

## A SPATIAL EVALUATION OF COUGAR-HUMAN ENCOUNTERS IN U.S. NATIONAL PARKS: THE CASES OF GLACIER AND BIG BEND NATIONAL PARKS

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**Abstract:** Tourist visitation to national parks in the western United States has climbed to record numbers over the past few decades. With changing levels of tolerance to large carnivores during this time and reduced persecution of the mountain lions in some areas, it appears that their population in the West has rebounded. The chance of human encounters with mountain lions has increased due to these trends. Human response to encounters is guided by a number of characteristics that might be represented by awareness, attitudes and motivations. To improve the chances of avoiding negative outcomes from encounters reports of encounters with mountain lions in two western parks are evaluated to determine the spatial settings of these events. Large-scale analyses of the patterns of the encounters in Glacier National Park, Montana and Big Bend National Park, Texas help to understand the landscapes within which encounters occur. Evaluation of these settings provides information that can assist in the development of effective hazard-communication tools.

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Aside from the day-to-day encounters experienced by humans residing in mountain-lion country, United States' national parks are the most frequent settings for human-mountain lion interaction. The ingredients for contact are enhanced in national parks by both the reduced persecution of mountain lions and the increased density of human use of natural environments. Encounters have the potential for negative outcomes for both people and the animals attacks on people and the resulting extermination of the offending lion. To reduce this risk, it is important to inform visitors to parks that they should not only expect to encounter mountain lions, but also should be educated in ways to avert a disastrous encounter. In some cases, however, the rather simple task of providing information to visitors increases in difficulty with increased resistance of visitors to receipt of educational messages.

Visitors to national parks originate from many different places and arrive with a wide range of attitudes toward wild animals and pre-conceptualizations of nature. In order to communicate the risk inherent in natural settings and to help visitors achieve safe and fulfilling experiences at parks, methods should be designed to reach the variety of conceptual and attitudinal paradigms possessed by the assortment of visitors. Luckily, these paradigms also predispose visitors to certain activities conducted in particular settings within parks because basic recreational motivations and preferences guide them. For instance, some visitors tend not to stray far from their vehicles and paved roadways because it is not necessary in order for them to achieve recreational satisfaction. Other park users will venture deep into park backcountry, some hiking and others in four-wheel drive vehicles. To begin to understand the risk posed to national park visitors resulting from awareness of and response to environmental hazards, we assessed the frequency and distribution of mountain lion encounters in two western national parks: Glacier National Park, Montana and Big Bend National Park, Texas. This paper describes the parks and the acquisition and manipulation of data from the parks. We discuss the ramifications of the spatial patterns of encounters.

## HUMAN ENCOUNTERS WITH MOUNTAIN LIONS: DEFINITIONS AND DISTRIBUTIONS

This study differs from studies of reported attacks and/or fatalities of human-lion interaction because it focuses on the report of humans “encountering” mountain lions. An “encounter” is a recognizable interactive “moment” when a person believes they have “experienced” a mountain lion. This moment may involve seeing, hearing or coming face to face with a mountain lion. In some cases, individuals may report an encounter based upon their belief that they’d had one there may never have even been a lion present. These phenomena are just as important as “real” encounters, however, insofar as they may lead a visitor to seek both a deeper understanding of their recreational environment and more information about the inherent risks of natural places.

The tasks undertaken in this study are threefold and they are designed to understand the geography of visitors' experiences of mountain lions in national parks. We mapped the locations of encounters within national parks, identified the spatial types of recreational settings within which encounters occur, and sought to differentiate visitor types that tend to frequent the range of settings where encounters occur. By understanding the types of visitors likely to encounter lions in these parks, we may begin to understand the challenges to active prevention of encounters with negative consequences.

