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Wildlife-Human Interactions in National Parks in Canada and the USA

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Abstract

The chance to view wildlife draws millions of visitors each year to the national parks of North America. The combination of a large number of people and abundant wildlife leads to a variety of wildlife-human interactions. In this paper we explore the nature of those wildlife-human interactions, theoretical frameworks social scientists are using to understand those interactions, and approaches used by national parks across North America to manage those interactions.

Introduction and Scope

North American national parks provide some of the best opportunities to meet public desires for viewing wildlife and enjoying the sounds of nature (Driver et al. 1991). The "bear jams" that result in places like Yellowstone National Park are continued evidence of people's fascination with wildlife (Compton 1994). However, close proximity of people and wildlife in national parks leads to interactions that can pose threats and/or direct injury to the wildlife species people come to enjoy. Some interactions also result in human injury, death, and property damage. National park managers are faced in part with the difficult tasks of providing opportunities for visitors to enjoy and learn about wildlife, protecting wildlife from visitors, protecting visitors from wildlife, protecting rare plants and forested ecosystems from wildlife, and making all these decisions with the support and understanding of the various publics interested in national parks and their management.

Various national laws in both Canada and the United States of America (USA) provide a legal context for understanding and managing wildlife-human interactions in national parks. The Canadian National Parks Act (1930) does not directly deal with wildlife-human interactions. It does state, however, that "parks are dedicated to the people of Canada for their benefit, education and enjoyment...and shall be maintained and made use of so as to leave them unimpaired for the enjoyment of future generations" (Parks Canada Agency 2000). In addition, the act grants the field unit manager the power to make regulations for "the protection of wild animals and the disposal of noxious, predatory or superabundant animals." In Canada, national park regulations also permit the field unit manager to regulate access to areas to protect wildlife, prohibit the feeding of wildlife in national parks, and to set garbage regulations. These park managers also have the authority to control animals deemed dangerous to human safety (e. g., supporting the removal of problem bears), and to control and dispose of surplus animals deemed harmful to the natural environment (e.g., white-tailed deer in Point Pelee National Park, Ontario).

Similarly, the U.S. National Park Service (NPS) has a broad policy that allows for the management of animals and plants and their environment to minimize human interference. The NPS will not allow activities that "...present a clear danger to pub-

lic health and safety" (Aguirre and Starkey 1994). NPS policy states, "the saving of human life will take precedence over all other management actions." Generally, park policies in the USA seem aimed more at preventing direct wildlife-human interactions than facilitating other forms of interaction. Similar to the Canadian system, USA national park superintendents have a great degree of latitude in interpreting policies and choosing management actions to address the unique conditions of the area.

Although legislation in both the USA and Canada protects people from wildlife, legislation to protect wildlife from people and to restore endangered wildlife appears stronger in the USA than in Canada. In Canadian national parks, wilderness zones (zone two) are delineated in which human impacts on wildlife may be reduced passively, but no national wilderness legislation exists. As of 2002, Parks Canada is discussing legislating wilderness zones in national parks. In contrast, the Wilderness Act of 1964 in the USA directs federal land managers to actively minimize potential negative human impacts on wildlife within any designated wilderness areas occurring in national parks. In addition, managers of national parks in the USA utilize the Endangered Species Act of 1973 to specifically protect rare and threatened species and recover such species actively, as seen, for example, with wolves in Yellowstone National Park (Bangs and Fritts 1996). Canada has only recently acquired in 2002 national endangered species legislation (i.e., Species at Risk Legislation), and it is yet to be seen whether such legislation can be used to actively recover species in national parks. Within Parks Canada, a new emphasis on "ecological integrity" strives to put protection of flora and fauna ahead of human uses (Parks Canada Agency 2000). However, such emphasis is merely a principle to guide management; there exists no equivalent to the much stronger legislation in the USA.

These legal contexts and policy sideboards for management in both countries seem to have influenced research aimed at informing management actions to address wildlife-human interactions. Our interpretation of these sideboards is that they lead to: 1) emphasis on prevention or minimization of interactions that may be perceived by park staff as negative; 2) a narrow definition of negative interactions as prevention or minimization of interactions that may be perceived by park staff as negative; and (3) facilitation of positive interactions in relatively controlled situations. This interpretation is supported by gaps occurring in the published literature about wildlife-human interactions in national parks, especially in the limited amount of research about positive "human dimensions" of interactions other than viewing enjoyment.

The field of human dimensions in wildlife management focuses on understanding how people value wildlife, on understanding public support or opposition to management actions, and on working with people who are affected by, or can affect, wildlife decisions (Decker et al. 2001). Human-dimensions insights, gained through the application of appropriate social science theory and methods, can enhance managers' confidence that they are making the best possible decisions to address wildlife-human interactions that occur in national parks. This is not to say that public attitudes should drive management decisions, but that a greater understanding of human perceptions of interactions with wildlife, along with ecological knowledge and an understanding of the various other human perspectives (e.g., social, institutional arrangements, economics, legal, and political) of natural resource management can help managers make better decisions (Mitchell 1989) .

In this paper, we review scientific literature pertaining to wildlife-human interactions within the three categories mentioned above, using examples from Canadian and USA national parks. We then present a classification scheme to aid managers' consideration of the social science aspects of these wildlife-human interactions. Next, we discuss how an understanding of public values, attitudes, and beliefs about wildlife-human interactions can provide managers with insights to address potential conflicts between interest groups, and between interest groups and park managers, with respect to wildlife-human interactions. We describe several social sci-

ence theories that have been applied to help understand the human dimensions of wildlife-human interactions and to prevent or resolve conflicts over the management of these interactions. Finally, we describe how public involvement techniques, an important suite of human-dimensions tools, have been used to collect data for making management decisions about wildlife-human interactions, to help make those decisions, and to assist managers in implementing decisions. Throughout the paper, we share examples of how national parks in Canada and the USA are classifying and dealing with wildlife-human interactions, thus providing opportunities for managers to network with other national parks managers regarding their own wildlife-human interaction issues.

The Nature of Wildlife-Human Interactions in the Literature

Wildlife-human interactions typically have been categorized in one of three ways in the literature: 1) wildlife conflicting with people, 2) people enjoying wildlife, and 3) people harassing or negatively affecting wildlife. Within each of these categories, various interest groups may perceive these interactions quite differently, resulting in people-people conflicts about the nature of the problem and subsequent management action (Riley et al. 2002).

Wildlife Conflicting with People

Conflicts can be as minor as an inconvenience for humans (e.g., ground squirrels, skunks, and raccoons eating food in campgrounds), as major as human injury or death (e.g., from mountain lions or grizzly bears), or they can involve a perception that humans are at increased risk of injury or death (e.g., moose-vehicle collisions). The most visible conflicts occur between humans and large mammals such as bears, other carnivores, and ungulates (AXYS Environmental Consulting Ltd. 2001, Kuss et al. 1990, Wellman 1987, Wright 1992). Conflicts between people and large wildlife occur both in wilderness areas of parks and in developed areas. For example, Hemmera Resource Consultants Ltd. (1999) documented cases of aggressive elk chasing and injuring visitors and local residents in the developed area of Lake Louise, Banff National Park, Alberta. Research also has been aimed at understanding and addressing similar wildlife-human conflicts within a region known as the Three-Valley Confluence Area of Jasper National Park (AXYS Environmental Consulting Ltd. 2001, Bertwhistle 2000, Jasper National Park 1998, Mattson et al. 1995, Mercer and Purves 2000, Weaver et al. 1996). Mountain lions, wolves, and bison also have stalked, pursued, or attacked park visitors (Riley and Decker 2000, Braithwaite and McCool 1989, Linnell et al. 2002). Medium-sized predators such as coyotes, foxes, and bobcats also cause conflicts with people, especially in developed areas of parks (Gibeau 1993) or in parks near urban areas (Bounds and Shaw 1994, Harris et al. 1997). The bases of these conflicts usually are either increased fear or perceived risk to human safety or actual risk to pets (e.g., from coyotes). Other documented conflicts between wildlife and humans include predators (e.g., coyotes, wolves, owls, and hawks) killing visitors' pets (Geary 2001), concern about the transmission of disease to visitors, e.g., rabies in bats, (LaFleur 1982) or to livestock near parks, e.g., brucellosis in bison (Agguire and Starkey 1994, Inserro 1997).

