piece in the resource protection puzzle.

So far, I have discussed how visitors sometimes struggle to find features outside of or adjacent to the paved Summit Trail. However, it should be noted that visitors often misunderstood the configuration of the summit trail itself. This paved trail loops around the summit of Cadillac’s gently rounded peak. It has two entrances from the parking lot. These entryways are short spurs connecting the loop shaped trail with the parking lot. This looping quality is the most misunderstood aspect of the summit trail. It was fairly common to hear groups debating amongst themselves whether the trail was a loop or if it led off

somewhere else. In one particular incident, I observed a group as they rambled off-trail and then I heard one of the group members proclaim, "There's a loop, let's do the loop." In some cases, "doing the loop" kept people on trail. In these cases I overheard discussions and discovered that the group decided to stay on the paved summit trail simply to do the loop.

Communicating that the loop allows you to see all the views and visit all the interpretive signs may be an important way to encourage visitors to stay on the summit trail. Such a message could possibly convince some visitors that they don't need to rush in straight lines across the summit. They'll actually experience more by doing the loop.

In looking at why visitors go off-trail, it's important to note that not every visitor may have conceptualized trails as park employees do. Cadillac's summit has numerous areas where visitors have worn away vegetation. Of course, the summit has areas naturally lacking vegetation, too. There are areas, sometimes in the form of linear social paths and sometimes in irregularly shaped patches, that seem to confuse visitors. On several occasions I heard visitors who claimed to have found a path. Those paths were actually areas where foot traffic had cleared a route, (i.e., social paths). Many visitors used these off-trail routes through sensitive areas to get from point A to point B on the summit. However, barely any visitors recognized that these bare soil areas were the products of visitors trampling and killing vegetation. Some visitors did notice the bare areas, but they tended to identify them with fire and water erosion (which, in the case of water erosion, could be partly true in some cases). It is difficult to assess whether visitors who used social trails viewed them as convenient informal routes or as purposefully designed trails.

### **Visitor Reactions to Physical Barriers and Signs**

The field season was roughly split into an observation period occurring before, and a period occurring after, park staff erected physical exclosures and



signs with low-impact messages. This split season enabled me to observe visitors' off-trail behavior and trampling action before the park undertook on-site actions to influence visitor behavior. While these two periods did not entail a pre/post-treatment scheme, they did allow me to better observe how visitors reacted to park management actions of exclosures and signage. Once again, the combination of observing relevant behaviors and overhearing meaningful comments provided insights into how visitors responded to park actions.

The physical barriers erected to restrict visitors from sensitive areas suffering vegetation loss were made out of round cedar logs roughly four to six inches thick. These barriers were fashioned in such a way that they resembled saw horses. Each barrier was approximately six feet long. Barriers were used individually to block passage, or were used in groups to encircle a protected area, acting as exclosures (see figure 8). Signs were placed on most barriers to explain the purpose of the barriers and how visitors could reduce their impacts. The initial signs were not specifically designed for Cadillac. These generic re-vegetation signs were used alone from July 29th to September 4th. On September 4th, new signs, specifically crafted for Cadillac summit, were placed on barriers or on tripods specifically built to support them. The wording of the signs differed markedly. To illustrate the differences, table 1 compares the various signs and their specific messages.

Observation of visitors' spatial interactions with the physical barriers pointed to several fairly clear patterns. The first pattern to emerge related to the effectiveness of lone barriers. In an attempt to reduce foot traffic on sensitive areas, lone barriers were placed at key locations around Cadillac summit. Individual barriers were placed in locations adjacent to the Summit Trail where popular social trails originated. Essentially barriers were placed at "hopping off points" where visitors frequently left the paved summit trail and headed off-trail on paths established through repeated trampling by previous visitors.

**Figure 8**  
**Barriers and exclosures**



Note that this is an exclosure. If an individual "saw horse" was used alone, then that would be considered a barrier.

Table 1

Wording of signs at the Summit of Cadillac Mountain, Acadia National Park.

<u>Sign</u>	<u>Wording</u>
<i>Initial brown revegetation signs</i>	PLEASE DO NOT WALK HERE. Plants here were trampled by people. The National Park Service is rehabilitating this area. Please help protect these sensitive plants. Stay on the trail and walk on rocks whenever possible.
<i>Signs erected in September</i>	PRESERVE FRAGILE MOUNTAIN PLANTS AND SOILS. *Step only on paved trail or rocks.* Avoid plants and areas of bare soil.  - "GOING....GOING...GONE??? Millions of visitors have walked on Cadillac Mountain in the past 200 years. Those well intentioned but uninformed footsteps have destroyed plants, eroded soils, and altered the natural landscape. Look around You. How can Cadillac survive the millions to come? LEAVE NO TRACE Here's how: * Step only on paved trail or rocks. * Avoid plants and areas of Bare soil.

Observations clearly indicated that the individual barriers were largely ineffective. Lone barriers were simply skirted to one side or the other. This actually led to increased vegetation impacts when visitors chose to go around a barrier and were forced to step on vegetation adjacent to the social trail. It was amazing how frequently visitors skirted these barriers. A teenage boy was even seen running and hurdling a barrier. While some visitors skirted barriers, others would move 10 to 30 yards up or down the summit trail and access the same social trail via a connecting social trail. This illustrates an important point. Cadillac's summit is so heavily impacted that social trail networks resemble a spider's web or maze. Due to the interconnected nature of multiple social trails, it is difficult to block individual social trails. When visitors moved up or down the summit trail and accessed sensitive areas behind barriers, they effectively used the back door to get around lone barriers. These observed visitor actions do not imply that people are purposefully "scheming" to get around barriers.

The ineffectiveness of barriers was quickly and repeatedly observed. Therefore, approximately half of the originally lone barriers were later used to create an additional exclosure. Whereas individual barriers were largely ineffective in restricting foot traffic on selected areas, exclosures were seen as being quite effective. Exclosures were designed to keep visitors out of specific areas where trampling had produced severe soil and vegetation impacts. Choosing areas to exclude appeared to be a rather haphazard process, for the entire summit is a patchwork of impacted areas. Ultimately, three exclosures were established within the area surrounded by the Summit Trail loop. All three exclosures were roughly oval shaped and approximately the same size. The effectiveness of exclosures was very specific to their area. For the most part visitors did not pass into or through exclosures, thus the exclosures protected the area within their boundaries. Still, visitors did not avoid the areas where exclosures were placed. Instead, foot traffic patterns were such that they flowed

around the exclosures as if they were river water and the exclosures were boulders. I commonly observed visitors who appeared to be drawn to the exclosures simply to see what they were and what the signs on them said.

The three exclosures varied in their design and effectiveness. One exclosure was formed by placing barriers directly next to one another to create an oval corral that protected an area near the large erratic boulder. This was observed to be the most effective exclosure. Another exclosure located just east of the summit circle was also formed with closely spaced barriers, though not all of them were touching. This exclosure was seen as effective, though a few people were observed within its boundaries during August, September and October, while the previously mentioned exclosure near the erratic had only two individuals enter its perimeter during the observation periods.

The third exclosure was established in the general vicinity of the two parking lot entrances to the summit trail. This exclosure was just above the parking lot and just below the Stephen Mather plaque. While the other two exclosures were formed by placing barriers closely together to establish an obvious perimeter, this third exclosure used fewer barriers to create a more "suggestive perimeter." No individual barriers were touching. In fact, distances as great as 30 feet separated them, resulting in a much "looser" design than the other two exclosures. This "tightness" or "looseness" of design seems to be the key factor in the effectiveness of an exclosure. The third exclosure, which was by far the loosest one, was by the least effective exclosure, and was as ineffective as the lone barriers.

A picture of visitor spatial interactions with physical barrier emerges. Specifically, visitors respect that which is very clear. Tightly designed exclosures leave little ambiguity about what is being restricted. Loosely designed exclosures and lone barriers do not seem to have as much persuasive force. Perhaps the psychological deterrent of trespassing into a corral-like structure is

much more powerful than the deterrent posed by a suggested enclosure or a lone barrier. Maybe visitors do not perceive a lone barrier as being there to block off an entire social trail.

