

Spectacled Bear Conservation Action Plan

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IUCN Category: Vulnerable, A2bc **CITES Listing:** Appendix I

Scientific Name: *Tremarctos ornatus*

Common Names: spectacled bear; Andean bear; *oso de anteojos*, *oso frontino* (spectacled bear); *oso achupayero* (bromeliad eating bear); *oso ganadero* (cow eating bear); *el salvaje*, *oso real*; *manaba*; *meéni*; *ucumari*, *ucucu*, *uco*, *uca* (bear with mystical power); *puca mate* (red fronted bear from eating cows); *yura mateo* (white fronted bear); *yanapuma* (black puma)

Introduction

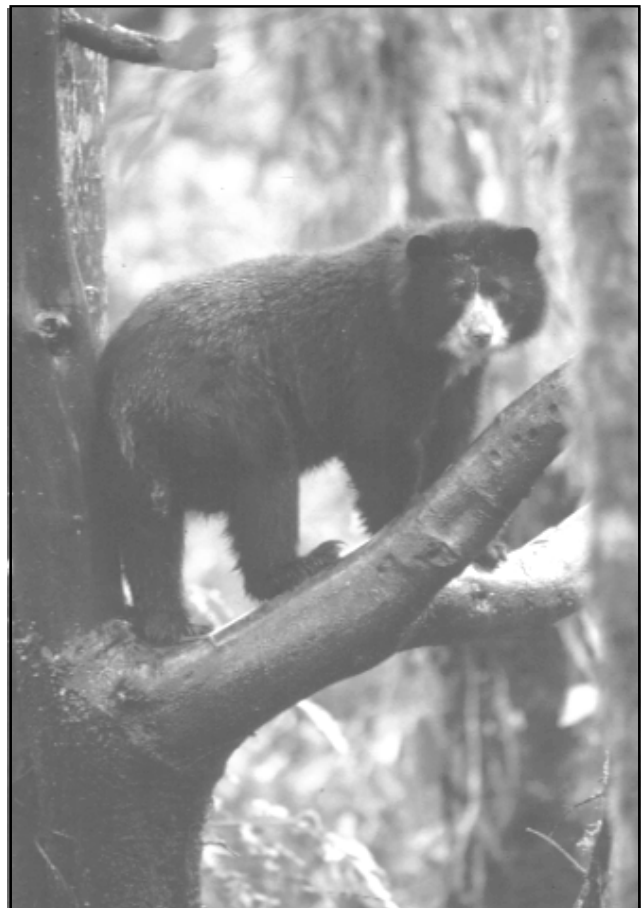
Between 1991 and 1993, five country reports (for Bolivia, Perú, Ecuador, Colombia, and Venezuela) were written by coordinators who solicited information from more than 60 individuals familiar with spectacled bears. This introduction contains a summary of the main themes addressed in these reports as well as information on the biology of the species, its management needs, and conservation value. The country reports contain detailed information on actions that are needed to counter threats to spectacled bear populations and their habitat.

Physical description: Spectacled bears are an intermediate-sized bear. Adult males measure 1.5 to 2.0m head-body length and weigh between 140 and 175kg (Peyton 1980, Mondolfi 1971). Female bears are 2/3 the size of male bears. Pelage is usually black but can be a dark red brown. The common name “spectacled” refers to the white to light yellow markings that appear on the bridge of the nose, and most often over or around one or both eyes, under the chin, and sometimes extending down to the chest. These markings are individually variant (Roth 1964).

Like all bears, spectacled bears are plantigrade and have longer front limbs than hind limbs. The latter feature enables bears to climb trees, a behavior spectacled bears are especially known for (Peyton 1980). They have stocky bodies, short tails that are often hidden in the fur, short thick necks, small rounded ears, and the shortest relative muzzle length of the extant bears (Mondolfi 1971). Spectacled bears also have the largest zygomaticomandibularis muscle relative to its body size of any bear species (Davis 1955). The last two features, which are shared most similarly with the giant panda (*Ailuropoda melanoleuca*), allow spectacled bears to grind tough fibrous foods, thereby securing its niche against competitors. Unlike the ursid bears whose fourth premolar has a more well-developed protoconid, an adaptation for shearing flesh (Kurtén 1966), the fourth premolar of

spectacled bears has blunt lophs (like its other molars and premolars), has three pulp cavities instead of two, and can have three roots instead of the two that characterize ursid bears (Thenius 1976). The musculature and tooth characteristics are designed to support the stresses of grinding and crushing vegetation. Quite possibly spectacled bears are the most herbivorous of all bear species. They share the ursid dental formula of 42 teeth

Spectacled bear (*Tremarctos ornatus*) in Andean forest, Colombia.



L. Mazariegos

(i 3/3, c 1/1, p 4/4, and m 2/3). The chromosome number, $2n=52$, is unique among bears (Ewer 1973; Nash and O'Brien 1987).

Reproduction: Presumed mating pairs have been observed together at times of fruit ripening between March and October, indicating that wild spectacled bears may be adapted to breed at various times of the year, as they do in captivity (Dathe 1967). Like all bears, spectacled bears are monestrous. They are probably capable of delayed implantation as evidenced by the variable gestation periods of 160 to 255 days observed in captive bears (Saporiti 1949; Grzimek 1975; Bloxam 1977; Rosenthal 1987a) and wild births that occur "out of season", but appropriately timed for cubs to ingest ripe fruit during years when the El Niño current disrupts normal fruiting phenology. Wild births normally occur several months prior to a time of heavy fruit fall during the rainy season. The timing allows cubs to be old enough to ingest ripe fruits. Parturition for most spectacled bears in captivity (101 of 112 births, Mueller 1989) and the wild (Peyton 1980) occurs between December and February. From one to three young, weighing 300–330g each are born in captivity (Dathe 1967). Litter sizes in the wild range from one to four cubs with two being the most common. Generally reported litter sizes are positively correlated with hunter estimates of female weights, food diversity and abundance, and the degree to which fruiting is temporally predictable. Age of first reproduction in captive bears ranges from four to seven years for both sexes (Weinhardt 1987; Rosenthal 1987b). No data is available on age of first reproduction or litter intervals in the wild.