Perhaps the most frequent problems are not caused by large animals but by insects, whose effects on humans and human installations range from mere aggravation (e.g., mosquitoes and black flies) to possible death for certain park visitors (e.g., from wasp and bee stings). Insects attack ornamental trees, invade buildings, and in extreme cases can cause serious damage to visitor installations or plantation trees (Lafleur 1982). In LaMauricie National Park in Quebec park managers reported that the greatest number of complaints were about insects, followed by birds (LaFleur 1982). Defecation by nesting birds (e.g., starlings, sparrows, and swallows) damages buildings "...and give rise to significant maintenance costs and sometimes embarrassing situations" (LaFleur 1982).

In some cases visitors may intentionally get too close to animals to view or photograph them, presenting a management problem that could possibly be solved through better education efforts. In other

cases, visitors have been unsuspecting victims of attacks, a management problem requiring both education about wildlife behavior as well as public understanding and acceptance of possible trail closures and removal of problem animals. For example, the majority of elk and human conflicts in Jasper National Park have occurred in and around the town site and campgrounds. Parks Canada, as part of a community action plan to reduce human-elk conflicts (e.g., risk perception from goring and vehicle collisions), relocated 211 elk during the winters of 1998-99 and 1999-2000 (AXYS Environmental Consulting Ltd. 2001).

Some wildlife-human conflicts are indirect in that they are associated with wildlife-habitat interactions. For example, control of white-tailed deer populations in eastern USA national parks has been done to protect the forested ecosystems that the public values (Porter 1991, Warren 1991). Also, managers in Point Pelee National Park in Ontario carried out a white-tailed deer cull to protect the native Carolinian forest, an important habitat for birds and one of the key attributes leading to the park's establishment. Habitat degradation by burros in Grand Canyon National Park in Arizona was one reason for burro control programs in the 1970s (Behan 1978). Other indirect wildlife-human conflicts have been associated with wildlife-wildlife interactions. For example, advocates of piping plover restoration have called for the trapping of foxes that prey on plovers and their nests.

Analysis of similar kinds of wildlife-human interactions over time, and the management actions directed at addressing these interactions, seems to indicate that management efforts by park staff reflect policies to eliminate certain kinds of interactions as a way of minimizing wildlife-human conflicts. Some management actions that historically may have presented national parks as "wildlife zoos" were changed to present national parks more as wild ecosystems (Compton 1994; Wright 1992). For example, management actions that may have promoted close contact by people and wildlife eventually were discontinued, apparently to minimize the potential for wildlife-human conflicts. These actions included feeding milk to deer fawns in Yellowstone National Park and establishing bear feeding/viewing stations in Yosemite and Yellowstone national parks in the 1920s where national park rangers interpreted bear behavior to visitors (Compton 1994, Wright 1992). Today, feeding of any wildlife inside a national park in Canada or the USA is strictly prohibited.

Some management changes occurred in response to public and park staff concerns about human health and safety issues associated with what previously may have been promoted as a positive (e.g., viewing) experience. In 1967, Glacier National Park in the USA experienced its first fatal grizzly bear-inflicted attacks; two women were killed within a 24-hour period by different grizzly bears (Herrero and Higgins 1999). Additional dangerous interactions between bears and humans in national parks and protected areas were documented at about the same time (Moment 1968a, 1969, 1970; Herrero 1970a, 1970b, Mundy and Flook 1973). Serious incidents between bears and humans, i.e., bears physically contacting people, charging people, damaging property or food, or people taking evasive action from a bear (Albert and Bowyer 1991), apparently increased in North American national parks until garbage-management techniques were improved and other actions taken to minimize human use of areas frequented by bears (Mattson et al. 1996, McLellan et al. 1999, Ream 1979). While never as high as in the USA, injury rates in the Canadian Rocky Mountain parks also decreased with better garbage and food management (Herrero and Higgins 1999). All national parks with bears have management plans that address safety issues by either influencing bear behavior, e.g., through removal, relocation, or aversive conditioning (Rancourt 1998, Clark et al. 2002) or influencing human behavior, e.g., by closing areas to human use, requiring minimum group sizes when hiking in bear country (Albert and Bowyer 1991, Sherwonit 1996, White et al. 1999), enforcing clean campsites through fines, and confiscating coolers.

Enjoyment of Wildlife by People

At least since the early 1990s, national park managers have attempted to provide opportunities

to view bears and other wildlife in controlled situations to minimize potentially dangerous encounters between people and wildlife, minimize wildlife harassment, and enhance public enjoyment of wildlife (Clayton and Mendelsohn 1993). Park visitors also seek out and engage in informal, uncontrolled opportunities to view or photograph wildlife to enhance their enjoyment. Huge economic impacts of wildlife-related recreation have been documented through national surveys completed in Canada (Federal-Provincial-Territorial Task Force 2000) and the USA (USDI 1993), with a large amount of such wildlife-viewing activities occurring in national parks. These wildlife-human interactions are positive from a human perspective (i.e., economically and in terms of wildlife-enjoyment benefits), whether the activity is bird watching in Point Pelee National Park (Hvenegaard et al. 1989) or whale watching in Saguenay-St. Lawrence Marine Park (Gilbert and Saguenay-St. Lawrence Marine Park 1998). Auditory wildlife-human interactions, such as the popular wolf howling programs in Algonquin Provincial Park (Strickland 1983) and the enjoyment people experience listening to elk bugle in the fall in many western national parks in the USA and Canada (Compton 1994), are further examples of positive wildlife-human interactions.

Effects on Wildlife of Harassment by People

National park managers in Canada manage wildlife resources based upon the principle of ecological integrity (Parks Canada Agency 2000), and USA national park policies emphasize minimization of human impacts on wildlife. The notion that the impacts of humans should be at most minimal may be one reason why a large body of literature has focused on identifying impacts people have on wildlife (e.g., Bertwhistle 2000, Dobson 2000, Mercer et al. 2000, Mercer and Purves 2000, Purves and Doering 1999). Boyle and Samson (1985), upon reviewing 166 articles on the effects of non-consumptive outdoor recreation on wildlife, concluded that in 81% of the reviewed studies, humans were negatively impacting wildlife. The degree of impact varied by recreation activity (e.g., cross-country skiing, snowmobiling, motor boating, canoeing, photography), by species (noting that even within species some animals can become habituated to human activity), and along a continuum from short-term effects (e.g., short-term displacement, increased heart rate, nest abandonment) to long-term effects, including death. Knight and Gutzwiller (1995) reported a variety of human effects on wildlife, including impacts on nesting birds, deer, wolves, manatees, raptors, and bighorn sheep. Pomerantz et al. (1988) developed a classification scheme to assess the impacts of recreation on wildlife. While most of this research has been done in areas outside of national parks, we assume visitors to national parks and protected areas have similar effects on wildlife, whether intentionally or unintentionally. Research from Banff National Park (Paquet et al. 1996) and Jasper National Park in Canada (AXYS Environmental Consulting Ltd. 2001) support this assumption, having documented effects of various human activities on gray wolves, grizzly bears, elk, and bighorn sheep.