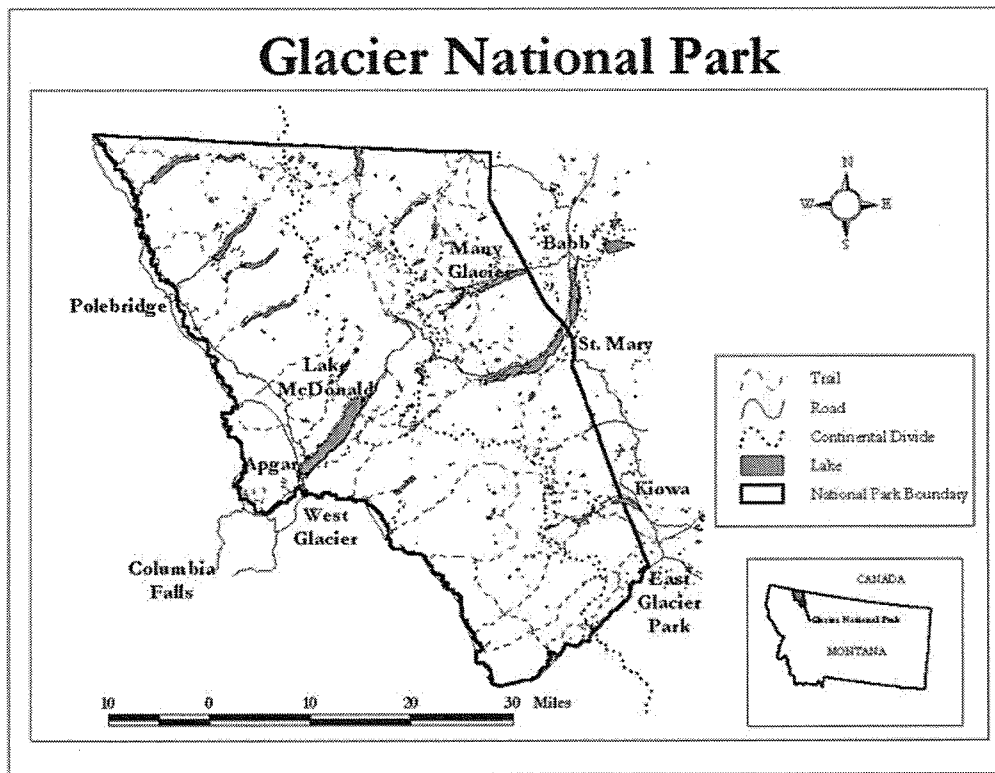
## DESCRIPTION OF THE STUDY AREAS

Glacier National Park (GNP), Montana, is an International Biosphere Reserve of over 0.4 million hectares astride the Continental Divide in the northern Rocky Mountains. Approximately 2,000,000 people visit GNP each year (Table 1), primarily in the summer months, although park use in winter and transitional-seasons has accelerated in the past decade.

**Table 1: Encounters and the number of annual visitors to Glacier National Park, Montana**

Year	Encounters*	Visitation**
1985	1	1,603,011
1986	2	1,579,151
1987	3	1,660,737
1988	3	1,817,733
1989	6	1,821,523
1990	13	1,986,787
1991	5	2,096,966
1992	11	2,199,767
1993	20	2,141,704
1994	8	2,152,989
1995	2	1,839,518
1996	3	1,720,805
1997	4	1,708,856
1998	5	1,830,944
Total	86	

Sources: \*Hungry Horse News; \*\*National Park



**Figure 1. Developed areas in Glacier National Park, Montana.**

Bear Creek and the Middle and North Forks of the Flathead River form the southeastern and western borders of GNP, respectively. The northern border is delineated by the international boundary with Canada. The eastern edge of the park also marks the western boundary of the adjacent Blackfeet Indian Reservation. Small communities whose economic base is primarily tourism ring the border of the park (Figure 1). The collective permanent population of these communities is only several hundred, concentrated primarily around park headquarters in West Glacier. During the summer tourist season, seasonal employees cause this number to swell to about 4-5 times the winter population.

Big Bend National Park (BIBE), Texas, is also an International Biosphere Reserve of over 0.3 million hectares at the southern termini of the Rocky Mountains and Great Basin. Approximately 350,000 people visit BIBE each year (Table 2), primarily from late fall through early spring. The Rio Grande forms the southern boundary of BIBE and the United States' boundary with Mexico. Eastern, northern and western portions of the boundary are geometric and follow the limits of federal land ownership. Units of the state park system abut BIBE to its east and west and private lands ring the central portion of the park's northern boundary. Small communities supported by ranching, hunting and other forms of tourism lie to the park's north and west (Figure 2). The permanent population of the region is low, but the seasonal population swells in park communities and surrounding towns like Marathon, Lajitas and Study Butte during the late fall, winter and early spring months.