The park staff also placed a different type of enclosure in the Gorge Path area. This enclosure, made with nylon cording and stakes driven into the soil, was located where visitors were starting to wear away low vegetation and more substantial shrub vegetation. This enclosure appeared to be effective, though the differences in location and surrounding vegetation make comparison difficult. One trait it seemed to share was that it, too, concentrated impact around its perimeter

Now, let's examine visitors' verbal reactions (i.e., comments overheard from visitors talking about messages and barriers). Negative comments were almost non-existent. For example, one of the only statements that could imply an unfavorable reaction was when a mother told her child, "That's not a really good place to take a picture. The sun is behind you and the fences are in the picture." "The fences" (the enclosure) must have diminished the perceived beauty of the spot, or else the woman wouldn't have mentioned them. I observed others who photographed scenes in which the enclosures were in their photos. None of them were heard complaining. There truly was little, if any, grumbling about the physical barriers.

If visitors accepted the physical barriers without complaint, then the next question is: did visitor comments suggest that they correctly understood why the park had established the barriers and how they as visitors could act to improve the situation? Unfortunately, I did not hear many comments about lone barriers. However, I did hear a fair amount about enclosures. Based on visitor comments, most visitors seemed to understand that the enclosures were erected to protect vegetation. Although a few visitors seemed to recognize that not only were enclosures devised to protect living vegetation, they were also

intended to promote re-vegetation of the barren soil within the exclosures. One visitor was overheard commenting, "By the time that patch is restored, everything else will be trampled." This person's astute comment shows a fair degree of comprehension in that he recognized the restorative purpose of the exclosure. His remark about "everything else" hints at a very prevalent notion expressed by visitors. Visitors frequently made comments implying that the park was only attempting to protect the areas within the physical structures. Visitors did not seem to make the connection that the park erected exclosures to protect specific areas and that these protected areas were not the only impacted areas. To put it another way, visitors did not seem, by and large, to recognize that although specific areas were being restricted, the entire summit was fragile and being impacted.

This is neither an inference that visitors were obtuse or that park managers were inept communicators. These comments do suggest that erecting exclosures may lead to an unintended message that you can't go into the exclosure because park staff is trying to protect that area, but you can walk elsewhere without concern.

Numerous observations were made where visitors skirted exclosures and trampled soil and vegetation. This appears to support the idea that many visitors recognized the protective nature of the exclosures but did not heed concern for areas outside of the exclosures. Of course, they may have avoided entering the exclosures because of physical or social deterrents (i.e., concerns for protecting resources may not have been a big factor). This study cannot estimate frequencies of the various reasons why visitors did or did not understand that the entire summit was, in fact, of serious concern. What it can do is state that visitors frequently flowed around exclosures and still caused impact. Furthermore, this study found that visitor comments support the premise that visitors often perceived the exclosures in such a way that exclosures

suggested specific and limited protection efforts. For instance, parents were frequently overheard telling children that exclosures were there to protect the plants within them. One visitor was overheard stating, "They're trying to protect a few small areas." In another incident a woman next to an exclosure stated, "Grass here was trampled." After reading this, she and her male companion trampled over grasses identical to the grasses within the exclosure. Perhaps she and her companion didn't care about the message. Perhaps, more likely, she perceived that the areas inside the exclosures merited protection but areas outside the exclosures were different. Areas outside were not inside, and as such were not of concern.

As a society, we are accustomed to following authority with little thought. We stop our cars at red lights. We park between the lines in parking lots. Could visitors be quickly interpreting the scene by assessing that within exclosures equals protection and outside exclosures equals no need for restraint?

The previous question, whether or not people associated exclosures with protection and also associated areas outside the exclosures as warranting little concern, hinges upon visitors paying minimal attention to the signs and the exclosures. Signs used from July 31 to September 7, which were not specifically designed for Cadillac, expresses that all trail areas, regardless of whether or not an exclosure is present, benefit if visitors tread lightly. Specifically, this sign urges that if you travel off-trail, you should walk only on rocks. It is noteworthy that this sign places the walk on rocks message last. So, if visitors actually read all of this sign, the idea is that they would use appropriate off-trail techniques, walking only on rocks and not on soil and vegetation.

Did visitors begin to walk only on rocks when they ventured off-trail? The short answer is no. It was rare, especially when only the initial brown signs were up, to see a visitor clearly attempting to only walk on rocks. Of course, prior to the placement of the brown signs, it was even more rare to see a rock-



hopping visitor. With potentially thousands of visitors visiting Cadillac summit every day, I rarely saw even one who was truly only stepping on rocks. Granted, many visitors never went off the trail. They, thereby, behaved in a low-impact manner. I'll also grant that visitors who diligently, yet casually avoided soil and plants probably escaped my detection. However, having traipsed all over that summit, I know that to effectively avoid plants and soil you need to use circuitous routes and you are required to do a fair amount of hopping and reaching. I simply did not see a lot of visitors off-trail who were performing the actions required for being off-trail without causing impact.

The numbers of visitors trampling within the plots defined through plot sampling methods did not show any strong trend in response to the placement of barriers/exclosures and signs. Plot # 1 (of 3) had an exclosure effectively "cut it in half" – the exclosure reduced the area available to foot traffic within the plot by half. This same plot had its average number of tramples (visitors seen trampling within the plot) go from an average of 53 to 50/half-hour. Although this plot had its average reduced slightly, its "post-exclosure" average occurred on half the area. The other two plots saw increases of roughly 14 and 13 people per half-hour.

Off-trail actions did seem to improve slightly after the signs designed specifically for Cadillac were placed on the summit (September 4th). In this period, I observed smaller crowds, yet I saw more incidents of positive off-trail actions. Though the new signs were likely more effective, I had fewer observation periods with them in place and the composition of the crowds was different from the summer. This change in visitor composition limits the ability to compare observations made before and after the new signs were established.

Initial signs did not seem to influence a big change in off-trail behavior. The signs specifically designed for the site appeared to be more effective, though the comparison is confounded by seasonal demographic changes. Neither set of

signs, however, produced a drastic change in off-trail behavior. The obvious question is why? Throughout the field season, especially following the placement of signs and exclosures, I would hear visitors talking about trampling or low-impact techniques as they themselves trampled on sensitive areas. These types of observations were made quite regularly, though certainly not everyday. Usually, groups that mentioned low-impact messages did not trample vegetation, though that did occur. Most groups that mentioned low-impact techniques and trampled only trampled soil. For example, a group commented about "sensitive vegetation being mentioned in the park newspaper". This group was, as they spoke, trampling in a sensitive soil area. Similarly, a group with the Park paper in hand, and with low-impact promoting patches on their children's shirts, trampled on not only soil, but also vegetation. Although these two examples identify the paper as the communicative medium, messages from signs were frequently quoted as well. In either case, the same pattern typified these incidents: actions did not match what people were talking about. Perhaps visitors talked about the messages but didn't care. This happened in one incident where two men and two women walked across a patch of vegetation and sarcastically commented about "Leave No Trace". On the other hand, visitors may have misunderstood the messages. I believe this was the case in the majority of incidents where visitors voiced concern for their low-impact behavior but still trampled soil (those voicing concern were not observed stepping on plants). One specific incident illustrates this argument that the impact of trampling soil was unrecognized. On August 10th, a man rather arrogantly preached to his companions about walking on rocks. However, as he preached, he was himself trampling all over the gravely, grape-nut-like soil. The inference here is that this devout visitor, despite his best efforts, trampled on soil and thereby inhibited new plant growth. His misconception of what constituted "a rock" led to his failure to truly behave in a low-impact manner.