Harassment includes events that cause excitement and/or stress, disturbance of essential activities, severe exertion, displacement, and sometimes death of wildlife (Ream 1979). Some forms of harassment are intentional, as when visitors try to elicit a response from wildlife by chasing or throwing objects at them (Wright 1992). Sometimes harassment is unintentional. For example, use of motorized off-road vehicles (e.g., snowmobiles, jet skis, helicopter over-flights) can displace animals, increasing their home range and affecting their patterns of activity (Cottereau 1972, Freddy et al. 1986, King and Workman 1986, Kuss et al. 1990). Removal of woody debris for firewood and ornamental uses by visitors and staff in Point Pelee National Park reduced habitat available for five-lined skinks, which use woody debris as refuge sites (Hecnar and McCloskey 1995, 1998). Local pet store operators collected skinks from Point Pelee National Park, not realizing the collection of species within a national park was illegal (Hecnar and McCloskey 1995, 1998). Hood and Parker (2001) found that human activities, including increased trail use by people, had negative impacts on habitat suitability for grizzly bears. Similarly, heavy traffic volume on roads can modify

movement and feeding patterns of some wildlife (Mattson et al. 1987, Mattson 1990). For example, in Denali National Park, moose were found to avoid areas with high road traffic volume, but "caribou and grizzly bear distribution indicated no pattern of traffic avoidance" (Yost and Wright 2001).

Wildlife mortality on roads and rail lines in national parks has long been recognized as an important negative wildlife-human interaction. Wildlife-vehicle collisions in parks cause thousands of dollars of damage, numerous human injuries, and some human deaths each year (Conover et al. 1995). In western Canada, where park establishment was linked purposefully to economic development, wildlife routinely are killed along major highways and rail lines running through some of the Rocky Mountain national parks (Hatler 1979). "In some years, the combined kill of moose and deer from collisions with vehicles and trains probably exceeds the hunter kill for some local herds" (Hatler 1979). Jasper National Park managers have been particularly concerned with the large number of mortalities of elk, white-tailed deer, mule deer, wolves, grizzlies, and black bear in the Yellowhead Highway along the Miette and Athabaska River valleys, the paralleling Canadian National rail line, and Highway #93 south along the Athabaska River. Significant numbers of wildlife, including elk, grizzly, and black bear, are killed along the rail line, frequently in association with grain spills (AXYS Environmental Consulting Ltd. 2001, Bertwhistle 2000). Other species killed by vehicles or trains in national parks include bighorn sheep (Van Tighem 1981) and moose (Bertwhistle 2000, The Ungulate Ecology Group 1988).

In 1982, Damas and Smith (1982) reported the significant amounts of wildlife mortality in transportation corridors in Canada's national parks, and since then research has focused on reducing such wildlife-vehicle collisions. Heap (1987) began to explore mechanisms to reduce wildlife-vehicle collisions in Riding Mountain National Park, Manitoba in the late 1980s; however, most of the research and search for solutions remains concentrated within the Rocky Mountain region (Poll 1989, Romin and Bissonnette 1996, Ruediger et al. 1999, Clevenger 2000). Bradford (1988), Woods (1990), Shury (1996), and Clevenger and Waltho (2000) have explored the effectiveness of underpasses and fences to reduce wildlife mortality. Clevenger and Waltho (2000) suggest that underpasses can prove useful in reducing mortality, but there are many factors that influence the effectiveness of structural fixes.

Managers have benefited from understanding both human behaviors that lead to wildlife-vehicle collisions and acceptance of slowing down and being more vigilant while driving (Bath 1997, Romin and Bissonnette 1996). While speed zone reductions in Jasper National Park from 90 to 70km/hr in key areas used for daily and seasonal migrations of elk reduced the rate of increase in elk mortalities over a three-year period, bighorn sheep mortalities were in fact higher in 70km/hr zones than 90km/hr zones (AXYS Environmental Consulting Ltd. 2001, Bertwhistle 2000). Lighted and animated warning signs, reflectors, fencing, public awareness, and private cooperation with particular interest groups have all been used with various degrees of success in reducing vehicle and train collisions with wildlife (AXYS Environmental Consulting Ltd. 2001, Romin and Bissonnette 1996). Targeted working initiatives with interest groups could be particularly effective. For example, as truck traffic in Jasper National Park is responsible for a disproportionately high percentage of wildlife kills, communication with truck companies could prove useful. Likewise, ensuring that Canadian National Railway (CNR) expediently cleans grain spills along its lines could reduce collisions with bears and elk (AXYS Environmental Consulting Ltd. 2001).

From a wildlife perspective, the loss of animals from the local population due to highway kills or other human impacts may represent a threat to ecological integrity, particularly where species of high management concern and low reproductive capacity are involved (AXYS Environmental Consulting Ltd. 2001). For example, Jasper National Park managers have a specific goal to maintain <1% human-caused mortality for grizzly bears and wolves, species that have low recruitment and/or high vulnerability

to human-caused mortality (Jasper National Park - Parks Canada 2000). From a human perspective, reducing wildlife-human conflicts is consistent with park mandates in Canada and the USA that emphasize public safety.

The problem of wildlife-vehicle collisions is not limited to just large mammals and the Rocky Mountain National Park complex. Bernardino and Dalrymple (1992) documented road mortality of snakes, and while such mortality does not cause the same degree of damage to vehicles, it can have significant impacts on local populations. However, no studies exist that focus on human perceptions of these collisions and their effects on wildlife.

Boating activities can disturb birds with floating nests, making the nests vulnerable to damage and the birds susceptible to stress (Kuss et al. 1990). Stolley et al. (1999) documented reduced nest success and gosling survival for Canada geese due to human disturbance at Fish Springs National Wildlife Refuge in Utah. In addition, rock climbing at Joshua Tree National Park has disturbed nests of cliff-nesting birds, although the effect on survival of fledglings was uncertain (Camp and Knight 1998). On the Maligne River in Jasper National Park, canoeists displaced harlequin ducks (Smith 2000) until commercial rafting on the river was banned by Parks Canada in the late 1990s. Watercraft in Voyageurs National Park in Minnesota were found to reduce nesting success of bald eagles (Grubb et al. 2002). Bald eagles were also negatively affected in Grand Canyon National Park, Arizona by human activity along the Colorado River (Brown and Stevens 1997). Along the beaches in Nova Scotia and in Prince Edward Island National Park, Flemming et al. (1988) documented various impacts on piping plovers, an endangered shorebird species, including an energy deficit in chicks that made them more susceptible to inclement weather and predation, thereby reducing fledging success. Beach-goers also disrupted colonization of new beaches by northern elephant seals at Point Reyes National Seashore in California (Allen 1999). Various species of wildlife have choked on or been poisoned by campground litter, and camping activities have collapsed burrows and suffocated animals (Kuss et al. 1990). Harris et al. (1995) showed that disturbance by visitors to Saguaro National Park in Arizona increased mortality of desert bighorn sheep. In general, data are lacking about whether people recognize the effects of these interactions and whether they believe those effects are important (i.e., either beneficial or detrimental in some way).

Management Approaches to Wildlife-Human Interactions

Park managers address harassment of wildlife, wildlife conflict with people, and enjoyment of wildlife through a variety of management actions, including public-involvement approaches, implementing trail and area closures, and actively reducing wildlife populations. For example, the phenomenal growth since the 1980s in whale-watching activities within the Saguenay-St. Lawrence Marine Park region and the concern over potential harassment of marine life resulted in Parks Canada managers, business interests, and other interest groups working together through a facilitated approach to design a set of guidelines for whale-watching activities (Gilbert and Saguenay-St. Lawrence Marine Park 1998). To effectively understand and address snowmobiling issues in Gros Morne National Park, Parks Canada and representatives of local communities worked together toward a common vision and set of core values through a series of facilitated workshops producing a set of guidelines for that activity. The process not only addressed concerns about wildlife-human interactions, but also built trust and credibility between the park and local communities.