Year	Encounters*	Visitation**
1985	31	188,045
1986	26	200,622
1987	78	227,291
1988	61	239,595
1989	49	281,728
1990	97	257,378
1991	76	269,470
1992	107	294,535
1993	119	327,907
1994	264	330,417
1995	157	295,460
1996	148	279,454
1997	161	305,882
1998	262	338,442
1999	145	N/A
2000	77	N/A
Total	1858	

Sources: \*Big Bend National Park archives; \*\*National Park Service

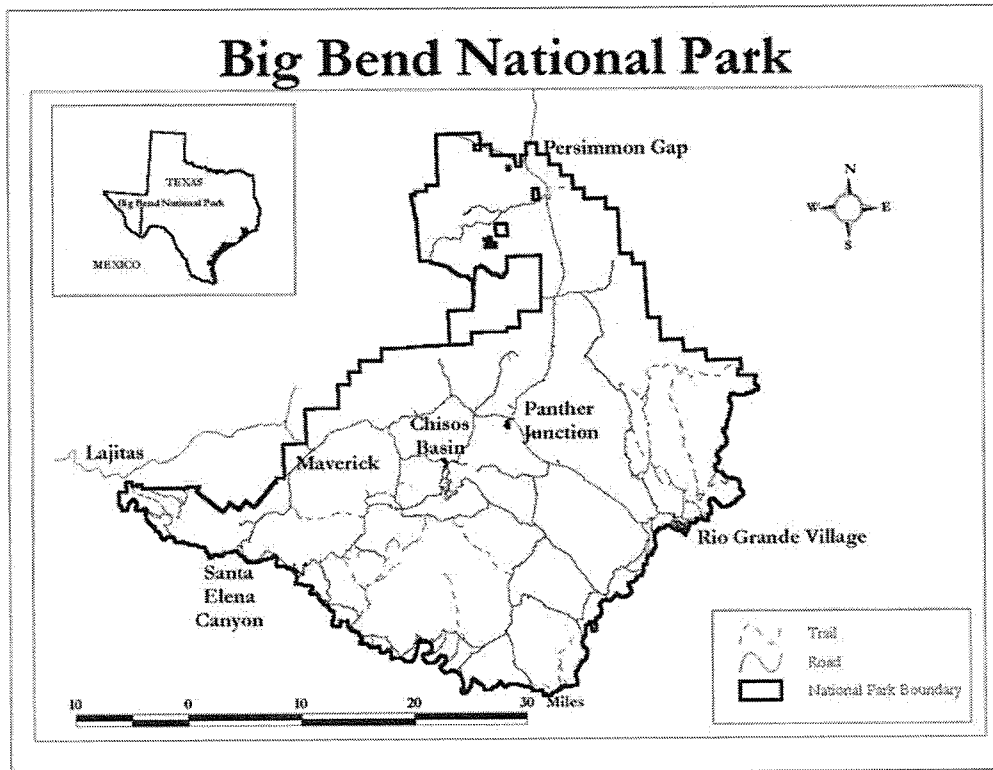
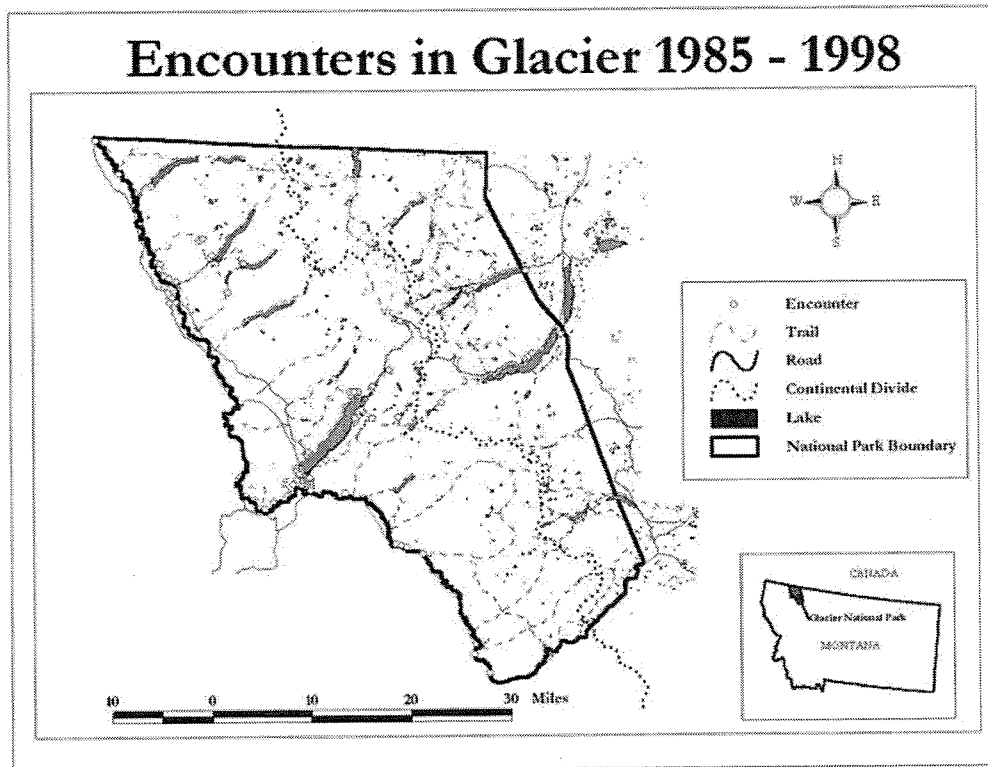