Another incident may suggest that the question of "What is rock? What is soil?" is tough for visitors to answer. In this incident, a fairly large group gathered at the Summit Trail trailhead (in the parking lot) in anticipation of an interpretive walk. Before starting the walk, the interpretive ranger leading the walk slowly and clearly showed the visitors the soil. She deliberately pointed out what was sensitive soil and what was resistant bedrock. All of the program attendees followed her movements and appeared to be listening. Within five minutes, they moved (with the program) off-trail to the erratic boulder (see figure 9); the majority of those who received the first person lesson trampled on soil. Now, one of a few things could have occurred. Visitors may not have understood the message. If this is the case, I do not know how the message could be made clearer. Maybe, visitors forgot the message as they were drawn to the erratic boulder (or as they were consumed by the program). Or, perhaps they simply did not care enough about the message to follow it. After all, accessing the boulder without trampling soil requires a little hopping and some long-reaching strides.

One final incident demonstrates the fact that visitors likely have variable thresholds beyond which they will not follow voluntary guidelines. Specifically, the threshold is the point at which their desire to follow low-impact guidelines is super ceded by desire or need. This incident illustrating the idea of thresholds is one in which a large group of teenagers were off-trail for at least 20 minutes. During this time, they spoke about "walking on rocks" and some of them were visibly hopping across soil and vegetation areas. However, they eventually came to an impasse, they reached a large spot devoid of rocks. At this point, without saying a word, they all trampled soil as they passed from point A to point B. The inference I have drawn from this incident is that the teenagers were willing to follow the "walk on rocks" guideline so long as it didn't infringe upon where they wanted to be.

**Figure 9**

**Ranger led interpretation program at the erratic boulder**



## **Positive Comments and Incidents- Some Success Stories**

There were some examples where visitors expressed positive comments and exhibited good low-impact behavior. In essence, these were the success stories. Unfortunately, there are few "success stories" to tell. Most positive incidents involved a group member encouraging another group member to practice appropriate off-trail, low-impact techniques. For example, in one incident a young boy got his mother to actively rock-hop across a sensitive soil area. In another instance, a woman told her companion to walk on the rocks, not on the "dirt." Her mentioning dirt showed a relatively high level of understanding. Plus, she and her friend actually avoided the dirt.

Positive comments usually included phrases borrowed from Park messages. "Walk on rocks" was heard fairly frequently, but again, the rarity was seeing the action performed. None the less, the word seemed to be getting out, at least partially. In one instance, I heard a mother sternly tell her child, "You walk on the path or on the rocks." I even heard a group using the quote, "Grow by the inch, die by the foot" (a phrase used on a sign placed on Cadillac in September). In another exchange, a man and his mother deliberately discussed whether it was OK to go off-trail. After deliberation, the son persuaded his mother that it was all right to venture off-trail as long as you stayed on rocks. It should be noted that all of the groups cited here as making positive, correct low-impact statements also exhibited low-impact off-trail behavior. That is what separates these incidents from those exhibiting a disconnect between their comments and their actions.

## **OTHER CONTEXTUAL ASPECTS OF THE SITE**

### **Sunrise**

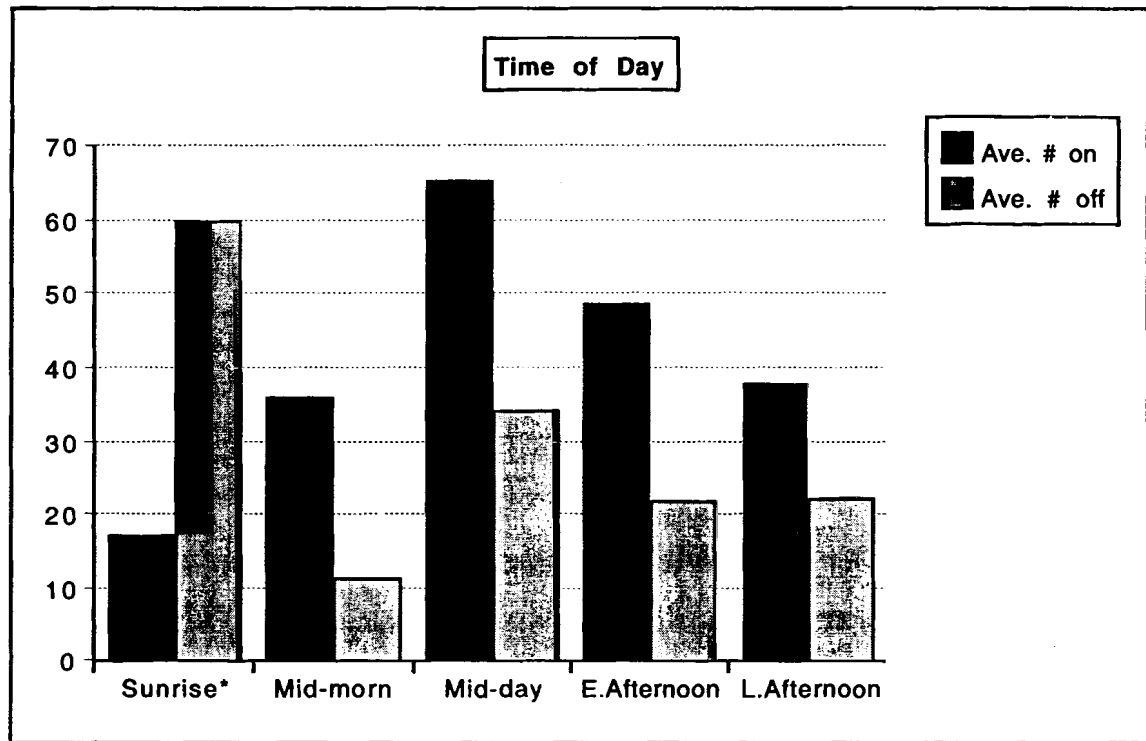
Watching the sunrise atop Cadillac is a powerful experience. Despite the early hour, significant crowds show up to see the sun emerge from behind Maine's eastern coastline. By being on Cadillac's summit, visitors may,

depending upon seasonal astronomical factors, be the first people in the United States to receive the day's first rays of sun. After observing the sunrise crowd, an interesting pattern was recognized. As opposed to other times of day, most visitors at sunrise were seated. Visitors largely sat within the area encircled by the Summit Trail. Some others sat in the Gorge Path Area. Data from video scans also shows the unique character of the sunrise crowd. Figure 10 depicts the relationship between time of day, the number of people off-trail, and the number of people on-trail. At the height of the sunrise, the number of people off-trail drastically exceeds the number on-trail. The actual time of sunrise is the only time of day when more visitors were recorded off-trail than on-trail. A large percentage of visitors (approximately 80%) were sitting off-trail. A sizable group also waited in, on, or next to their cars. The group with their cars all parked in the section of the parking lot overlooking Bar Harbor. The behavior of the sunrise crowd is significant in that the early hour may exacerbate impacts. One ranger indicated that she observed visitors who trampled all over vegetation as they walked in the predawn darkness. This same ranger told a story about a loud, drunken group of visitors who acted obnoxiously. Considering the early hour and sensitivity of the sunrise "experience", social impacts, such as may be caused by a loud group of drunken men, may be very damaging at sunrise.

#### **Lack of Malicious Behaviors**

One of the most powerful findings taken from the field data is the near absence of openly malicious and intentionally destructive behaviors. Only two observations were placed into a "malicious acts" category. In one case, three rowdy men in their late-twenties or early-thirties, threw rocks, swore, and urinated in the bushes. Although urinating in bushes is not, by itself, malicious outdoor activity, it was quite obnoxious considering the busy nature of the site and the fact that the men were also swearing and throwing rocks. The other

**Figure 10**  
**Number of visitors off-trail versus the number of visitors on-trail based upon**  
**time of day**



Note: data was obtained through "scan sampling". This data is not based on random sampling. The sunrise column is based on one day's observations. Other columns are averages of five to eleven scans. Mid-morn is defined as 8:30am -10:59am. Mid-day is 11:00am- 1:59pm. Early afternoon is 2:00pm- 4:59pm. Late afternoon is 5:00pm-8:00pm.

malicious act involved two teenage boys firing rocks at raven with the aid of a slingshot. The boys, who were doing this at approximately seven o'clock in the morning, were rather obtrusively asked to stop by the only other person on site, me (this was the only time during the study that I felt it necessary to stop just being an observer).