Closing areas to people has been a traditional approach to minimizing impact on wildlife. Parts of Yellowstone National Park (e.g., backcountry areas near Dunraven Pass) are permanently closed to visitors to reduce human-grizzly interactions. Closing specific trails during sensitive breeding times is another form of management to help protect wildlife from people (Flemming et al. 1992). The James Callaghan Trail in Gros Morne National Park is closed in the spring during the breeding period for ptarmigan. Nevertheless, closing areas to

people to reduce conflicts with wildlife can be a controversial and time-consuming process, as various interest groups value wildlife differently. Closing Fishing Bridge Campground in Yellowstone National Park to protect grizzly bears took many years beyond the initial realization that the campground was located in prime grizzly habitat. These cases illustrate that while managers have tried to manage interactions between wildlife and people directly, they also need to manage issues leading to those interactions, including the benefits people want from encounters with wildlife.

A Classification System of Wildlife-Human Interactions

Although we focus on wildlife-human interactions in national parks, in a broader context we are discussing human-environment relationships that exist within national park settings and the need to integrate the human component into natural resource management. Nepstead and Nilsen (1993) proposed a framework for understanding these broader human-environment relationships in Canadian national parks, encouraging managers to think about and manage the interface of landscape/seascape/people and processes. Our discussion of wildlife-human interactions is consistent with this broader framework.

Wildlife-human interactions and the biophysical effects associated with them do not inherently create wildlife-human conflicts. Conflicts occur because of differences among people's values – differences in terms of which wildlife are deemed desirable *vs.* undesirable, in which human activities in parks are viewed as acceptable or unacceptable, and differences in how people interpret the biophysical effects of their activities. For example, Pruit (1971) suggested that compaction of snow by snowmobiles severely limits the subnivean movements of small mammals and invertebrates. Neumann and Merriam (1972) go further by showing that compacted snow decreases temperatures, significantly increasing metabolic rates of the short-tailed shrew. Finally, Jarvinen and Schmid (1973) found that even moderate packing of a field by snowmobiles resulted in 100% mortality of the small mammal fauna, including meadow voles, short-tailed shrews, and white-footed mice. Some people value the protection of all wildlife and believe that humans should not affect even rodents inside a national park, while for other people, rodents have no value or importance. Some people weigh the benefits of seeing other wildlife via snowmobile as more important than the negative impact of snowmobiling on rodents. Thus, management decisions aimed at addressing problems associated with wildlife-human interactions can be informed greatly by understanding the human dimensions of these interactions and their various effects (Riley et al. 2002).

Obviously, almost any wildlife-human interaction could be classified as: 1) a conflict between wildlife and humans, 2) enjoyment of wildlife by humans, or 3) harassment of wildlife by humans. To help managers better consider how people may interpret differently and place varying levels of importance on these interactions and their effects (Riley et al. 2002), we present a conceptual framework with four dimensions:

- *Perspective* - is the impact of the interaction described or considered from the perspective of people or of wildlife?
- *Motivation* - is the interaction intentional or unintentional? This should be considered from the people's perspective and from the animals' perspective (e.g., predatory behavior or surprise encounter).
- *Directness of the effect* – is the effect direct (e.g., through visual, auditory, or olfactory cues) or indirect (e.g., snowmobiles leave trails that allow animals to move through the area long after snowmobiles are gone)?
- *Desirability of impact* – is the interaction perceived as good or bad (e.g., seeing a bear on the trail while out backcountry hiking *vs.* seeing a bear on the trail when out for morning exercise)?

Perspective dimension Any interaction can be considered from the perspective of either humans or wildlife. For example, consider people snowmobiling near a herd of bison during the winter. The interaction may increase human satisfaction with their visit because their expectation for seeing

Table 1: Framework Re-Categorizing Wildlife-Human Interactions in National Parks

1) Perspective dimension	People	
	Wildlife	
2) Motivation dimension	Intentional	
	Unintentional	
3) Effect dimension	Direct	
	Indirect	
4) Impact dimension	Desirable	*People:* attitudinal (satisfaction, risk perception, fear, excitement, return visitation, tolerance, etc.) *Wildlife:* behavioral (mortality, survival, movement, harassment, etc.)
	Undesirable	

wildlife is met. The interaction may also disturb the bison, increase their energetic demands, and decrease survival (Meagher 1989). The degree to which managers take action to prevent or ameliorate these negative effects on wildlife depends in part on whether managers or other groups believe these effects are important enough to manage.

Certain activities intended to facilitate or enhance positive interactions for humans can result in a variety of unintentional negative or positive encounters from the perspective of wildlife. For example, use of off-road vehicles can allow visitors to get twice as close to nesting birds as people on foot (Cole and Knight 1991). Snowmobiles can serve a similar purpose in winter, allowing individuals easier access to backcountry areas to view wildlife. However, the compacted snow of snowmobile trails can adversely affect mice and voles by reducing their ability to burrow in snow for insulation (Kuss et al. 1990). On the other hand, some wildlife species, such as red fox (Neumann and Merriam 1972) and bison (Meagher 1989), may use the trails to increase their mobility.

Motivational dimension From the perspective of either people or animals, the cause of an interaction may be intentional or unintentional. For example, people may intentionally set out to view wildlife when visiting a park (primary benefit). Alternatively, they may visit a park for the purpose of hiking in the backcountry and may have an exhilarating experience when a bear crosses the trail in front of them (secondary benefit). In the case of a bear entering a campground, the bear may be obtaining food purposefully, but may unintentionally cause a conflict from the perspective of people. A bear that purposively pulls a hiker out of a tent (predatory motivation) is quite different from an attack motivated by surprising a sow with cubs on a trail. Similarly, motivations among people may vary considerably, depending upon a variety of factors.

Various groups of visitors and other interest groups affected by park management decisions sometimes disagree about management actions taken to minimize human safety risks. Some visitors wish all bears and dangerous wildlife to be removed from their "pleasuring grounds;" others want close contact with animals, and many believe "...national parks are not intended to be zoos without cages" (Wright 1992). These differences in motivations and values can lead to conflicts; thus, managers need to understand the various motivations and hierarchy of values within the wildlife-recreation experience (e.g., for some people safety in the wilderness is more important than the exhilaration of hiking in grizzly bear country).

Individuals may have a variety of motivations for pursuing wildlife-recreation activities. For some individuals, it may be important to be with others and to reach specific goals of seeing certain species, while for others seeking the quiet of the outdoors away from people and not being driven by any specific achievement goals may be important. Understanding motivations helps park managers create experiences that will satisfy visitors and minimize conflicts between various interest groups. McFarlane (1994) found that experienced birdwatchers were more motivated by personal achievement (i.e., expanding knowledge and improving skills) than were casual birdwatchers, who placed more importance on appreciative issues, such as being in the outdoors. We further discuss issues of motivations, expectations, and satisfaction in the next section on social science approaches.

Effect dimension Wildlife-human interactions may have either direct or indirect effects on people and/or animals. There may be immediate visual or physical contact, or there may be human influence on an animal's surrounding habitat, which in turn would somehow affect the animal itself. For example, using snowmobiles may provide people greater access to directly encounter wildlife visually. Grooming roads for snowmobiling in parks also may harass animals and cause them to flee the area as grooming occurs, but can provide subsequent (indirect) access to additional foraging areas (Meagher 1989, Bjornlie and Garrott 2001).

Impact dimension From the perspective of humans or wildlife the impact of a particular interaction may be either desirable or undesirable. This is potentially the most complex dimension because a variety of behavioral indicators (by humans or wildlife) or attitudinal indicators (humans) may be used to assess or evaluate interactions. Wildlife-human interactions can be evaluated as either desirable or undesirable depending on how people interpret the effects associated with those interactions. The evaluation or assessment depends on the underlying attitudes and values of the people involved. People's risk perception also influences their interpretation of a wildlife interaction as either positive or negative.