Social behavior: Spectacled bears are generally solitary, but are reported by farmers and hunters to feed in groups of up to nine individuals in *Opuntia* cactus groves and cornfields. Cubs have been reported to stay with their mothers for up to a year after birth. Spectacled bears are active both day and night in the cloud forest. They bed down under cover during the midday in the Peruvian desert. There is no evidence that spectacled bears hibernate.

Spectacled bears are able to climb vines and understory trees with diameters equal to that of their front paws in order to reach fruit in trees with diameters too large for the animal to embrace. In forest canopies that will not support a bear's weight, the animal employs a destructive foraging technique that results in the creation of platforms of bent branches that have been described as tree nests (Tate 1931; Peyton 1987). The repeated markings of climbing bears on fruit trees, and the prevalence of scats and day beds on inclined trunks and branches are evidence of considerable arboreal activity. When fruit is unavailable, spectacled bears subsist on tough fibrous foods such as leaf petiole bases of bromeliads (*Puya*, *Tillandsia*, and *Guzmania* spp.) and palms, frailejon (*Espeletia* spp.), orchid pseudobulbs,

and the meristematic tissue of certain bamboo and desert tree species. Additionally spectacled bears eat insects, rodents, birds, livestock, and carrion (Peyton 1980, 1987; Jorgenson and Rodriguez 1986; Suarez 1988; Brown and Rumiz 1989; Goldstein 1989).

Olfaction is the dominant sense. When disturbed from a day bed, spectacled bears walk several paces in different directions from a spot to which they return, then slowly negotiate steep terrain to escape. The importance of vision is suggested by saplings that are bitten and clawed on the sides facing trail entrances near concentrated food sources or along ridge lines. These signs could advertise territory ownership. The common name "ucucu", when said slowly, approximates a vocalization of the spectacled bear. Low and high pitched trills of captive bears have been postulated to function in keeping cubs and mothers united (Moss 1987).

Benefits of spectacled bear conservation

The arguments to maintain spectacled bear populations apply to all bear species; however, three benefits are particularly important to Andean residents:

Watershed maintenance: The loss of watershed products due to the destruction of bear habitat imperils the existence of Andean civilization as we know it. One half to more than three quarters of the people in the five Andean nations with bears live in highland areas close to spectacled bears (Gonzales 1991). The primary reason that governments established conservation units with spectacled bears was to preserve watershed products for this largely urban population. Their ability to govern depends on it. The trend is further deterioration of watersheds causing shortages in highland food production, drinking water, hydroelectric power, and transport capabilities. The social consequences are massive unemployment leading to anarchy in urban centers. Andean governments increasingly define the deterioration of watersheds as national security issues, sidelining their wildlife and parks officials in favor of their military to control insurgencies in the following bear inhabited areas: the Perija region of Venezuela, the central Andean range in Colombia and Perú, and the middle of the Oriental Andean range in Bolivia (see country reports). The root problem in all these areas was disproportional ownership of land and other resources; conditions which have forced farmers to abandon their fields and cut new ones on steep Andean slopes. Before long-term solutions to these social problems can be implemented, bear habitat must be maintained to prevent further social unrest that resources shortages will exacerbate. Adopting the goal of maintaining bear populations helps humans address their collective interests.

Biodiversity benefits: The spectacled bear is well-qualified to serve as an umbrella species for biodiversity in the Andes and in the world. For example, its range in the Oriental Andes from Venezuela to Bolivia comprises only 3.2% of land area in South America, yet contains 76% of the continent's mammalian species (Mares 1992). On a regional scale diversity of plant species in the northern Andes (30,000–40,000 spp.) is greater than that estimated for the Amazon basin, and far greater than the floristic richness of Europe and North America (Gentry 1982, 1991; Henderson *et al.* 1991). William Duellman (pers. comm. 1995, unpubl. data) found more than 150 species of frogs on one transect through spectacled bear habitat in Cayambe-Coca ER in northern Ecuador. This is roughly twice the number of frog species known to exist in North America (N=81 spp.). Approximately 15% of Perú's vascular plants and vertebrate species are present in 5% of Perú's landmass that is the spectacled bear's range in the cloud forests of the Oriental Andes above 1,500m (Table 9.6 in Perú's country report).

Local endemism is unusually high in the spectacled bear's range. The bear's range in the Oriental Andes from Venezuela to Bolivia contains 63% of South America's endemic mammals (Mares 1992). Typically, endemic woody plants comprise ca. 20% of the floristic richness found in these isolated habitat islands (Gentry 1986). The cloud forest range of the spectacled bear in Perú's Oriental Andes contains 32% of that country's endemic birds, mammals, and anurans combined. The ratio of the number of endemic species per unit area is approximately 5.75 times greater in these cloud forests than it is in Perú's Amazonian forest (Leo 1993). Existing conservation units contain only a small fraction of Andean biodiversity.