### **Visitor Comments on Regulations**

Regulations, whether expressed formally or promoted as voluntary actions, seemed to be received in a variety of ways. Several sets of reactions merit discussion. First, a pattern emerged where parents seemed to use the Park Service as a source of authority to control their children's actions. An example of this is shown by an incident where a mother urged her child not too pick flowers. First, she used a stewardship argument, "If you pick a flower, others won't be able to see it". As the child picked another flower, the mother switched to the phrase "You're not allowed to pick flowers". This incident illustrates the Park's authority role (a role parents use to control their children).

Even after frequently observing parents using the Park as the "bad cop" (i.e. the parents weren't being mean, but rather, the Park didn't want people doing what the kids wanted to do), I still could not infer whether parents sought to control their children out of concern for the resource, or for more personal reasons. Some visitors appeared to exhibit anxiety that their children might get hurt if they ran around off-trail. Parents frequently tell their children to stay on the trail because the park says so. Staying on the trail is not a formal regulation. It is encouraged, but signs also urge visitors who go off-trail to use low-impact techniques. So, these parents are, in effect, misquoting the park. Are they doing this because they misunderstood the rules or because they find it convenient to keep their kids on the trail by stating that the Park doesn't allow you off-trail? It is difficult to definitely answer that question, though it is probably a combination of both.



Throughout the data gathering process, I would occasionally hear a comment that reflected a visitor's attitude towards regulations. In general, the frequencies of positive and negative comments were in balance. For instance, a woman's comment that, "It's pretty cool that you can walk all around here" is balanced by another visitor's comment stating that "I'm surprised that they let people off the trail". In another incident, an older man in a group thought he spotted Mt. Katahdin on the horizon. This eventually led to his making a statement that praised Cadillac because "you can drive right up to it" (as opposed to Katahdin, whose summit lies miles from any type of road). Somewhat surprisingly, few visitors were overheard commenting on the number of visitors.

### **Handicapped Visitor Issues**

Throughout the field season, I would occasionally observe handicapped visitors and their interactions with the site. No strong pattern emerged concerning handicapped users and barriers. However, some group members who were not handicapped but had a handicapped individual in their party went to great lengths to include the handicapped member in the group activity. One man placed a wheelchair-bound child over his shoulders and carried him down the "stairs to nowhere" to where the group was having a picnic. However, other groups diverged, the handicapped (usually wheelchair-bound) individual(s) stayed in the parking area while other group members ventured to the summit. More commonly, another group member pushed an individual in a wheelchair around the summit trail. Pushing someone around the summit can be difficult at times. In one case, a woman pushing her father commented that she was "afraid I'm going to lose dad". She was at the time pushing him around the portion of the summit trail near the Magma interpretation sign.

It is difficult, based on this data, to make strong statements about handicapped issues at the site. Not being handicapped, I cannot interpret how

handicapped visitors relate to Cadillac's perceived limitations and restrictions. However, the northeast corner of the teardrop parking lot, which affords visitors views overlooking Bar Harbor seemed to be a magnet for handicapped visitors, and for older visitors as well. In the cases where a handicapped visitor "waited" for non-handicapped group members to visit the summit circle, they almost always waited in this section of the parking lot.

### **Physical Ability**

In my discussion of off-trail behavior, I did not discuss observed differences between apparent hikers (identified mainly by their carrying a pack and/or water) and those who accessed the summit with the aid of an auto (either personal vehicle or tour bus). In short, there was little difference. Based on my observations, hikers did not exhibit off-trail behaviors that were any different from non-hikers. I also did not discuss how physical ability may relate to off-trail behavior.

Physical limitations did not seem to deter some visitors from venturing off-trail. I observed visitors with prosthetic legs off-trail. I saw people on crutches who ventured well off-trail. The implication is that these off-trail visitors may not have the capacity (strength, dexterity, etc.) to be off-trail and still follow the low-impact technique of walking only on rocks. This was specifically observed. I routinely observed individuals who seemed to struggle as they moved around the site in off-trail areas. I cannot say that these people intended to follow the walk on rocks guideline, but I can assert that they probably couldn't have effectively performed that behavior even if they wanted to. Thus, these people could not venture off-trail without trampling soil and/or plants.

### **Rock Throwing and Rock Theft**

Both rock throwing and rock theft were somewhat regularly observed on the summit. I recorded 29 incidents of rock throwing and 21 incidents of rock theft over the season's duration. In all but one instance (the drunken men

previously mentioned), children were the rock-throwers. A few older boys were seen throwing medium sized stones (baseball size), but most rock throwers were younger children throwing smaller rocks and pebbles. Some of the rock throwing behaviors were quite tame; small kids would toss pebbles and stones in puddles. Still, seemingly small actions add up, so these behaviors were recorded. Rock theft, as opposed to rock throwing, showed no age characteristics. Young and old alike stole rocks. Most rocks taken were small, pocket-sized cobbles. One woman was seen shoulder-carrying a melon-sized stone straight to the trunk of her car.

It was interesting to note that some visitors recognized taking home rocks as being a questionable activity. Often heard were phrases such as "no more rocks", or "just take a few", or "leave the rocks here". One incident involved a middle-aged female visitor chastising a mother and her two boys for taking rocks. The women, who spoke with a heavy Texas drawl, did not seem to influence the mother and her sons, who looked confused and said nothing in return. The mother and her sons apparently only spoke French. Children's asking their parents for permission to take rocks was common. In every case where permission was asked, it was granted.

#### **Visitors and Wildlife, Unleashed Pets, and Litter**

Visitors, particularly picnickers, routinely fed gulls. This happened so frequently, that it usually went unrecorded. Occasionally, I would see a child chase the gulls. As mentioned earlier, I did see one incident where teenage boys, armed with slingshots, were shooting rocks at ravens. Many owners did not leash their dogs. Leashing dogs is a park rule. In two separate incidents, during the same day (August 3rd), unleashed dogs scuffled with other dogs, growled, and barked. I recorded nine incidents of dogs being off-leash, but more than nine dogs were certainly off-leash during the season.

Litter is commonly seen atop Cadillac. Dense bushes in depressions around the immediate summit area conceal trash. Popsicle sticks are found here and there around the summit (the gift shop sells Popsicles). Cigarette butts are scattered. In short, the site is neither "trashed" nor "pristine".

During the season, very little intentional littering was observed. I saw older women toss a wrapper down and I witnessed a woman who put out her cigarette in the soil and then buried it with pebbles and stones. What I saw more frequently was unintentional littering. People opening their car doors during windy gusts, especially if they opened two opposite doors, would quickly spread lightweight trash from inside their vehicles. This air borne trash would fly across the summit parking area and end up in the bushes. This also happened during picnics, though less frequently. This may have been partially due to the fact that on the windiest days (which were also often cold, wet, and cloudy) people weren't out picnicking.

Once in a great while, I would hear a group talking about taking care of litter. For instance, a mother told her young daughter to pick up her coke can that was sitting on a bolder. "You can't leave that here. Pick it up. That's garbage" were the mother's words. Once I heard an ethical debate about whether or not a dog's feces should be picked up. Against the argument of the man in the group, the family group decided to pick up their dog's feces. Visitor comments also indicated recognition of litter. The main comments about litter centered on cigarette butts.

### **Parking Lot**

While parking lot observations were deemed important, they were not a major priority of the study. However, periodic observations did produce a few findings. One finding was that the location of the gift shop/restrooms led to visitors who parked on the opposite side trampling across the vegetation "island" in the center of the parking lot loop. Another pattern was that not all

portions of the parking lot were "equal". The portion overlooking Bar Harbor (the only portion with an expansive view) appeared to be used more than other sections in the mornings, in the evening, in the fall and by tour groups. In fact, tour groups frequently had their group pictures taken in the parking lot with the view of Bar Harbor behind them

Observations of the parking area also allowed me to look at vehicle patterns. I noticed that tour buses and tour vehicles often took up a lot of designated private car spaces by parking where they weren't supposed to. On heavy visitation days, I observed a lot of illegal parking. On one of these busy days, an RV crawled around the outer loop of the parking lot while other visitors gave directions to help the driver negotiate the road without clipping another vehicle. One visitor remarked, "If you can't drive those up here, you shouldn't be up here". I don't think those belong up here". This was the only comment that I heard all season relating to RV's (or traffic for that matter). Figure 11 shows overflow parking on a busy day.