Any wildlife-human interaction might result in both positive and negative effects. The same person may even interpret the effects in very different ways depending upon the motivations at the particular time of the wildlife-human interaction and the spatial context (where the interaction occurs). For example, a local resident in Banff National Park is jogging alone along a trail for exercise. This same person might also have a low tolerance for seeing large animals at close distances. To see wildlife on that trail at that time may not be his/her motivation for being there, thus encountering a large mammal near the trail could cause concern and result in a negative wildlife-human interaction. On the other hand, the same individual on the same trail with his/her family may at another time be seeking to view wildlife, and seeing a large mammal under these circumstances could be positive. If however, the individual has a low tolerance of risk for large mammals, regardless of the situational context, the end result would be a negative interaction. Without social science research that understands the nature of behavior, an interpretation and subsequent management of the wildlife-human interaction is difficult. Encountering wildlife close to home or the campsite may be negative (e.g., bear in the backyard or campground), but seeing the same bear on a backcountry trail could be very rewarding. The spatial, temporal, and motivational context must be understood to effectively evaluate the nature of the wildlife-human interaction.

People's previous experiences with wildlife may influence their evaluations of wildlife-human interactions. For example, visitors to Great Smoky Mountains National Park who had previous bear-related experience perceived a lower risk from bears compared to those with no previous bear-related experience (Pelton et al. 1981). Upon classifying the nature of the wildlife-human interaction, various social science approaches can be used to understand the issues and gain public acceptance of management decisions.

Social Science Approaches to Wildlife-Human Interactions

Social scientists often use one of two broad categories of theoretical approaches to examine the human dimensions of wildlife-human interactions: cognitive approaches examining attitudes and values or motivational approaches used to understand and predict human behavior (Decker et al. 2001). Within these two broad categories are a variety of specific conceptual frameworks that can be used to understand the complex nature of wildlife-human interactions (Table 2). Most of these frameworks have rarely been applied in national parks, but park managers could use such frameworks to help articulate management decisions and determine the types of human-dimensions data that might be useful in informing those decisions (Decker et al. 2001).

For example, using a framework based on visitor motivations and behavioral intentions could help park managers understand and predict the types of interactions people are likely to have with wildlife (both intentional and unintentional) and whether people are likely to recognize and place importance on certain effects of those interactions. This information could help managers deliver more effective interpretive messages. In addition, park managers could use an understanding of motivations to help achieve better satisfaction among visitors by providing experiences that visitors desire. Park managers could also gauge public acceptance or tolerance of certain wildlife-human interactions (e.g., do people perceive the interaction as desirable or unacceptable) by assessing attitudes toward the interactions. An assessment of visitors' risk perceptions also could shed light on why an interaction is interpreted by visitors as tolerable or intolerable. Any of these conceptual frameworks could help managers investigate questions such as: 1) is the interaction an important issue for people, and, if so, for which groups; and 2) do people expect managers to take some action to prevent the interaction, or will they demand action to facilitate the wildlife-human interaction under controlled circumstances? If action is required, an understanding of attitudes toward various management options to address the wildlife-human interaction will increase the possibility of implementing a decision with public support.

Human-dimensions or social science research can address these issues and offer managers data representative of the entire constituency to make better decisions, but often such passive research will not resolve conflict. For conflict situations, an active human-dimensions approach utilizing a suite of public involvement tools are available to help build trust and credibility between park staff and various interest groups. In the next section, we outline briefly the nature of these social science research approaches and public involvement tools (see also Force and Forester 2002).

Understanding Attitudes – A Fundamental Concept in Social Science Research

Assessing attitudes of various interest groups toward wildlife species, interactions with those species, and management options to address the interactions can be useful for understanding public support and opposition to management decisions. Social scientists typically divide attitudes into three components (Fishbein and Ajzen 1975): 1) affective (i.e., liking or disliking the species), 2) cognitive (i.e., beliefs about the species that may or may not be true), and 3) behavioral intention (i.e., what people or groups say they will do with respect to the species). Under well-defined conditions, these three factors can be used to predict overt behavior – what people actually do. By formulating questions within each component, researchers are able to better understand the human component of the wildlife-human interaction.

For example, Bright and Manfredo (1996) examined attitudes toward wolves and wolf restoration in Colorado, beliefs about wolves, and behavioral intentions to support or oppose restoration measures. They then explained behavioral intentions based on knowledge of people's attitudes and beliefs about wolves and the potential consequences of wolf restoration. Further examples of assessing attitudes and beliefs include documentation of visitor attitudes toward grizzly bears in Glacier National

Table 2. Summary of Approaches Used to Understand Wildlife-Human Interactions.

Approach: Risk Perception

- Assumes increasing perceptions of risk are associated with increasing perceived likelihood of conflict and decreasing acceptance of the risk.
- Data collected using questionnaires.

Strengths of approach

- Know this and one can manage to reduce risk perception by reducing interactions perceived as risky, or by trying to decrease perceived risk through risk communication. Good for addressing wildlife-human interactions defined as conflict. Also can be used to help develop realistic perceptions about risk if people do not recognize risk associated with some kinds of interactions.

Weaknesses of approach

- Focuses only on overcoming negative effects of interactions (ignores positive effects), and on a narrow set (risk to human health and safety) of negative interactions. Not suitable for addressing interactions defined as "harassment" or "wildlife enjoyment."

Approach: Wildlife Acceptance Capacity (WAC)

- Assumes acceptance is based on tolerance of perceived problems associated with perceived wildlife population level. Perception of numbers of population is one of the most important variables in predicting attitude toward management options and toward the species.
- Data collected using questionnaires.

Strengths of approach

- Good for addressing "conflict." Questionnaire can be designed to understand the nature of the conflict (cognitive, value, cost/benefits, behavioral), adding additional value.

Weaknesses of approach

- Potential to place too much emphasis on a biological strategy focusing on wildlife population management as the solution to the "conflict."
- Often pays attention only to upper level of acceptance and ignores lower level of acceptance, however, a modified questionnaire approach could get at this.

Table 2. Summary of Approaches Used to Understand Wildlife-Human Interactions (cont.).

Approach: Wildlife Stakeholder Acceptance Capacity (WSAC)

- Assumes that addressing human values (not wildlife populations per se) is the central mission of management.
- Data collected through questionnaires.

Strengths of approach

- Mixture of peoples' tolerance of negative interactions and desire for positive ones.
- Could be used for addressing "conflict," "harassment," and "wildlife enjoyment."

Weaknesses of approach

- Survey methodology has not been extensively tested.
- Clearly defines groups as stakeholders, implying clear positions and position negotiations rather than consideration of groups as various interests focusing upon common visions, goals, objectives, and targets and negotiations based upon principles.

Approach: Wildlife Attitudes and Values Typologies (e.g., Kellert Typology, WAVS)

- Quantitative instrument that can allow managers to categorize individuals and groups into various attitudinal types.
- Data collected through questionnaires.

Strengths of approach

- Has been widely used and tested. Attitudinal items have strong reliability estimates.

Weaknesses of approach

- Does not specifically address management questions.
- Sometimes difficult to transfer insights from the measurement of abstract thoughts (attitudes and values) to practical management decisions.

Approach: Visitor Satisfaction with Wildlife-Related Experiences

- Assumes increasing levels of satisfaction are associated with increasing levels of "wildlife enjoyment."
- Data collected using questionnaires.

Strengths of approach

- Parks have experience in measuring and monitoring satisfaction levels over time, and while satisfaction levels are often high, some parks have begun to assess concept by looking at dissatisfaction (if greater than 15%).
- Could be appropriate to address "wildlife enjoyment" interactions.