Cultural and spiritual reasons: In pre-Colombian mythology, the spectacled bear was worshiped as a grand mediator by which people and their endeavors passed from one condition to another, a role which undoubtedly derived in part from the bear's enormous elevational range (e.g., between the dark forces that inhabited the jungle and light upperworld on the mountain peaks, evil and good, sickness and health, death and rebirth, harvest and planting, and thus one year to the next; Randall 1982). Although increasing competition between bears and people for resources and the adoption of western culture has replaced much of the spiritual awe indigenous land users had for spectacled bears with machoistic values, vestiges of these early beliefs exist throughout the range of the spectacled bear, most notably in Colombia, southern Perú, and northern Bolivia. Everyone that identifies with spectacled bears, whether through humility or machismo, derives strength from this species to combat their deteriorating socio-economic conditions. A lot of hope for self-improvement will die with the extinction of spectacled bears in the wild.

Status and distribution

Spectacled bears occur in all three ranges of the Andes from the Cordillera Merida in Venezuela to the Argentine/Bolivian border (see country reports for details). The species has been reported to occur in the Darién region of Panama (Jorgenson 1984), and up until very recently in northwestern Argentina where isolated individuals may still exist (Brown and Rumiz 1989).

The altitudinal range of the species on the western Andean slope extends from 250m in the coastal deserts of Perú to 4,750m at the snowline. On the eastern Andean slope the known range extends down to 900m in parts of Ecuador and Perú, and 550m in Amboro, Bolivia. Within these elevational limits, spectacled bears inhabit dry thorn forests, humid to super-saturated rain forests, steppe lands, paramos, and puna grasslands. Before spectacled bear populations became fragmented during the last 500 years, a single spectacled bear population on the border of Perú and Ecuador inhabited as great a range of habitat types (250m to 4m annual precipitation) as the world's brown bears now occupy. The best habitats are humid to very humid montane forests. These cloud forests typically occupy a 500–1,000m elevational band between 1,000m and 2,700m, depending on latitude. Generally, the wetter these forests are the more food species they support for bears. That is a reason why relative population densities and reported litter sizes are higher in the tropical forests from Colombia to northern Perú than they are in the subtropical forests of Venezuela, southern Perú, and Bolivia. Most of the cloud forests are on the eastern slope of the Oriental Andes where an estimated 85% of the spectacled bear population is found.

Female spectacled bears with cubs occupy areas with concentrated food sources near relatively inaccessible security cover. In the Peruvian desert these areas are centered around water holes flanked by steep cliffs where day beds were found under boulders. Tree canopies provide security cover and fruit for cubs in the cloud forest. Female bears make use of paramo grasslands at the forest edge five to eight months after cubs are born. Security cover here is found in small forest patches on steep slopes. The thick tangle of branches up to 2m from the ground on frost damaged trees were microsites that yielded the most evidence of being occupied by cubs. These bedding sites were within 100m of concentrated sources of food (terrestrial bromeliads), and were generally located at the point where a stream entered the forest from the grasslands. Predators of spectacled bear cubs include mountain lion (*Felis concolor*), and possibly male bears. Spectacled bears appear to avoid jaguar (*Panthera onca*), suggesting that jaguar might be considered a predator. The elevational ranges of these two species in Perú and Bolivia do not overlap on the same mountain slope, but do for 900m of elevation if the entire Cordillera Oriental is considered.

Here, jaguar can occur up to 1,500m in elevation and spectacled bears can descend as low as 600m in elevation (B. Peyton unpubl. data).

Spectacled Bear Specialist Group (SBSG) members are confident that there are at least 18,250 wild spectacled bears. Given the amount of area the bears occupy, there could be several times that amount. Spectacled bears currently occupy at least 50 habitat fragments totaling

approximately 260,000km² (Figure 9.1, Table 9.1). Four habitat fragments probably contain more than 1,000 adult spectacled bears each. All of these occur on the eastern slope of the Oriental Andes. The largest habitat fragments are in Perú and Bolivia where over two-thirds of the bear's range exists (Peyton *et al.* 1997).

According to the IUCN Red List categories (IUCN 1996), spectacled bear populations are Vulnerable to



Figure 9.1. Range of the spectacled bear (*Tremarctos ornatus*) in Latin America's protected (black shaded) and unprotected (gray shaded) parts of the Andes. Letters denote parks or reserves that contain >1,900km² of habitat occupied by spectacled bears or that have that potential (areas A–C and G). Protected areas A–J are: A) Sierra Nevada/Tapo Caparo, B) El Cocuy, C) Sumapaz, D) Sierra de la Macarena, E) Cayambe–Coca/Sumaco–Napó, F) Sangay, G) Podocarpus, H) Río Abiseo, I) Manu, J) Carrasco/Amboro.

Table 9.1. Amount of spectacled bear range under conservation status (categories I–V of IUCN 1984) and in unprotected wilderness in five Andean nations.

Statistics also include the number of parks containing spectacled bears, their total area, and the total amount of spectacled bear range within a country. Figures in parentheses are the percent of protected land areas occupied by bears.