### **Curiosities**

Every now and then, visitors were seen looking at license plates, eying a motorcycle or car, or otherwise checking out the vehicles atop the summit. In this sense, the traffic atop the summit may actually be of interest to some visitors. Additionally, groups such as motor bikers (Harley riders) and antique car enthusiasts were seen visiting the summit in large groups. Although Cadillac is famed for its natural beauty, its curiosities also draw visitors' attention. The giant super-ferry, the CAT, is a very popular feature among summit visitors who watch the CAT as it barrels into Frenchman's bay on return from Nova Scotia.

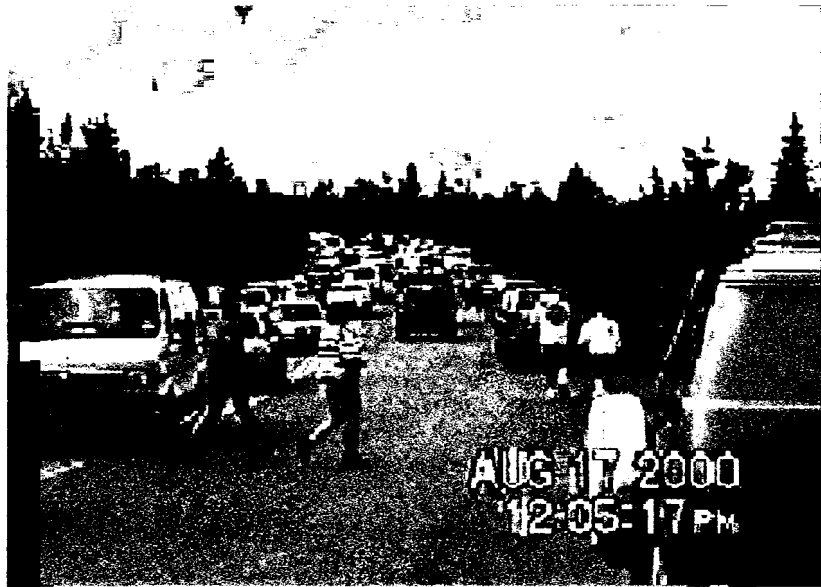
The gift shop is also somewhat of a curiosity. Hikers can hike to the top of a mountain and buy an ice cream bar. On the summit visitors can shop, picnic, talk to other visitors about the pet dog they have with them, and watch other

people do things like fly kites and get married. There is a lot going on besides people enjoying scenic vistas.

### **Audio Devices and Noise**

One last observation concerns electrical devices. Walkie-talkie type devices and cell-phones were used frequently, while portable radios were almost non-existent. Although the noise from vehicles at the summit was constant during peak hours, few visitors blared their car stereos. Car alarms occasionally went off, bleeping across the open summit. This auditory "litter" can be as distracting as visual litter to visitors. While visitor comments about noise were very sparse, I was struck by the difference in noise levels between high and low use periods. The different "atmospheres" of the summit probably were not recognized by most visitors because they only had the experience of their single visit. The exception could be with repeat visitors. However, I did not hear many insightful comments from repeat visitors.

**Figure 11**  
**Overflow parking**



This view is looking back down the summit auto road from where the road begins to split to form the loop attached to the parking lot. Only the van in the fore ground of the photo is parked in a parking space.

## CHAPTER 4

### Implications

The findings of this study provide valuable insight for persuasive communication efforts on Cadillac. First of all, a 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 were not malicious or flagrant but rather unskilled, uninformed, careless, or unavoidable. Table 2 shows the relationships between types of behavior and the potential to effect change through persuasion. This table, originally created by Hendee, et al., (1990) lists types of behavior ranging from illegal to unavoidable. Persuasion's potential degree of effectiveness is listed on the right. It should be noted that while I chose the examples from this research, the degree of effectiveness was established by Hendee and refers to the type of behavior.

According to table 2, uninformed actions, which are characterized by unfamiliarity, are highly susceptible to change through persuasion. The uninformed actions at Cadillac seem to include cairn building, adding stones to cairns, trampling on soil (primarily), and not understanding the site's layout (and thereby leaving the Summit Trail out of fear that it isn't a loop). Unskilled actions, where a user attempts an appropriate behavior but fails to successfully accomplish that behavior, are also quite receptive to persuasion. An example of an unskilled action at Cadillac is when a visitor believes they are avoiding sensitive vegetation and soils as they walk on gravelly soil that could be recolonized by plants (if it weren't trampled on so often). Unavoidable, illegal, and careless actions such as littering are less receptive to persuasion. Careless



**Table 2**  
**General typology of undesirable visitor behavior and the potential of persuasion for reducing each type.**

<u>Type of behavior</u> <u>degree of</u>	<u>Example from Cadillac</u>	<u>Persuasions potential</u> <u>effectiveness</u>
<i>Illegal</i>	Dogs off-leash, rock theft	+
<i>Careless</i>	Litter inadvertently ends up on site when the wind blows trash out of vehicles in the parking lot.	++
<i>Unskilled actions</i>	Some visitors do not recognize the difference between gravelly soil and true rock surfaces. They thereby misunderstand the "walk on rocks" message.	+++
<i>Uninformed</i>	Visitors do not often recognize that patches actions of barren soil are the result of foot traffic. By building cairns atop Cadillac <i>and not explaining their purpose on-site</i> , Park managers actually instigate some visitors to build cairns.	++++
<i>Unavoidable actions</i>	Some visitors are physically unable to follow the walk on rocks guideline.	+
	+	low
	++	moderate
	+++	high
	++++	very high

Adapted from Hendee et al., (1990)

actions, seen less often, included littering and, depending on your perspective, use of cell phones and walkie-talkies. Illegal actions were rare, unless having a dog off-leash is considered (it is prohibited by law). Unavoidable actions were common in that visitors routinely stepped off the busy Summit Trail to let others pass by. This simple courtesy led to impacts along the sides of the trail.

Many of the visitor behaviors that lead to resource damage at Cadillac fall into either the unskilled actions or uninformed actions categories. This implies that a large portion of the problems at Cadillac may be susceptible to reduction through persuasive communication. However, some damaging behaviors may be unavoidable given current visitation rates. These unavoidable actions, along with illegal actions, are not receptive to persuasive communication.

#### **EVALUATION OF CURRENT COMMUNICATION APPROACHES ON CADILLAC'S SUMMIT**

How do the current, October 2000, persuasive communication approaches at Cadillac's summit align with suggestions from the research literature? They actually align quite well. The signs used on site since September 2000 are focused, with only a few key points listed. They prescriptively promote walking on rocks, as opposed to proscriptively stating "Don't Walk Here" (the dominant message on the original brown signs). Interpretive programs led by uniformed rangers discuss low-impact concerns held by management. However, the rangers were generally on-site for only a few hours at the most each day. Their programs, while drawing decent numbers for an interpretive program, only reached a minute fraction of visitors to the site (and added to the impacts).

The apparent profile of visitors to Cadillac matches up well with the three visitor characteristics that Hammitt and Cole (1998) find to increase receptivity to messages. First, Cadillac visitors could be made to think of themselves as being part of the problem. Second, they may likely have low levels of prior knowledge and experience (this is a scenic area accessed by a well-maintained

auto road). Third, though large groups do visit the summit, the majority of visitors arrive in small groups. These three factors, recognizing one's self as part of the problem, having low prior knowledge, and being in small groups, are all positively associated with receptivity to messages.