Weaknesses of approach

- May not be as useful for examining the nature of "conflict" or "harassment" interactions.
- Visitors tend to state high satisfaction with park facilities in general.

Park, USA (Mahalic 1974), and the exploration by Bath (1989, 1991) and Bath and Buchanan (1989) of attitudes and beliefs of interest groups and the general public in Wyoming, Montana, and Idaho toward wolf restoration in Yellowstone National Park. By documenting the attitudes of the general public by political unit (statewide samples in the three-state area) and by interest group (e.g., Wyoming Wildlife Federation, a group mainly consisting of hunters, Wyoming Stock Growers, livestock operators, and Defenders of Wildlife members) toward wolves and wolf restoration, the Yellowstone study served a variety of purposes. Political leaders in Montana, Wyoming, and Idaho had publicly stated their opposition or support for wolf restoration, claiming they were speaking on behalf of their state constituents. For those politicians who truly wanted to represent their constituents' views, this research gave them an accurate assessment of their voters' opinions. Further, by documenting the positions of interest groups with very differing views, it was possible to define the attitudinal spectrum across a variety of management questions and attitudinal items, thus allowing managers to assess how far apart various interest groups were on certain issues and whether the distance between groups remained constant or varied, suggesting areas for possible compromises. Specifically, ranchers supported the idea of compensation, an important compromise in resolving potential livestock depredation issues, thus allowing wolf restoration to move ahead. Managers could also balance the views of the interest groups toward the issue by understanding the nature of general public attitudes statewide and within the counties directly surrounding Yellowstone.

Attitudinal and belief studies not only provide an accurate and representative assessment of public attitudes and beliefs for managers, but also can act as baseline information, allowing changing attitudes and beliefs to be monitored over time. Such studies can be used as a first step in evaluating changes in public perceptions after implementation of new policies and/or management actions. Attitudes and beliefs can also be monitored with the changing dynamics of the biological population. The strength of such human-dimension research occurs when it is integrated with biophysical data. Attitudinal assessments can also help park managers predict where conflicts may occur over management actions. For example, while habitat outside a park may be very good from a biophysical perspective for recovery of a certain species, attitudes may be so negative in that region that animals may be killed if they cross outside park boundaries, suggesting that park managers consider other areas that have more positive human attributes to ensure successful recovery of the species. An assessment of public attitudes toward wolves in two provinces in France has helped park managers of Mercantour National Park understand how people perceive wolves that live in areas surrounding the park and the likelihood of wildlife-human conflicts as wolves expand their range and enter the cultural landscape of France (Bath 2000).

Several different attitude and value scales have been used as a foundation for understanding how people are likely to react to various kinds of wildlife-human interactions. Edgell and Nowell (1989) have argued that wildlife management conflicts are part of a broader conflict between beliefs and values emphasizing a technological, growth-oriented utilization of the environment (labeled as a dominant social paradigm) and a more recent set of beliefs and values emphasizing an ecological perspective (labeled as the new environmental paradigm). Dunlap and Van Liere (1978) developed the new environmental paradigm (NEP) scale consisting of 12 value statements to examine people's general environmental dispositions. The scale has an emphasis on the "Spaceship Earth" metaphor. Several researchers (Albrecht et al. 1982; Geller and Lasley 1985; Edgell and Nowell 1989; Kuhn and Jackson 1989) have found that the 12-item scale can be clustered into three belief domains (balance of nature, limits to growth, and humanity over nature) that can be used to help understand underlying public attitudes and values toward wildlife-human interactions. While the NEP scale has not been widely applied to wildlife-human relationships, Edgell and Nowell (1989) applied the scale to help understand wildlife and environmental beliefs of commercial fishers, Greenpeace members, and the general public in British Columbia, Canada.

Another example is the attitudinal typology developed by Kellert and Berry (1980) that categorizes humans based on ten attitudinal dimensions, which have been discussed in a variety of papers (Kellert 1976, 1980, 1983, 1985, 1991). One premise of this typology is that people's attitudes toward wildlife species and the interactions they have with humans will be affected by whether people are more oriented toward naturalistic versus utilitarian perspectives. However, people across the attitudinal spectrum tend to express the most positive attitudes toward pets and large mammals that have high esthetic value, high phylogenetic similarity with humans, low perceived risk to human health and safety, high cultural importance, and high perceived/real economic value. More negative attitudes are associated with wildlife having opposite characteristics. The Kellert attitude typology, while dated, continues to be used in many studies focusing on a variety of wildlife species and wildlife-human interactions in many different locations (Bjerke et al. 1998; Kaltenborn et al. 1999; Vitterso et al. 1999).

The wildlife attitudes and values scale (WAVS) is another example of an attitude typology used to understand how people interpret or evaluate interactions with wildlife (Purdy and Decker 1989). WAVS uses a set of statements about wildlife to determine how personally important it is for people to relate to wildlife and its use along four basic dimensions. A social-benefits dimension pertains to appreciation and existence of wildlife. A communication-benefits dimension pertains to observing and talking about wildlife as part of everyday experiences. A problem-tolerance dimension includes concerns about economic and safety risks associated with wildlife. A traditional-conservation dimension pertains to management of wildlife. Application of WAVS in more than a dozen management contexts over more than 15 years in New York State has helped wildlife managers evaluate their assumption that rural and non-rural residents would differ in their tolerance for conflicts with wildlife and their likelihood of supporting certain kinds of management actions (Butler et al. 2001). Instead of differences, the authors (Butler et al. 2001) found that both rural and urban people's tolerance for experiencing conflicts with wildlife decreased over a 15-year period. Further, managers had assumed that protectionist values had been increasing over time. Instead, Butler et al. (2001) found that protectionist values had remained stable, bringing into question another assumption that society had become less accepting of the idea of managing wildlife populations to address conflicts.

However, understanding attitudes based upon Kellert's typology, WAVs, or NEP may not directly provide managers with information to make informed management decisions regarding wildlife-human interactions, particularly when such attitudes manifest themselves in different behaviors and when the attitude scales are broader than the specific management issue at hand. Even so, understanding attitudes can shed light on how the public feels generally about a wildlife species, interaction, or management action. It also can increase understanding about why people seek certain kinds of park experiences or why they support or oppose different management actions. For example, people with more protectionist attitudes have been found to be less supportive of lethal control of mountain lions in areas near Rocky Mountain National Park compared to people not expressing protectionist attitudes (Zinn et al. 1998).

Understanding Beliefs – The Linkages to Attitudes

Social scientists also strive to understand the belief component (i.e., items that may or may not be true) of attitudes and explore linkages between beliefs and attitudes toward management options and the species, thus providing park managers with the necessary information to design more effective interpretation programs and messages. Gray (1985) has suggested that beliefs about wildlife are complex and multidimensional in nature, requiring multivariate analysis. For example, Bath (2002) identified key beliefs of residents who lived near Terra Nova National Park, Newfoundland that were most directly related to attitudes toward the endangered Newfoundland marten and its management. Such information may enhance effective design and evaluation of research programs in national parks by helping to target interpretive messages to key audiences, thus

resulting in interpretive programs that resonate with visitors. By understanding beliefs, park managers can also develop recreational opportunities for people that are consistent with people's attitudes and values toward wildlife.

Understanding Wildlife-People and People-People Conflicts – Risk Perception and Public Involvement

Wildlife-human interactions involving conflict can be considered in terms of human tolerance for the wildlife species in question (e.g., risk perception, wildlife acceptance capacity), but conflict can also be explored in terms of conflicts between various interest groups regarding the management solution to a wildlife-human interaction. The former involves scientific research based upon theoretical approaches; the latter depends on a more practical public-involvement process requiring an understanding of conflict, principle versus position negotiations, and public involvement approaches and tools. Examples of both are discussed in this section.