Country	Number of parks	Park area (km ²)	HABITAT OCCUPIED BY BEARS		Total bear range (km ²)
			Park (km ²)	Wilderness (km ²)	
Venezuela	13	14,230	1,000 (2.1%)	20,410	21,410 (8.2%)
Colombia	20	32,610	8,250 (17.0%)	21,830	30,080 (11.5%)
Ecuador	10	20,250	8,230 (17.0%) ^{**}	20,580	28,810 (11.1%)
Perú	6	23,330	5,760 (11.9%)	76,440	82,200 (31.5%)
Bolivia	9	54,210	25,150 (52.0%)	73,040	98,190 (37.7%)
Total	58	144,630	48,390	212,300	260,690

^{*} Area does not include the Galápagos Marine Resource Reserve;
^{**} Area does not include Langanates National Park and Illinizas Ecological Reserve because the extent of bear occupied habitat in these two recently created parks is unknown.

extinction. The accelerated pace of habitat conversion to commercial agriculture including drugs, hunting, and the threat of the illegal trade in bear parts all point to a faster rate of decline in both numbers of individuals, populations, and habitat than has existed in the past. Less than 10% of the original tropical montane forest remains in Colombia (Henderson *et al.* 1991), almost none remains in Ecuador's central valley between the Andean ranges, and less than 4% is left on the western Andean slope in Ecuador (Dodson and Gentry 1991). The largest remaining tracts of tropical montane forest exist on the eastern slope of the Oriental Andes south of the Ecuador/Colombia border.

The best measure that has benefited spectacled bears has been the rapid creation, enlargement, and connecting of conservation units during the last 30 years (see country reports for details). Currently there are 58 conservation units that contain spectacled bears that are classified in the first five IUCN management categories (IUCN 1984). All but two of these were established in the last 30 years, and 12 of them were established in this decade. Colombia has the most parks with bears (n = 20) and Bolivia has just over half the area with bears that is protected (25,150km² or 52%, Table 9.1, Peyton *et al.* 1997). Counting parks that are adjacent to each other or connected by corridors as one unit, eight protected areas contain over 1,900km² of bear occupied habitat (Figure 9.1). This area criteria was the median park size (n=41 parks) that contained a population of spectacled bears that were reported in 1988 to be stable or increasing (Peyton 1988). Until further studies are conducted, the SBSG considers 1,900km² to be the minimum size for a park to maintain a viable population of spectacled bears without fairly intensive management.

Legal status

Although hunting of spectacled bears is prohibited under forestry laws in each of the five Andean countries, the laws are not enforced. As a species listed in Appendix I, trade

in spectacled bears and their parts is prohibited in these countries under the terms of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Recently enacted legislation in Bolivia (1990) and Perú (1992 and 1993) threaten both these protective measures by allowing the take of spectacled bears for captive breeding purposes without sufficient background checks on where the bears came from or monitoring what happens to them.

Management

With the exception of productive efforts in Venezuela to manage spectacled bear populations based on mostly anecdotal information, there is no population level management being implemented for spectacled bears in the Andes that has an empirical foundation. The centralized decision-making abilities of Andean governments has allowed them to address the threats of diminishing populations of spectacled bears on theoretical grounds without hard data (e.g., create new parks and significantly enlarge others to connect habitat fragments).

Up until the last 15 years, government authorities have relied on the inaccessibility of cloud forest strongholds to protect spectacled bears. The problems associated with the increased influx of landless peasants into spectacled bear habitat (see country reports) necessitates active management at a time when institutions and their budgets are severely stressed. The consolidation and decentralization of resource management agencies that occurred in Perú in the late 1980s and in Colombia in 1993 has placed severe strains on these countries to implement management on the ground. For example there is only one park guard for every 5,700km² of spectacled bear habitat in Perú (Young 1992), and no vehicles for transportation. The situation is similar in Bolivia where only three of 36 parks had guards in 1991 (Marconi and Donosco 1992). Lack of inter-ministerial cooperation has resulted in governments supporting

colonization, building of roads and infrastructures, oil extraction, timber harvest, and mining in national parks where such activity was prohibited (notably in Ecuador and Bolivia).

Management styles differ dramatically between Andean nations. Over the past 40 years, Venezuelans have invested oil profits in training technicians in managerial sciences. The strong institutions that resulted from these investments could afford to implement a top-down approach to protecting spectacled bear habitat. This they have done by declaring new national parks that link existing ones and removing villagers within them. The other four nations that lack both the financial and trained human resources have implemented more management sharing operations between government, private industries, and native people to protect spectacled bear habitat (notably Colombia). Proponents of these two approaches have much to teach each other.

One of the reasons why Venezuelans have been successful at implementing conservation action from the top-down is because only 1% of its population are indigenous people. Native people comprise a great deal more of the populations of Ecuador (21.8%), Perú (35.4%), and Bolivia (21.8%, Schwerin 1991) and are the majority of the people who live with spectacled bears in these countries. Policies that encourage formal employment of these people will benefit spectacled bears more than current policies that drive them further into bear habitat.

Human-bear interactions

Spectacled bears are perhaps the least aggressive of all bear species towards humans. During four years of field work throughout Perú, B. Peyton (unpubl.) heard of only one human death caused by a spectacled bear that fell on a hunter after he shot it, and one woman who was bitten on the cheek after a surprise encounter with a bear in a cornfield. The predominant interactions are with bears that eat corn that has replaced their natural food sources. As many as 20% of the cornfields at the forest edge are besieged by spectacled bears. A few bears kill cattle, and many kills are wrongly attributed to spectacled bears. Hunter induced mortality of crop depredating spectacled bears has increased to the point where it is perceived to be as great a problem as habitat destruction (Yerena 1998). There is evidence that spectacled bears reduce both their habitat use and communication with each other following the introduction of cattle in wilderness areas (Downer pers. comm. 1993).

Public education needs

Twenty years ago it was uncommon to find someone from an Andean city who knew spectacled bears existed. Such is not the case today. Leading the way have been hundreds of

non-government conservation organizations that do everything from conducting radio talk shows and lobbying legislators to managing nature reserves. The primary needs are to educate Andean residents about their role in preserving watershed products. As the largest resident of these watersheds, the spectacled bear has become symbolic of humanity's future existence.