It seems as though research basically supports the communication methods employed by ANP at Cadillac. Yet observations from this study indicate that trampling was not noticeably reduced by signs. Again, the "better", newer signs (not the brown revegetation signs) were not on site for as long as the older signs. Still, during the whole study, trampling was extremely common. One possible explanation for this apparent ineffectiveness is that most of the signs' messages, though well crafted, used the central route to persuasion in a location that may be more suited to other approaches, including the peripheral route to persuasion.

"If the learning environment is highly distractive, such as a very noisy visitor center, then the peripheral route is almost a necessity" (Roggenbuck, 1992). Cadillac's summit can be very active. As I observed the scene during peak hours, I saw buses and personal vehicles constantly coming and going, children running around calling to one another, couples posing as helpful strangers took their photo, etc. Signs were scattered amidst all this commotion. And roughly once a day, an interpreter would lead a program around the site.

The literature on persuasion could be interpreted to suggest that this site might be better suited to a peripheral route approach. Observations showed that a lot of visitors paid no or minimal attention to signs. Interestingly, this pattern didn't seem to be influenced by the number of visitors at the site. Whether five or five hundred people were on site didn't appear to influence how much attention visitors gave to reading signs. If crowding isn't an influence on whether or not people read the signs, then perhaps the allure of features on site distracts people's attention. After all, it's tempting to skip by a sign when an

open panorama is unfolding around you. Perhaps this accounts for some visitors reading signs on the way out. Thus, even when the crowding level is lower, visitors may not pay much attention to signs. Instead, other attractions, such as views, win their immediate attention. When the summit is its busiest, messages not only have to compete with natural attractions, but they also compete with curiosities such as unique vehicles, hundreds of other visitors, and perhaps even the occasional marriage ceremony.

Which is it then? Should the communication strategy used on Cadillac use the central or peripheral route? Should incentives and/or disincentives (applied behavioral analysis) be considered? What about direct management? Hammitt and Cole (1998) probably offer the best advice: managers should use as many approaches as possible and remember that persuading visitors to use low-impact techniques is a difficult task. Currently, managers at ANP are focusing their efforts on LNT and the central route to persuasion. This approach should not be abandoned, but perhaps it could be augmented with peripheral messages such as international symbol signage. Another example of using the peripheral route would be promoting staying on the Summit Trail by using a message urging visitors to "See How Beautiful a Third of a Mile Can Be". Messages such as this might keep visitors on the Summit Trail not because they ethically decide to reduce impacts by staying on the trail, but rather because they quickly gather that the trail offers a prestigious opportunity.

There are numerous specific recommendations that could be picked out of this research. These recommendations range from using only "tightly" configured exclosures to suggesting that a cairn sign be placed adjacent to the Bar Harbor overlook interpretive panel (instead of or in addition to the sign next to the first cairn on the Gorge Path). Instead of discussing these minor (albeit important) pieces of information, I wish to focus on a few larger issues. These are: opening visitors' eyes to resource impacts, promoting a holistic view of the

summit, and stepping back to consider the amount of use and its implications for various management strategies.

"Opening visitors' eyes" involves understanding visitor perception of impacts. One concept commonly expressed in the literature is that visitors often fail to notice visitor-generated impacts to natural resources (Cole and Benedict, 1983; Lucas 1979; Manning 1986). Knudson and Curry (1981) found that campers' campsite ratings for ground cover conditions rated very high, despite the fact that three-fourths of the campsite was heavily impacted or bare. This trend was seen in this study as well. Before signs were placed on site, no visitors were heard attributing the cause of widespread barren areas to visitor impacts. A few visitors did notice the barren patches, though they attributed the patches to natural causes. After signs were erected, some visitors seemed to understand that impacts were occurring, though many still did not seem to recognize that visitor-generated vegetation loss was widespread across the summit.

Several researchers (Stankey, 1973; Roggenbuck, 1992; Noe et al., 1997) have found that visitors are more likely to recognize and react negatively to litter (as opposed to more ecologically damaging recreation impacts). This too was seen in this study. Visitors much more frequently noticed cigarette butts than social trails and reduced ground cover.

Future education efforts at Cadillac may want to address the gap between managers' perceptions of impacts and visitors perceptions. In fact, this approach has already begun on a limited basis. By opening visitors' eyes to the high level of impact, perhaps some visitors would not only change their behavior but also spread concern by word of mouth. While the goal of "impact education" should not be to diminish experiences, visitors should at least hear the story of impacts to their national treasures.

Resource protection messages on Cadillac should emphasize the *whole* summit's fragility. By establishing exclosures, the park may have inadvertently

sent the message that protection efforts were limited to areas specifically protected by exclosures (note that this “accidental” message likely traveled through the “peripheral route”). To combat this concept, messages should be created and shared that express the vulnerability of the entire summit. The “September” signs were a good step in this direction. Telling the story of visitation rates to Cadillac may be a component of raising awareness about the whole summit’s plight.

Finally, it would be useful for managers to step back and examine visitation rates. Hammitt and Cole (1998) list locating use on resistant sites, permanent closures, temporary site closures, influencing spatial distribution of use, site hardening and shielding, and rehabilitation of sites as *site management* alternatives. *Visitor management* alternatives include: use limits, length of stay limits, dispersal of use, concentration of use, restrictions on type of use, group size limits, low impact education, seasonal limitations on use. Not all of these alternatives are applicable to Cadillac. Length of stay limits, for example, are not particularly relevant. A select few management alternatives were used on Cadillac. Small areas were closed when the exclosures were erected. The Summit Trail, paved decades ago, is a testament to previous efforts to harden the site and presumably concentrate use. Low impact education was heavily emphasized. There is, however, one unused alternative that influences the realized or potential effectiveness of all of the other alternatives. By not limiting the amount of use on Cadillac, all of the other alternatives may be hampered. Visitors cannot be asked to only stay on designated trails. There simply isn’t enough room. Hardening enough surfaces to accommodate the high number of visitors would require a great deal of hardening. Should Cadillac become a mountain wearing a helmet? Closing off damaged areas might simply push impacts to other areas. This happened on a small scale with the exclosures. More significant closings might lead to impact shifts on a larger scale.

• Low impact education efforts were also negatively impacted by unrestricted use levels. The resource protection messages espoused on signs have to compete for attention with natural attraction *and* the spectacle of large crowds. Furthermore, the amount of use on Cadillac is so high that education efforts need to be incredibly effective if vegetation is to be significantly protected. 1999 visitation to ANP equaled 2,602,227 people. Of that total, 76 percent visited the summit of Cadillac. That equals a total of 1,977,693 visitors. Additionally, it can take as few as 25 trampling passes to reduce some types of vegetation cover by 50 percent (Kuss, Graefe, and Vaske, 1990). And if education (and other alternatives) persuades 99 percent of visitors to effectively stay off vegetation, then 19,776 visitors will still be trampling sensitive vegetation. Those same visitors, most likely even more, will trample soil that could be recolonized by plant species if not for trampling.

While reducing the amount of use on Cadillac would likely increase protection for Cadillac's vegetation, it would not be a "magic bullet". Hammitt and Cole (1998) and Kuss, Graefe, and Vaske (1990) state that the greatest change in vegetation occurs at low-use levels. Thus, if *restoration* of vegetation is a management objective, then other alternatives need to be used along with reducing the amount of use. Still, by reducing the amount of use, other alternatives become more practical and potentially more effective.

#### **POTENTIAL MANAGEMENT SCENARIOS**

Management decisions for Cadillac will require the establishment of measurable indicators. These indicators should address not only the resource but also visitor experiences. Depending upon what objectives are chosen and what indicators are selected, various management scenarios might be desirable. A few possible scenarios are listed below.

Scenario # 1: Remove exclosures and signs. Continue interpretation programs and park-wide low impact messages in the park paper.

Scenario # 2: Keep the same management approaches as in 2000 (including exclosures and signs).