Wildlife-human interactions described as conflict can be understood when framed using the concept of risk perception. Risk perception is a belief or view of what the probability is, or could be, of adverse effects of a wildlife-human interaction (Knuth et al. 1992). Park visitors may have accurate or inaccurate assumptions regarding possible risks associated with interacting with wildlife. For example, Riley and Decker (2000) found that Montana residents' perceptions of the risk of serious injury from mountain lions greatly exceeded an objective measure of actual risk. They found that people's perceptions of risk were influenced both by cognitive risk judgments (i.e., the probability of a risk event occurring) and affective risk judgments (i.e., level of fear associated with a risk event). An elevated risk perception can occur if people's affective risk judgment is high, even if they know that the actual probability of a terrifying event is very low.

Risk management can be used to "...integrate risk assessment data with social, economic, and political information to decide how to reduce or eliminate potential risks identified" (Reinert et al. 1991). In Terra Nova National Park there are approximately 25 moose-vehicle collisions each year in the park, even though moose densities are several times higher outside the park where collisions are very few. Moose biologists found no clear patterns between the occurrence of moose-vehicle collisions and either characteristics of the moose (age, condition, sex, home ranges) or vegetation along roads where collisions occurred. A human-dimension study, focused on drivers' perceptions of risk, knowledge, beliefs, and driving behavior, revealed most respondents did not realize when most collisions occurred, perceived a lower risk than actually existed, were willing to not drive at night, and did not realize that most collisions occurred when the animal came from the opposite side of the road while drivers were concentrating on the nearest ditch or talking with a passenger (Bath 1997). Integrating this social science information with the biophysical data provided managers with a better understanding of the moose-vehicle collision situation in Terra Nova National Park, enabling them to design effective education efforts to help reduce accidents (Bath 1997).

Interest groups (e.g., livestock operators, timber companies), local/gateway communities, and aboriginal people may be located outside the boundaries of national parks in North America and thus be affected in unique ways by decisions made within park boundaries. These groups may have heightened risk perceptions regarding loss of livestock due to predators protected within park boundaries (Bath 1989, Scarce 1998), increased perceptions of possible damage to agricultural lands (e.g., haystacks) caused by protected ungulates, and heightened perceived risk of transmission of disease (e.g., brucellosis transmission from bison) to domestic livestock (Aguirre and Starkey 1994, Inserro 1997). Those involved in the livestock industry on the boundaries of a national park may have a variety of concerns, including loss of income from treating sick animals or not being able to sell agricultural products, concern about the welfare of their animals (i.e., worry about animals becoming sick or injured), loss of personal investment in husbandry knowledge and skills, and the loss of self-determination and freedom (i.e., loss of a traditional way of life). Park

managers can benefit from determining which risks are most important to the livestock operator and which risks are above acceptable levels. If managers simply make assumptions about which risks are perceived to be above acceptable levels and take actions to manage those risks, either by mitigating them (e.g., physically separating wildlife and livestock by electric fences or other means), or by communicating about real economic risk, they could be managing the wrong problem. Scarce (1998) found that relatively low acceptance of fair-market-value compensation programs was related to the fact that farmers cared more about loss of self-determination and freedom than possible economic losses associated with livestock depredation. This indicates the importance of ascertaining how people define a problem, either in terms of risk perception or inconsistencies between opportunities and motivations, and articulating and examining all assumptions about the issue (Enck and Decker 1997).

Related to risk perception is the concept of wildlife acceptance capacity (WAC). WAC is adapted from the notion of biological carrying capacity and is an assessment of the maximum number of individuals of a species that is acceptable to people in an area (Decker and Purdy 1988). WAC is based on people's perceptions of the negative impacts that a wildlife species may cause in an area, rather than on a biological estimate of population numbers. This hierarchy of perceived negative impacts influences the upper acceptable limit of a wildlife population. In general, WAC will be lower for animals that pose a perceived risk to human health and safety (e.g., mountain lions) than for those that pose a risk of economic damage (e.g., ground squirrels in campsites) (Decker and Purdy 1988). However, the number and types of actual interactions, amount of controversy surrounding management of those interactions, amount of concern that people have about a potential risk, wildlife species involved, and perceptions of wildlife population trends all can influence WAC (Decker and Purdy 1988, Craven et al. 1992, Loker et al. 1999). For example, Pelton et al. (1981) found that visitors' tolerance of nuisance encounters with black bears in Great Smoky Mountains National Park increased with increasing level of previous experience with bears.

A more recent outgrowth of WAC is the notion of wildlife stakeholder acceptance capacity (WSAC) (Carpenter et al. 2000). WSAC is an improvement over wildlife acceptance capacity because it includes recognition that people perceive a range of acceptable population levels. People do not want a wildlife population to drop below some minimum acceptable threshold, nor exceed some maximum acceptable level. Both minimum and maximum thresholds are determined for any group of people by the ways in which they weigh the various positive and negative impacts associated with wildlife-human interactions. The lower limit is the willingness of people to accept the absence of positive interactions and the upper limit is the willingness to tolerate negative interactions. Application of these concepts remains limited in the wildlife management area, especially with species that are not hunted as a population-control mechanism. In national parks and protected areas where hunting is prohibited or restricted to traditional uses, there is a need to test such theories.

Conflict between wildlife and humans is subjective. What is considered a conflict to one person or interest group may not be viewed as a conflict by another interest group. National park managers face many conflicts between interest groups over wildlife-human interactions, including whether to restore wolves, whether to prevent bison from migrating out of a park, whether to minimize disturbance of wildlife by closing trails or campsites, and how best to prevent habituation of wildlife. Successful resolution of people-people conflicts requires an understanding of the types of conflicts. According to Mitchell (1989) there are four basic types of conflict: 1) cognitive (based on differing beliefs of what may or may not be true); 2) value (based on differences in importance of wildlife in comparison with other aspects of society); 3) costs/benefits (based on economic factors, such as who benefits and who pays); and 4) behavioral conflicts (based upon mistrust or on the credibility of an individual or particular agency). Any one or more of these types of conflict may exist in the context of wildlife-human interactions. Social scientists can help managers identify the types of conflicts, thus providing the necessary first step toward conflict resolution.

Enjoyment of Wildlife by People – Understanding Motivations and Satisfaction

To understand enjoyment of wildlife by people, social scientists understand people's expectations, motivations, and satisfaction levels. Motivation theories are used to explore why people interact the way they do with wildlife-related recreation activities, thus allowing managers to understand the outcomes, expectations, and benefits people seek from a wildlife-related experience. One major theoretical approach is to view satisfaction as a function of the discrepancies between expectations and actual experiences (Decker et al. 2001). Hendee (1974) began discussions about motivations and satisfaction levels when he explored satisfaction levels of hunters and concluded that satisfaction is a multi-faceted concept, not just dependent on hunters bagging game. Decker et al. (1984, 1987) further explored motivations of hunters based on need-classification theories. They found three important motivations: 1) affiliation (i.e., enjoyment of being with others), 2) achievement (i.e., reaching specific goals, such as bagging an animal), and 3) appreciation (i.e., seeking peace in the outdoors). While hunting is not usually an issue within national parks, the motivations for participation in this activity may also be important in understanding wildlife-human interactions classified as enjoyment of wildlife by people in national parks.

Driver et al. (1991) have used the expectancy-value theory of motivation to explore a variety of wildlife-related recreation opportunities. The theory states that a person's choice of activity is a function of expectations that certain behaviors will lead to desirable events and the likelihood that those events will lead to valued psychological outcomes (Decker et al. 2001). Knowing motivations can help managers better understand their customers and thus increase satisfaction levels. In addition, such information often aids in identifying sources of conflict between interest groups regarding wildlife-human interactions.