The target of education should include more rural inhabitants with messages that address their real concerns of land titles and food security (crop depredation included). Lack of education and other means toward upward mobility in rural areas is a major reason why peasants leave farms for overcrowded cities. Latin America now has the most urban population of any continent (75% of total population, WRI 1992), a fact that belies the magnitude of these human migrations over the last 45 years. The predominantly urban population places demands on the spectacled bear habitat to provide resources that are disproportionate to the number of rural inhabitants who live with bears. At the institutional level, administrators need to become more aware of the state-of-the-art theories and practices of managerial sciences.

Specific management recommendations

1. Strengthen institutions

The first ingredient in any bear survival plan are strong institutions at all social levels. Institutions need improvements in policy coordination, training, and funding. The lack of policy coordination between government ministries is evidenced by stronger ministries (e.g., military, those regulating extractive industries, colonization, tourism, etc.) ignoring the sustained resource use policies of the weaker ones. For example oil concessions were granted in Sumaco Napo–Galeras within days of its being established as a national park (Wray and Alvarado 1996), and parts of Amboro have been simultaneously designated national park land as well as land for colonization and timber harvest (see Bolivia's country report). This lack of coordination confirms feelings of distrust that local communities have had about central governments for hundreds of years. Up until the last decade wildlife agencies were powerless to change that situation. Deficits in trained staff and funding severely limited abilities of central governments to enforce policies and monitor their compliance in rural areas. Community institutions were not granted authority over local resource use, and thus were powerless to prevent resources being wasted by outsiders and their own members. Recent partnerships between central government agencies, industry, communities, and private organizations have empowered people at all social levels to preserve resources. An important objective facilitated by private and foreign

aid has been the training resource managers have received in practical and theoretical conservation science.

2. Research and monitor distribution, threats, and trends in spectacled bear populations and habitat.

The level of information on spectacled bears and their needs is in its infancy. Geographic distribution of spectacled bears is not known for much of Colombia, most of southern Ecuador, and northern Bolivia. Distribution of bears within national parks, and their seasonal habitat use has only been studied in some detail in five of 58 parks with bears. There is no information to construct a life table, or estimate reproductive parameters to model the trend in a spectacled bear population. Difficulties such as the inaccessibility and complexity of cloud forests make it unlikely that we will soon know detailed information on the needs of females with cubs, litter sizes, when females first reproduce, and seasonal movements of bears or their home range sizes.

Notwithstanding difficulties, research should generate the most useful information with the least capital expenditure and impact on bears (Servheen 1994). Research questions that meet these criteria seek to know: how much habitat spectacled bears occupy or could potentially occupy (both in and outside parks), relative population densities in these habitats, relationships between diet and reproduction in the wild, role of spectacled bears as dispersers of lumber-producing trees, trends in forest cover removal, hunting mortality, economic loss from crop and livestock, and public attitudes towards bears. Land managers thus informed could decide with greater confidence to protect critical habitat, or enact programs to reduce bear mortalities and crop depredation, etc. Research does not need to be expensive, employ high technology, or be lengthy to meet immediate management needs (Servheen 1994).

3. Concentrate management efforts in the 12 largest areas under conservation status (Figure 9.1) and/or in conservation units near large cities. Expand management to the areas between conservation units.

The era of park creation in the Andes is drawing to a close. Andean governments are starting to recognize the colonization and logging that has taken place within national parks such as Sangay (Ecuador) and Amboro (Bolivia) by reclassifying those lands as human use areas. Land in parks will continue to be lost to bears and other wildlife unless parks can become viable institutions of conservation. Management efforts should focus on the 12 largest areas of protected bear habitat (Figure 9.1), and some smaller bear areas near major urban centers such as Chingaza NP. Approximately 20% of Colombia's people (residents of Bogota) depend on Chingaza to provide water and hydroelectric power. Protected bear areas near urban centers also have greater educational and

recreational value than areas farther away. Management should expand outward from these core areas to link them together or create buffer zones against further habitat fragmentation. Andean parks with bears are most linked in Venezuela and most fragmented in Perú. Although Perú has 31.5% of the total range of the spectacled bear in Latin America, only 7% of that range is included within park boundaries (Table 9.1). Three parks on the eastern slope of the Oriental Andes have approximately 90% of the protected bear habitat in Perú and are separated from each other by >250km of unprotected wilderness (Peyton *et al.* 1997). In addition to preserving land bridges within Perú, transfrontier corridors should be protected between Ecuador's conservation units and those of its neighbors (El Angel with the Awa NR in Colombia, and Podocarpus with Tabaconas–Namballe in Perú). In addition to protecting bears, these transfrontier parks would promote peace and protect two of the Andean areas of highest species diversity.

4. Create stewardship for bears and their habitat at the local level. Implement government policies that allow local communities security of land tenure. Link benefits facilitated by these policy changes with compliance with forestry law.

The existence of wild spectacled bears is dependent on communities having stewardship for them and their habitat. Land use policies throughout the Andes encourage the mining of cloud forest products without replacement. Communities with unrecognized land ownership rights and without access to credit or technical aid have little ability to thwart the destruction of resources by outsiders, and are encouraged to exploit resources before others do (see Brown and Wyckoff-Baird 1992). The necessary condition for the survival of spectacled bears are the incentives to use resources sustainably. Incentives are created by providing ownership and a shared responsibility for how those resources are used. At least 20% of the spectacled bear's range is occupied by landless peasants who are involved in the production and trafficking of narcotics, informal subsistence farming, mining, and road building. These events are the result of failed policies to initiate land reform and formal employment (Peyton *et al.* 1997).