Scenario # 3: Same as # 2, plus: stop vehicles at the base of the summit auto road and give them a personal low impact message (central route) and an informative handout, work with Eastern National (concessionaire) so that its gift shop personnel can share resource protection concerns with visitors, work with tour operators so that they can share resource protection concerns with visitors, look for opportunities to incorporate peripheral messages into the message "arsenal", seek out ways to direct children's creative impulses into positive behaviors (e.g., provide a controlled area for families to learn about and build a cairn without causing impact).

Scenario # 4: Same as # 3, plus: reduce amount of use through a rationing system or by not allowing personal vehicles to access the summit (riding an island explorer bus, taking a commercial tour, hiking, or possibly biking would be the only ways to reach the summit).

Scenario # 5: Same as # 4, plus: require visitors to stay on trails. A few additional areas could be hardened. Signs would need to be changed to share the new stay on the trail message. Exclosures would be abandoned, or expanded if a relatively high level of trampling still occurred. A stronger law enforcement presence might be required.

The importance of visitor experiences should be considered for each of these scenarios. The more restrictive scenarios might reduce freedom and be more burdensome to visitors. Restrictive policies might exclude some types of visitors. However, restrictive policies might also generate heightened experiences. For example, a reduction in the number of cars could reduce the noise level at the summit. A reduction in crowding *could* produce improved visitor satisfaction.



## CONCLUSION

The purpose of this research was not to direct policy, or to serve as a soapbox for personal opinions. Rather, it was intended to augment the knowledge base of ANP managers and identify future research needs. However, the way in which information presented in this paper is used depends largely on the goals established for the summit of Cadillac.

The findings of this research, generated through unobtrusive observation of behaviors and comments, point to new research questions and hopefully give ANP managers newfound insights. The visitor behavior patterns outlined in this report are an initial step towards understanding how to best balance visitor use and resource protection at Cadillac. All recommendations are based on a combination of observations, interpretations, and principles gleaned from visitor management literature. If any recommendations seem to go beyond the parameters of the initial research problems, that is only because the ultimate factors influencing on site problems stem from larger issues. Specifically, the high amount of use at Cadillac confounds efforts to manage impacts.

A major emphasis of this report is that while significant impacts are occurring, there was little evidence of willfully depreciative behaviors. Furthermore, most visitors did not recognize the impacts. So, park managers are faced with a situation in which the resource is being damaged yet visitors appear to be very pleased with their experiences. And reducing the amount of use may be a key management technique. At this juncture, it may be very useful to make an effort to formally evaluate visitor attitudes toward current management on Cadillac and towards future alternative management schemes. Again, if the summit of Cadillac is to be protected, and especially if it is going to be restored, then more intensive management approaches should be looked into.

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# Appendix A

## Summary of "Summit Stewards" Observations

Summit Steward Summary 1

### Cadillac Summit Roving Interpretation

#### Summary

2000

**Roving Interpreters (Summit Stewards)**  
Jennifer Ledenican  
Kristen Hoffman

Prepared by Kristen Britain, Writer-Editor

Interpretive rangers were specifically assigned to rove, present programs, and observe visitor behavior on Cadillac Mountain's summit. Interpreters made observations both in uniform and in plain clothes.

From June to September 28<sup>th</sup>, Summit Stewards made 908 interpretive contacts with visitors. Kristen and Jennifer are to be commended for the detailed observations they recorded, from which the following information has been derived. Their information reveals anecdotal insight into what goes on atop Cadillac, rather than scientific/statistical data.

More complete information, and specific observations made by interpreters, can be found in the Cadillac Summit Roving Interpretation Report.

#### Parking

- The interpreters often observed on busy days, even when the main lot was not full, visitors who parked along the road shoulder (prior to lot) because they saw other cars there and assumed the lot was full.
- Observations of vehicles (including buses and RVs) parked on curbs when spaces were not available.
- Vehicles using the outer loop of the lot would espy an empty space on the inner loop, and instead of going all the way around again, would go against the one way traffic at the end of the inner loop to reach the space.
- The craziest parking, with corresponding crowds, occurred on days following rainy and/or foggy conditions.
- At the height of the season, vehicles were observed parked off the side of the road and parking lot, entirely atop vegetation.



**Tour Buses**

- Interpreters observed a few instances where bus tour groups got off bus, went to gift shop and restrooms, then got back on bus and left.
- *Lots* of observations of cars parked in bus spots, and buses parked across car spots (largely the local bus tour companies).

**Island Explorer**

- Interpreters recorded two instances of visitors expecting to meet the *Island Explorer* at the summit.
- One instance of a family who hiked too late to catch the shuttle at the bottom of Cadillac's North or South Ridge Trails.

**Trails**

- Interpreters observed that visitors step off trail to take photos (with a more dramatic backdrop than available on trail), or to get around others taking photos. A popular place to go off trail for a photo is an outcrop near the Bar Harbor overlook.
- Others go off trail to get away from fellow visitors.
- Children want to run and explore, and parents who didn't want them too near the edge allowed them to run between the upper and lower portions of the trail.
- Visitors go off trail to picnic and to pick blueberries.
- It is easier for visitors with poor footwear (sandals, high heels) to walk on the soily areas than on the pavement.
- Visitors have little understanding that the trail is a loop. They don't know how long it is, so they use social trails to cut between the lower and upper parts.
- Some visitors read signs on exclosures and stayed on trail. LNT messages given at Hawkwatch site seemed to make visitors very conscious of where they put their feet.
- Interpreters observed that visitors tended to stay on trail more often during the fall.
- Many visitors liked to go by the erratic, and one interpreter wondered why the trail does not go by it.

### Exclosures

- When an exclosure did not enclose an entire area, visitors approached from behind (unable to read sign), sometimes stepping right over it. Others would walk right next to exclosure, not bothering to read the sign, or at least not all the way through.
- For some, the exclosures were fun hurdles to leap.
- Visitors were overheard speculating about the exclosures: Were we excavating? Two instances of people wondering if we were protecting rare soil/plants as they have been protecting the microbiotic crust in Arches National Park.
- While many disregarded the signs and exclosures, a goodly amount of visitors were observed reading the signs and staying on trail.

### Pets Leashed, and Not

- As in other places in the park, dogs were often allowed to run, though some (including a pet ferret) were leashed.
- In some cases, hikers would allow their dogs to run unleashed coming up one of the trails, then leash them when they neared the summit and the crowds. Other leashed their dogs in response to seeing the uniformed interpreters.

### Feeding Gulls

- Several instances of gull feeding recorded, many by visitors picnicking.

### Litter

- One interpreter observed that the litter she largely found consisted of popsicle sticks (from the gift shop), candy bar and gum wrappers, and napkins/tissues.
- One visitor wanted to know why there were no "No Littering" signs at the summit. He thought that parks in Canada were far cleaner.
- One visitor thought the summit looked cleaner than a couple years ago.

### Noise Pollution

- One interpreter was appalled by "obnoxious" and loud behavior by visitors (including a tour group of cyclists brought to the summit by motor vehicle, who then bicycled down the summit road) at sunrise.
- Lots of visitors used cell phones at the summit, talking loudly.

### Visitors and Resources

- Visitors were observed kicking cairns, and adding to cairns; scratching on the erratic; and picking up old nails and pottery shards at the true summit.

- One visitor praised the LNT effort.

#### Visitor Activities

- The following activities were observed: kids throwing rocks, picnicking, kite flying, running, climbing the erratic, whalewatching (they were actually seeing rocks in the ocean), hawkwatching, CATwatching, getting married, trying to get away from other visitors, and just sitting on a rock to enjoy the view.