While national park managers routinely examine visitor satisfaction through general surveys and monitoring of complaints, such broad measures of satisfaction have limited use in guiding program development, as they tend to elicit consistently high rates of satisfaction and only measure major changes in the quality of service (Manfredo et al. 1995). As discussed earlier, satisfaction can be viewed as a function of the discrepancy between visitor expectations (influenced by perceptions, knowledge, and attitudes) and the fulfillment of those expectations on-site (Decker et al. 2001). To inform management decisions in national parks, complex research designs involving pre- and post-tests and focused upon understanding expectations are needed, rather than after-the-fact, one-shot satisfaction studies.

Visitor satisfaction related to enjoyment of wildlife can be influenced by a variety of factors, including perceptions of human crowding. For example, Whittaker (1997) helped establish use limits on bear-viewing platforms that maintained visitor acceptance and satisfaction levels while addressing the ecological concern of limiting the number of visitors because of effects upon grizzly bears (Olson and Gilbert 1994).

Effects on Wildlife of Harassment - Moving beyond Biophysical Issues to the Human Dimension of Values, Conflict Resolution, and Public Involvement

Our review of the literature suggests that much research pertaining to wildlife-human interactions in national parks has focused on biophysical effects to determine whether the human activity has a negative impact. Two challenges associated with these research studies are that measuring the effects of specific human activities on animals is often difficult and that determining whether the effect is "significant" depends on human values. Most studies are deficient in several ways; they may be too short in duration (Wiens 1984), may not have adequate controls or be replicable (Hurlbert 1984), or have too many confounding variables to isolate the effects of a specific human activity (Cooke 1980; van der Zande and Vos 1984; Bell and Austin 1985; Anderson 1988; Madsen 1988).

Beginning in the late 1990s and continuing

into the twenty-first century, managers in Yellowstone National Park and in Gros Morne National Park researched whether snowmobiling affects wildlife, whether the effects are "significant" and, if so, how those effects should be managed. In Gros Morne National Park, research found that caribou run from the sight of snowmobiles. Coincidentally over the past 20 years, both unregulated snowmobiling activity and caribou numbers have increased in Gros Morne National Park. However, the question of snowmobile management is not solely one of proving or disproving physiological effects on wildlife, but a human-dimensions question. If there were no negative impact by snowmobiles on caribou, would national park managers be concerned about the activity? Many would argue "yes," because the issue is more about motorized access to wilderness areas, perceptions of pristineness, and the UNESCO world heritage site image.

Cross-country skiers have a negative effect on elk in Yellowstone National Park, causing animals to flee (Cassirer et al. 1992). Similar research in Elk Island National Park, Alberta found that moose numbers were negatively associated with cross-country ski trails. However, the issue of cross-country ski management in Yellowstone and Gros Morne national parks has not appeared in the scientific literature. Again, an argument can be made that resolving the issue is less about biophysical impacts and more about perceptions and attitudes of what is appropriate recreation in national parks.

The research questions regarding harassment and effects on wildlife are in many ways social science questions that need to be addressed through assessments of values, attitudes, and beliefs. The question for the many different interest groups concerned about snowmobiling activity in Yellowstone and Gros Morne should be one of "do people care about these wildlife species and what happens to them?" The answers to such complex issues can be informed by understanding the perspectives of all interest groups involved with the issue. In Gros Morne National Park a facilitated workshop approach has allowed various interest groups to discuss common visions for the area, key objectives, and concerns regarding snowmobiling issues inside the park. Participants have been given a mandate to work together using consensus to find a solution, and while the group can not "fetter the Minister's decision," it is understood that if a diverse group of interests could reach agreement this would be a powerful recommendation that would not be lightly dismissed. In the USA, federal laws (e.g., NEPA) prevent the use of such techniques for direct decision-making and management planning. However, such techniques might be used by national park managers to gain insights about the range of issues that need to be considered in any management actions.

Public involvement, defined as a redistribution of power from decision-makers or managers to the various publics (Praxis 1988), can contribute to the solution of many wildlife-human conflicts. National park managers can benefit from engaging community residents who live inside or outside the boundaries of the national parks in meaningful public involvement processes. Building trust and credibility with local communities is the first step toward understanding and addressing the various categories of wildlife-human interactions.

Conclusion

Our review of the literature determined that many types of interactions between humans and wildlife (e.g., physical, physiological, economic) have been documented, that specific interactions have been interpreted, studied, and managed from both a people perspective and a wildlife perspective, and that for different people the same interaction may have positive or negative effects, depending in part on the attitudes and motivations of people before, during, and after such wildlife-human interactions. Our review also discerned that different interest groups interpret wildlife interactions (e.g., predator-prey) or wildlife-habitat interactions (e.g., impacts of herbivores) as desirable or unacceptable, demonstrating that the effects of wildlife-human interactions also can be indirect.

Although research exists about public attitudes toward management options regarding large carnivores in national parks, surprisingly little

research was found about the importance of wildlife experiences to visitors' overall recreational experiences. Application of social science research can help managers make better management decisions about wildlife viewing, evaluation of interpretive programs, and provide a better understanding of community attitudes toward management issues and broader national park system goals. Our review suggests that much of the social science research to date done in Canadian and USA national parks has been issue-oriented and one-shot in nature. Similar to how biophysical scientists do long-term monitoring of biological populations, permitting them to assess changes after certain policies are implemented, there is a need for more longitudinal research and monitoring of attitudes and beliefs in national parks to assess the effects of interpretive programs and community-outreach education efforts. Satisfaction research currently being done in national parks could be set within a theoretical context that would provide managers a much better understanding of visitors' expectations and motivations and whether these were met. Such satisfaction research would provide a much better understanding of visitor satisfaction than the existing general visitor surveys currently employed. This being said, there have been many applications of theory without directly focusing on informing management decisions, and thus a real need exists to develop decision-based research agendas.

We suggest that managers can benefit in their decision-making by considering the degree to which specific kinds of interactions could be interpreted as either positive or negative, depending on the values and attitudes of the people involved, and depending on whether the interaction is considered from the perspective of humans or wildlife. Public acceptance of, and support for, management decisions regarding wildlife-human interactions likely will be highest when the public believes management "solutions" are consistent with their perceptions of management "problems" (Decker et al. 2001). Social science research can help understand what people do, why they do it, and what they think. With this information, national park managers can better manage wildlife for their entire resource constituency.

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Glossary

attitudes: Attitudes are general feelings toward an object or issue. Human-dimensions researchers are interested not only in the direction of the attitude (i.e., positive, negative or neutral), but also in the strength of the attitude. Attitudes are made up of four components: affective (i.e., liking or disliking of an object), cognitive or belief component (i.e., ideas that may or may not be true), behavioral intention (i.e., what people say they will do) and behavior (i.e., overt or actual behavior).

conflict: Conflict is a term used to describe various interactions and reasons for interactions between people. There are four basic types of conflict: cognitive conflict arising from differences in knowledge and beliefs between individuals or groups; value conflict arising from differences in the hierarchy of importance of various values between individuals or groups; costs/benefits conflicts arising from disagreements over which individual or group bears the costs and reaps the benefits; and finally behavioral conflicts focusing on mistrust and credibility issues between individuals, groups, or agencies. Several types of conflicts can occur at the same time.

harassment: Harassment to wildlife includes activities that cause excitement and/or stress to the wildlife, disturbance of essential activities such as breeding and feeding, severe exertion, displacement, and sometimes death.

non-consumptive wildlife use: Non-consumptive wildlife use includes activities in which people enjoy interacting with wildlife without deliberately trying to kill the animal. Many researchers have documented negative impacts on wildlife caused by non-consumptive wildlife activities.

public involvement: Public involvement is a process of redistributing the power of decision-making from managers to the various publics that are affected or can affect the successful implementation of a decision. Public involvement should be thought of as a continuum, ranging from situations where various groups have very little influence on decision-making to those cases where groups have complete control over decision-making.

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Notes

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