Policies and programs that increase employment for rural inhabitants should compensate for their reduced use of forest resources and be conditional on their compliance with forestry laws. Andean forests will continue to be cut down and bears will be poached until people perceive it in their best interest to stop these actions. A more decentralized and flexible management style that adapts to regional concerns will be necessary. Alternative employment to shifting agriculture and unsupervised grazing that have benefited rural inhabitants should be expanded upon (e.g., orchid farming, palm oil extraction, pharmaceutical development, tourism, etc.). Biologists

can do their part by designing research and monitoring projects to use the existing abilities of local inhabitants.

5. Educate the public, both national and international, about the benefits of preserving watersheds and spectacled bears.

Severe shortages of watershed products for urban centers is sufficient evidence for land managers to argue that preserving forests for bears also benefits humans. However, education at all social levels is required before collective action will take place. Heads of government should be made aware of the waste of natural capital (e.g., topsoil, fiber, fuel, etc.) that occurs when bear inhabited forests are converted to pasture. Administrations could more accurately estimate the impact of their policies once these costs are accounted for. The international community must learn that political stability in the Andes is a precondition for maintaining Andean environments and stopping the spread of subversive activities. Current policies of the more developed countries (e.g., trade barriers, domestic subsidies for agricultural produce, control of capital markets, drug eradication programs, etc.) increase political instability in the Andes. Two decades ago few urban residents in the Andes knew spectacled bears existed. Such is not the case today due to the public education efforts of hundreds of local private conservation organizations. These efforts must continue and include more programs that target rural inhabitants. Wildlife and park administrators have little ability to enforce forestry law or mitigate abuses. However, people can be held accountable for destroying bear habitat or poaching bears with pressure from an informed public. The following section contains the lesson that needs to be conveyed.

Status and management of the spectacled bear in Bolivia

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Historic range and current distribution

The oldest records of spectacled bears (*Tremarctos ornatus*) in Bolivia belong to D'Orbigny and Gervais (1847), who reported the presence of this species in Cochabamba and Chuquisaca, and to Arribalzaga (in Salazar and Anderson 1990) who also collected a specimen in Cochabamba for the Museo Argentino de Ciencias Naturales. It is difficult to assess the former distribution of the bear in Bolivia because there are not more than a dozen collecting sites. Based on habitat information from Peru (Peyton 1980), data on the historic presence of the bear in Northern Argentina (Brown and Rumiz 1989), and information

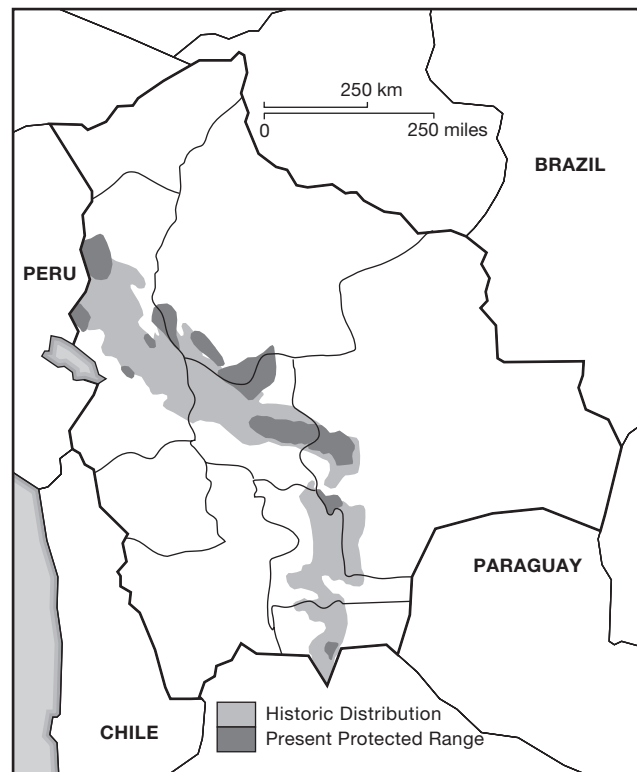


Figure 9.2. Probable historic distribution and present protected range of spectacled bear (*Tremarctos ornatus*) in Bolivia.

available pertaining to Bolivia, it can be assumed that in early 1900, spectacled bears occupied the eastern flank of the Andes, approximately between 500 and 3,000m. A possible exception to this distribution would be the dry valleys on the borders of Cochabamba, Santa Cruz, and Chuquisaca Departments (Figure 9.2).

The current country-wide distribution of the bear cannot be accurately depicted with the available information, except by extrapolating from 40 locations of signs, sightings, and collection sites from several sources (Salazar and Anderson 1990; Eulert 1995; Michel, J.A. pers. comm.) (Figure 9.2). These localities include mountain forest ecosystems between 550 and 3,200m, and a few non-forested slopes above 3,200m. Some localities may encompass areas which represent important bear populations (e.g. sites in Santa Cruz and neighboring Cochabamba, or in Yungas of La Paz), while in other sites the species may have disappeared. Extensive surveys are needed to update the bear distribution.

Status

Spectacled bear population numbers and range in Bolivia are the least known of any of the five South American countries that have bears. There has not been a country-wide survey carried out yet, and potentially important

areas remain to be assessed. However, the presence of significant populations in the best known areas of La Paz and Santa Cruz shows the potential within this country for the long-term survival of the species.