Figure 2. Developed areas in Big Bend National Park, Texas.

**ACQUIRING DATA ABOUT HUMAN ENCOUNTERS WITH MOUNTAIN LIONS**

*Glacier National Park.*-- By recommendation of the GNP park archivist we consulted the Hungry Horse News, a weekly newspaper published in nearby Columbia Falls, Montana, for information regarding mountain lion encounters. It was expected to have more thorough coverage of such encounters than available in the park's archives. This paper covers the news of GNP extensively and has served as a data source for many previous historical accounts of events in the park. Every issue of the newspaper published from 1985 through 1998 was reviewed for lion encounters. We recorded details of each encounter, its date and geographic location (as accurately as could be determined from the written descriptions). General descriptions, including place names, were used to establish event locations. The vagueness of descriptive geographic information in news reports (such as "at the head of Lake McDonald") unfortunately allowed only a general plotting of encounters in the park (Figure 3).e



**Figure 3. Distribution of encounters in Glacier National Park, Montana from 1985 to 1998.**

*Big Bend National Park.*-- For BIBE, we acquired an electronic database from the National Park Service Research Station at Panther Junction in BIBE that included all recorded reports from 1947 to June 1999. Paper reports from July 1999 to October 2000 were also reviewed and amended to the data set. Only the reports from 1985 through 2000 were manipulated for the present study. Encounters in BIBE were mapped using ArcView GIS. One third of encounter reports in the database included UTM coordinates and verbal descriptions of the encounter locations. The balance of the events required translation of verbal descriptions into UTM coordinates. Most of the sites that could be located on large-scale park maps were identified with coordinates at an accuracy of about 100 meters (Figure 4).