## Appendix B

### Vegetation & Environmental profile of "Blueberry Bald - Summit Shrubland Complex"

Acadia National Park Vegetation Types

Dwarf Shrubland - Evergreen - Upland

BBSS

MapCode(s)

BB

MSS

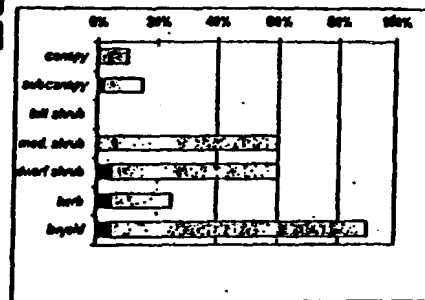
Blueberry Bald - Summit Shrubland Complex

<b>NYCS Names, Code, Hierarchy</b>	Kalmia angustifolia-Vaccinium angustifolium-Viburnum nudum-Betula spp Mid elevation mixed summit shrubland	CEGL006516
<b>Confidence Level</b>	1	N.A.1 N.A.1.N.d.
<b>State Name / Relationship</b>	Low-Elevation Summit Bald 1:1	

Number of Samples 12

#### Strata

<b>Tr. Canopy (1)</b>	0 - 10%, patchy; Pic rub, Abi bal, Qus rub, Bet pap, Bet cor
<b>Height</b>	none - 8 m
<b>Basal Area</b>	1 - 10 m <sup>2</sup> /ha
<b>Percent Conifer</b>	
<b>Subcanopy (2)</b>	2 - 15%; Abi bal, Pic rub, Bet pap
<b>High Shrub (3)</b>	usually none, rarely Amel sp.
<b>Med. Shrub (4)</b>	25 - 60% in MSS subtype; patchy, 0 - 25% in BB subtype; Nem muc, Vib nud, Ite ver, Ace rub, Pic rub
<b>Dwarf Shr. (5)</b>	5 - 80%; Vac ang, Kai ang, Gay bac, Pho mel (F, C); Ain vt, Vac vt, Sor ame (F); Ite ver, Nem muc, Rho can (C)
<b>Herb (6)</b>	5 - 25%; Sib trl, Des fe (F, C); Cor can, Sol ran, Dan spl, Mal can, Hyp gon (F); Min gla (F, BB); Tel oes (C, BB)
<b>Bryoid (7)</b>	5 - 80%; Pul pil, Grm sp, Cla syl (F, C); Sph gr (C, MSS), Cla arb (C), Cladina spp.
<b>Richness: vascular / all</b>	9 - 44 spp
	13 - 51 spp



#### Vegetation Description

A summit vegetation complex consisting of patches of bare rock (Rhizocarpon or other crustose lichens), patches of dwarf heath shrub vegetation with widely scattered Picea rubens or Abies balsamea (rarely Quercus rubra) trees (mapped as BB), and patches of dense taller non-heath shrubs with scattered stunted conifers over a heath shrub understory (mapped as MSS). The blueberry (BB) subtype consists of patches of Vaccinium angustifolium or Gaylussacia baccata, with lesser amounts of Kalmia angustifolia and Photinia melanocarpa, and sometimes Vaccinium vitis-idaea. The primary herbs, which can form the dominant vegetation in patches among the shrubs, are Sibbaldopsis tridentata and Deschampsia flexuosa. Minuartia glabra is locally common on bare rock patches at the edges of shrub areas. Frequent herbs include Cornus canadensis, Solidago canadensis, Danthonia spicata, Malanthemum canadense, and Hypericum gentianoides. Trichophorum cespitosum can dominate locally in shallow rock basins where moisture accumulates. On some summits, this patchy dwarf shrub - bare rock vegetation is punctuated by areas of mixed summit shrubland (MSS), where Nemopanthis mucronata, Viburnum nudum, and/or Ilex verticillata form a 1 - 2 m tall shrub layer with scattered Abies balsamea, Acer rubrum, Betula papyrifera, or B. populifolia. The heath shrub and herb layers under these shrubs are similar in composition to that in the blueberry subtype. Composition of the bryoid layer is variable as in the blueberry subtype, except that the mixed summit shrubland subtype generally has Sphagnum girgensohnii, absent from the more exposed areas.

#### Environmental Description

Summits and high upper slopes, all but one sample above 200 m and most above 350 m. Slopes are gentle, 5 - 15%. All occur on granitic bedrock, with "soils" consisting of weathered sand or gravel a few cm deep. Peat forms in some pockets and provides a substrate for much of the vegetation. Elevation and exposure, rather than fire, is the determining factor for this vegetation, and it occurs in areas both inside and outside of the 1947 fire area.

June 2000

III - 59

**BBSS***MapCode(s)***BB****MSS****Blueberry Bald - Summit Shrubland Complex****Diagnostics** Dwarf shrub vegetation in an upland setting.**Similar types** This type grades downslope into the birch scrub subtype (map type SB) of the aspen - birch woodland complex. As tree cover increases, it can also grade into pitch pine woodlands or other conifer woodland types.**Abundance** Abundant, Patchy**Variability** The presence of the MSS type varies from summit to summit (at least in mappable units). Distribution of vegetated vs unvegetated patches is variable within sites. Among sites, the dominant species are quite consistent although associates vary.**Conservation Considerations**Vaccinium boreale occurs locally at some sites. ~~Trampling due to heavy visitor use is a problem on some summits.~~**Comment** combines former NVCS types 5094, 6031, and "mixed summit shrublands" as a summit complex. Sibbaldiopsis tridentata-Deschampsia flexuosa sparsely vegetated summit (SiDfSV as temporary GELCODE) remains a separate type in the NVCS but is only occasionally extensive enough to map separately.

# Appendix C Daily Summary Sheet

DAILY REPORT - ACADIA TRAIL USE STUDY - 2000

Date: 7-6-00

Hours: Start 2:30

End 6:30

Observer: Rex Turner

Trail segment(s)/Location(s): 6.P. & Summit Top Area

Observational Highlights (from field notes):

Father makes kid pick up bottle that is not theirs.

but the mother with this "cute dog" is being done.

Key on a vegetation. A mother picks up her child

that picking flowers was bad because "the mother picked

can't enjoy them." When the child came, she at break

out the "you not allowed to pick the flowers" argument.

A woman and later her family, were observed "picking"

in the grassy soil near the summit. They were picked

about 100 yds. away, but did not appear to keep anything

or throw it away. The edge of the picking at 601

that our later Dr. Fisher appears to be a possible spot for groups. Went through of about 1000 at this spot & the

Summary (# individual events)

unleashed pets calm building rock graffiti

wildlife disturbance/feeding

plant/tree damage (other than trampling)

calm dismantling rock throwing

rock theft (any size)

littering other (describe)

Appendix D  
"Plot Maps"



Cumulative (adults & children  
before and after exclosures/signs)



**Adults & children  
before exclosures/signs**





**Adults & children after  
exclusions/signs**

# **Appendix E** **Plot Sampling Data**

	Plot # 1	Plot # 2	Gorge Path Plot
Before	37.00	30.00	26.00
Before	42.00	36.00	37.00
Before	75.00	27.00	12.00
Before	34.00	48.00	50.00
Before	50.00	47.00	17.00
Before	41.00	34.00	27.00
Before	13.00	20.00	6.00
Before	16.00	63.00	58.00
Before	94.00	33.00	50.00
Before	91.00	47.00	18.00
Before	85.00	19.00	23.00
After	42.00	50.00	38.00
After	63.00	50.00	14.00
After	70.00	74.00	53.00
After	38.00	26.00	33.00
After	57.00	91.00	25.00
After	15.00	40.00	122.00
After	62.00	27.00	38.00
After	23.00	39.00	17.00
After	83.00	70.00	13.00
After	67.00	39.00	56.00
After	25.00	49.00	68.00

Number of visitors who trampled within defined plots. Before and after refer to before and after exclosures and signs were placed on site.

## **BIOGRAPHY OF THE AUTHOR**

Rex Turner was born in Augusta, Maine on October 20th, 1975. He was raised in Augusta and graduated from Cony High School in 1994. He attended the University of Maine and graduated in 1998 with a Bachelor's degree in Recreation and Park Management. In the fall of 1999, Rex returned to the Parks, Recreation, and Tourism Program at the University of Maine to pursue his Master's of Science degree.

Rex has worked with the Maine Conservation Corps as an environmental educator and with E-Pro Environmental & Engineering, a consulting group based in Augusta, Maine. After receiving his degree, Rex will be working as an interpretive ranger at Acadia National Park. Rex is a candidate for the Master of Science degree in Forestry from the University of Maine in August, 2001.