Legal status

Bolivian national laws regarding particular wildlife species have existed since the last century, although for the most part, these regulations have had little or no impact on preventing poaching or regulating hunting. Prior to 1967, regulations only established taxes for trade on skins and live animals (Decreto Ley, DL# 04151 of 29/08/55; Decreto Supremo, DS# 05094 of 21/11/58; DL# 07784 of 03/08/66), and the last two laws specifically addressed tax values for spectacled bears, among other species. Hunting and trade of bears was prohibited in 1967 (DS# 08063), and in 1970 (DS# 09328) a fine was set for transgressors. A ban on hunting, transport, and trade of a list of endangered species, which included the spectacled bear, was established in 1979 (DS# 16605). The ban was extended to all wildlife for three years in 1986 (DS# 21312 of 27/06/86), and then it was extended indefinitely in 1987 (DS# 21774 of 26/11/87). In 1990, the government ratified this law and clarified that collections for scientific purposes were excluded from the ban, as long as Bolivian scientific institutions were involved (DS# 22641 of 08/11/90). However, because of lack of enforcement, none of these laws have prevented the killing of bears or their sale to zoos. This lack of law enforcement regarding wildlife issues in general is due to a series of factors, among which the inefficiency and lack of power of local wildlife officials have been the most important.

Population threats

Hunting of bears has been recorded in most parts of its range, and usually occurs when bears frequent either cornfields or grazing pastures. Bears are blamed for any cow killed or lost. Soon after a carcass is found, small hunting groups (2–3 people) are organized to go after any bears present. There are few accounts of people actually seeing a bear taking a cow. One person reported, "... the bear grabbed the animal by the horns, twisted the head towards the cliff and pushed it off. Once the animal is dead in the base of the cliff, then the bear climbs down the cliff and eats the stomach ..." (Salazar and Yañez, unpublished). Also in the Yungas of La Paz, bears are hunted because they raid cornfields, and they can "... easily consume 10 ears of corn every nine meters when alone, but they often come in pairs or with youngsters ..." (Salazar and Yañez, unpublished). These incursions usually happen in June or July (austral winter), a period of the year when it is dry and

the forest has no fruit. During this time, the bear preferentially uses the wet puna above the tree line and feeds on bromeliads and other plants. However corn represents a more attractive option for the bears.

There are no general estimates of the number of bears killed in Bolivia, but local reports indicate that bear hunting is widespread. In the Cordillera del Tambillo and Cordillera de Yunga Cruz, an area in the Yungas of La Paz Department, 56 bears were reported killed and six cubs were exported alive in different localities and time periods (Table 9.2).

Restricted data for a nearby region, the Cordillera de Quimsa Cruz (Salazar and Anderson 1990), show about ten adult bears and one youngster killed during a period of about ten years (1979–1989) within an area of 1,000km².

Other records of bears killed or captured are available for other parts of the country. In the Cordillera de Tiraque, Department of Cochabamba, an adult male weighing 150kg was killed by personnel of the Forestry Development Office in 1990 because it allegedly attacked cattle. Around the southern border of Amboró NP, in Santa Cruz Department, park guard records accounted for another ten bears killed by local people since the establishment of guard posts two years ago (1991 and 1992). Further to the south, in Huacareta (Department of Chuquisaca) in 1992, a female was killed and her cub was sold to the zoo in La Paz.

The lack of compliance and enforcement of the law regarding the hunting of bears is blatant. This is mostly due to ignorance or purposeful disregard of the law, both by local people and authorities. The situation is aggravated by the remoteness of the areas, the perception that it is justified to kill them because of the damage they do or may do, and the monetary or other return which is obtained from the animals. Bear remains are found in the houses of hunters, and are either used as decorations (paws) or as beds (pelts). Some people mentioned that in some seasons of the year, bear meat can be consumed and the fat is stored for cooking.

Native South Americans had a perception of the bear that was different from that of the cattle-killer or crop-raider. As early as 1600, Huaman Poma de Ayala described the bear as an important member of the religious world of these people. For them, it was a punishing manifestation

Table 9.2. Record of bears killed in the Yungas of La Paz.

Locality	Years	Bears killed	Extra cubs?
Tablería	1980–1992	17	
Santa Bárbara	1980–1992	12	8
Cau-Cau	1990	6	
Curihuati	1980–1992	8	2
Chilkani	1980–1992	10	several
Zorrizani	1990–1992	3	1

of the divinity, or a benign anthropomorphic being. Indeed, several tales currently told by campesinos depict the bear with a protective attitude towards people. Over time, these perceptions have changed, influenced by more secular religions. The old positive attitude towards the bear is loosing ground.

Habitat threats

The most menacing threat to the survival of the spectacled bear in Bolivia is the rapid rate of colonization and habitat clearing. This is particularly problematic, because, in most cases the damage is non-reversible. Liberman (1991) showed that because of high rainfall and steep slopes (60° on average), most of the topsoil in the cloud forest of the eastern Andes tends to be lost immediately after the forest has been cleared. Arce (1988) has identified five major threats to what he called the “ceja de selva” ecosystem in Bolivia. Among them are: expansion of the road system from the highlands to the lowlands, cattle grazing, mining, industrial agriculture, and logging.

Human population densities are higher in the highlands (altiplano) (15/km²) and lower in the lowlands (5/km²), although the lowlands produce the majority of goods and services that the populations in the highlands consume. This economic activity has resulted in the improvement of the road system, especially after the Agricultural Reform of 1952. Road improvement fostered the opening and expansion of the land area for cultivation and created the economic circumstances that encouraged the commercialization of agriculture. Since 1952, the size of the road system has increased about 70%, linking production centers with the centers of consumption and fragmenting the bear’s ecosystem. In one of the first environmental impact assessments of road construction in the Yungas of La Paz, Liberman (1991) found that even in the early phases of road construction, the area of influence around the road strip increased from an estimated 20m to almost 2km on each side of the road for large mammals. The increase of human population along these roads, and the introduction of high value cash crops such as coca and tea, have raised deforestation rates in the humid Andes of Bolivia.