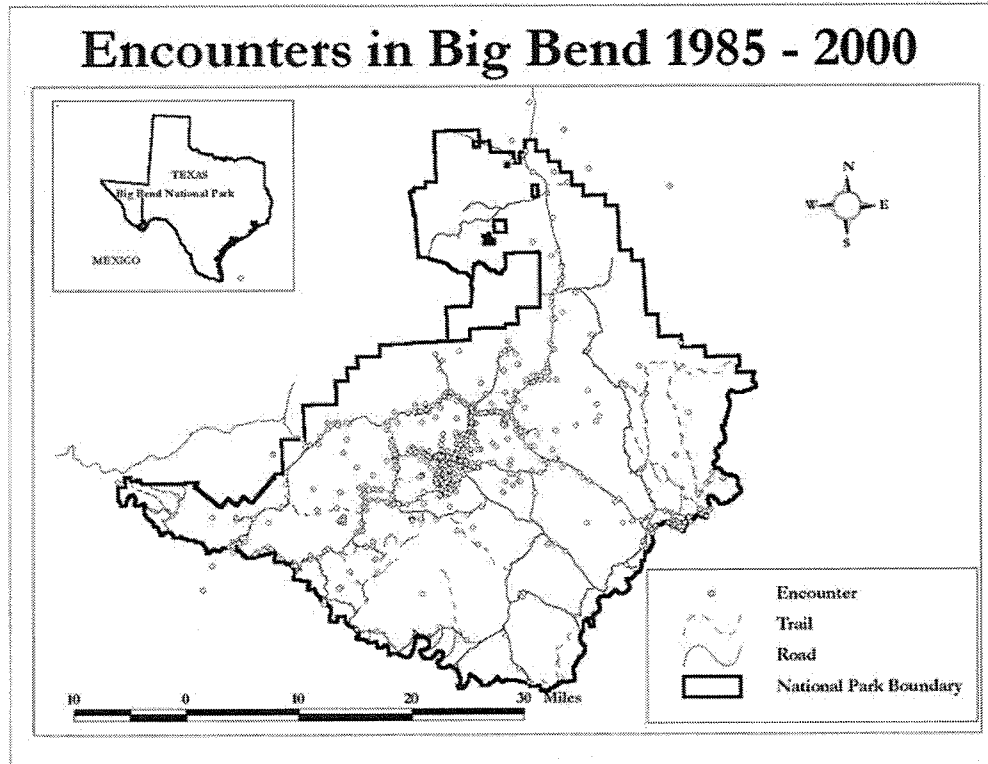


Figure 4. Distribution of encounters in Big Bend National Park, Texas from 1985 to 2000.

#### TEMPORAL AND SPATIAL DISTRIBUTIONS OF MOUNTAIN LION ENCOUNTERS

*Glacier National Park.*-- From 1985 to 1998, 86 mountain lion sightings or incidents were reported in the *Hungry Horse News* (Table 1). These cases include 73 sightings of lions (including several lions captured and collared by park researchers), discovery of 3 lion carcasses, 3 attacks on dogs, 5 cases where lions were observed stalking humans, and two verified attacks on young boys (in July, 1990, and August, 1992). All but 6 of the reported lion encounters occurred west of the Continental Divide (Figure 3). Of those 6, 3 were in the Many Glacier Valley and 3 were in the St. Mary Valley between Rising Sun and St. Mary. Given that these two valleys are among the most popular in the summer, this distribution is not unusual. We suspect that if more tourist facilities enticed visitors into other east-side valleys, a higher frequency of encounters might occur. Regardless of the eastside situation, however, the western distribution illustrates a large concentration of encounters (42) around the West Glacier-Apgar area, at the head of Lake McDonald and along Highway 2 (see Figures 1 and 3). Twenty more encounters were occurred in the vicinity of the northwestern portion of the park near Polebridge.

*Big Bend National Park.*-- Since 1985, there have been 1,858 reported mountain lion encounters in BIBE (Table 2). These cases include visual, aural and physical contact with a lion. The encounters are most heavily concentrated in and around the Chisos Basin in the center of the park where 1,259 encounters occurred, primarily in areas near more heavily traveled roads and campgrounds. One hundred and seventy-nine encounters occurred in the portion of the park to the east and southeast of Panther Junction and 213 occurred west and south of Maverick. About 130 more encounters occurred between Panther Junction and the park's northern boundary near Persimmon Gap. The remaining events were scattered beyond the boundaries of the park, but were reported to and recorded by the Park Service.

## SETTINGS AND THE PEOPLE THAT USE THEM

The typology of settings used in this paper are representative not of the specific kind of activity undertaken *in situ*, but rather the investment or level of commitment users exhibit to actively experience a park. The first “level” of commitment might be travelers’ initial decision to visit a specific park. Often parks are distant from major east-west or north-south highways and in the process in which parks become destinations for vacationers, expenditure is made toward the experience. Commitment levels progress as visitors venture deeper into the park environs. Drives through parks take in scenery. The commitment and experience are limited. Short stops to read roadside interpretive signs and short “nature walks” invest more of users’ time and energy and require a greater desire for experience. Overnight use at campgrounds is a logical step up of visitors’ commitment to park experience. The culmination of commitment might be extended energy- and time-intensive excursions to use backcountry for backpacking, rock-climbing and forms of off-road vehicle use. These “levels” might also reflect increasingly focused motivations and goals for park use and further might be related to socioeconomic and cultural group factors that determine the limits of recreation.

## TYPES OF PARK USERS AND THE PLACES THEY GO

As alluded to earlier in this paper, the paradigmatic goals and motivations of visitors might often determine the spatial pattern of their use of a park. We can, for instance, imagine that some types of visitors will not leave major thoroughfares in parks, while others will endeavor to venture deep into park backcountry. Likewise, campgrounds might be acceptable environs for some visitors, but will not appeal to all.

If we typify settings in parks by levels of common use, we might arrive at a list like this: main roads, visitor centers, campgrounds, front-country trails, backcountry trails, and backcountry campgrounds. We might then attempt to categorize the types of users commonly frequenting such settings. For discussion purposes, here is a sample list: “biophilic,” adventure seekers, vacationers, grand tourists, and “autophilic.” Nature-savvy seekers of bioregional knowledge, wisdom, and solitude might be referred to as “biophilic.” They might be motivated to take extended, contemplative excursions throughout a park to acquire fulfillment. “Adventure seekers,” however, might be activity oriented and might look for locations in parks that have the landscape characteristics that provide adventure. They might pursue heights for rock climbing, hike extensively, and generally orient their activities to the production of sweat and relief of stress. These settings might be front-country locations or might attract these users more deeply into the backcountry of the park. Families seeking to commune among themselves and to share growth experiences might be called “vacationers.” The most limiting member of the group (perhaps a child or elderly relative) might establish the limits of their activities. Vacationers rarely venture into energy-demanding activities or deep beyond the front-country. Another group of visitors might be called “grand tourists.” These people are whirlwind travelers that seek to visit only the major attractions as the prestige of the visit rather than the innate reward of the experience may motivate their travel plans. Invariably, grand tourists lack significant depth of knowledge of local environments. Finally, a group of travelers that move quickly through some parks might be called “autophilic” as they pursue vistas with a hasty examination of landscapes. Stops, if taken, are brief and never beyond main roads. Only superficial knowledge and awareness are gained during park experiences. Deeper experiences are serendipitous.

So who might be found at the types of locations mentioned above? Main roads will encompass the diversity of users. Autophilic, grand tourists, vacationers, adventure seekers, and biophilic will all be found on main roads, but will be found in decreasing percentages of the total users of each of those groups, respectively. Visitor centers seek to serve all visitors to parks, but certainly some tourists can’t be bothered to stop and learn. Some of these groups (biophilic and

adventure seekers) will need to stop to acquire more detailed information and use-permits to plan their visit, while others (vacationers and grand tourists) might stop briefly to determine their need for more information. Grand tourists and vacationers might head directly to campgrounds and nature trails to establish camp or to begin their exploration and might find little need to interface with park staff and exhibits. Front-country trails and campgrounds might see a similar mix of grand tourists, vacationers, adventure seekers and biophiliacs as would be found in visitor centers, but only some of these users will be equipped with localized knowledge and awareness of risks in such settings. The users of backcountry trails and campgrounds (i.e. more natural areas that require greater amounts of investment in equipment and preparation) will likely include only adventure seekers and biophiliacs. However these users are more apt to be equipped with knowledge, awareness and plans to respond to occasional encounters with natural hazards.

*Glacier National Park.*-- The setting of the 86 encounters in GNP has been categorized into three types of locations that occurred in the following frequencies: 65 front-country encounters, 9 backcountry encounters, and 12 encounters during capture and collar activities. Clearly the bulk of encounters are occurring in settings in which people might not be prepared with the proper knowledge, awareness and preparation for incidental mountain lion encounters. The nature of the composition of users of the front-country ought to be examined to determine the level of awareness and the motivation of these visitors.

*Big Bend National Park.*-- The setting of the BIBE encounters has been categorized into four types of locations and occurred in the following frequencies: 1,122 front-country encounters, 736 backcountry encounters, 377 campground encounters, and 18 residential encounters. Most encounters in BIBE are also in the settings of people that might not have the proper knowledge, awareness and preparation for incidental mountain lion encounters. The composition of these users also ought to be examined for awareness, their motivation, and clues to the best way to reach them with risk-communication messages.

## DISCUSSION

Every visitor to a national park arrives with predetermined levels of awareness, perception, and attitudes that guide their planned activities and behavior in natural settings. We can call the combination of these factors their "paradigm." Their paradigm can be changed and molded through education programs. Awareness and knowledge can be raised. Perception can be enhanced. And attitudes can be molded. If we desire to improve the quality and safety of encounters for both people and mountain lions, the process of educating the visitor's awareness, knowledge, perception and attitude must be undertaken to assist in the mitigation of risk in encounters.

Though park managers in both Glacier and Big Bend already strive on a daily basis to effectively communicate guidelines for wise and safe behavior in mountain lion country, they very likely cannot reach every visitor. Patterns of visitor encounters might help us understand the people and "paradigms" that are coming into contact with mountain lions. When we fully understand the level of understanding and desires of users of national parks we will be able to design more effective means of communicating the risks inherent in mountain lion country and mitigation techniques that might be effective for them.

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