This situation became aggravated in 1985 when international prices of wolfram and tin fell, and President Paz Estenssoro dismissed 20,000 miners from the non-profitable state mines. In a desperate attempt to solve the problems of unemployment, the central government offered incentives and land to those miners who would move from the highlands to the eastern side of the Andes and the lowlands. With little idea of how to survive in a new environment, the highland miners became farmers. They “slashed and burned” the forest at first to plant chili and tomatoes on a small scale. They then opened up the forest,

leaving just a few large trees, and planted coffee, cocoa, and citrus. Most of these became secondary crops to the more profitable tea and coca. Crops which rendered large yields grew rapidly, needed little care, and had large markets (especially coca). Coca cultivation in the Chapare region of Cochabamba totaled 7,000km² in 1987 (LIDEMA 1992), affecting bear habitat and bringing associated problems such as chemical contamination, lack of environmental law enforcement, weapons, and violence.

As a result of shifting agriculture, the already high sediment load of rivers flowing down from the Andes increased dramatically. Guyot *et al.* (1988) estimated that the amount of sediments carried out by the Beni river through the canyon “El Bala” reached 550,000tons/day. These data suggest a mechanical erosion of the Andes of ca. 3,000tons/km²/year. This estimate could double where the effect of the human settlements is higher.

Because rivers that come from the Andes have, in general, traces of gold, some areas are being intensively exploited with the use of heavy machinery. These practices enormously increase the sediment load of the streams, altering their aquatic biology. Worst of all is the use of mercury to extract gold from the sediments, which is later burned and released to the environment. The impact of these operations in the area is completely overlooked.

Logging of cedro (*Cedrela*) in the southern Bolivian-Tucumanian forests of Tarija and Chuquisaca is another cause of habitat destruction in this terrain of deep valleys and high slopes, but its magnitude has not been evaluated.

Protected areas

Salazar and Anderson (1990) listed five conservation areas within the bear’s distribution range in Bolivia, but more areas were declared or reviewed by subsequent legislation (Ribera 1996a). That number could be increased to ten potentially important reserves after recent and pending legislation and protected area projects (Table 9.3, Figure 9.2).

Although these conservation areas encompass a considerable area, and potentially harbor relatively large populations of bears, they do not guarantee the long-term survival of the species. People live and make a living in these areas. Thus human pressure on bears and their habitat occurs and may increase

Most of the areas are administered directly by the government (e.g., National System of Protected Areas) or through NGOs and indigenous groups. Their degree of management implementation is still incipient, and varies between the case of Ulla-Ulla, which has a director, park guards, control posts, vehicles, and a management plan under implementation, to the case of Rio Grande-Mascicuri which exists only on paper. Amboró, Carrasco, Pilón Lajas, and Isiboro Sécuré have personnel, infrastructure,

Table 9.3. National parks and reserves within the bear range.

Name and category ¹	Department	Total area ² (km ²)	Bear area (km ²)
Ulla-Ulla (NR)	La Paz	2,400	300
Cotapata (NP+NAIM)	La Paz	400	400
Alto Madidi (NP)	La Paz	18,960	10,000
Pilón-Lajas (NP+NAIM)	La Paz/Beni	4,000	1,000
Eva-Eva (BPA+IT)	Beni	1,350	1,350
Isiboro-Sécure (NP)	Cochabamba	12,000	3,300
Carrasco (NP+NAIM)	Cochabamba	6,226	3,000
Amboró (NP+NAIM)	Santa Cruz	6,376	4,100
Río Gde.-Mascicuri (FR)	Santa Cruz	2,420	1,200
Tariquía (NRFF)	Tarija	2,487	1,700
Total		56,619	26,350

¹ BPA Basin Protection Area, FR Forestry Reserve, IT Indigenous Territory, NAIM Natural Area of Integrated Management, NP National Park, NR National Reserve, NRFF National Reserve of Flora and Fauna.
² Habitat estimated from satellite images. Human settlements in protected areas may decrease potential habitat for bears.

and plans under development, while newer Cotapata, Madidi, and Tariquía do not have official administrations (Ribera 1996a). Recent policy has declared new areas and redefined limits, categories, and zoning. For example, the new and huge Madidi NP and Natural Area of Integrated Management now connects Ulla-Ulla with Pilón Lajas, resulting in a total area of 25,000km² with elevations between 200–6,000m. The connection with Pilón Lajas is too low to be used by bears. Bear reports exist from the three areas but no specific surveys have been carried out. The estimate that at least 10,000km² may represent bear habitat makes this the largest block of bear habitat in Bolivia under some protection, although it is subject to human use in the NAIMs.

The concept of NAIM applies to protected areas which include a mosaic of natural communities of biological importance, together with traditional systems of land use, and areas for multiple resource use. It aims to strike a balance between biodiversity conservation and development of local people by promoting sustainable use of natural resources (Ribera 1996b). Although the approach is theoretically positive, the design and implementation of plans for conservation and sustainable use of resources is just beginning in a few NAIM areas, and it is far from being effective. For example, after Amboró NP was expanded in 1991 to 6,370km², strong conflicts arose between the park management and peasant groups in the higher and lower altitudinal ranges of the park. This led in 1995 to a reduction of the park to 4,425km², and to the creation of a NAIM for the remaining area. For most peasants living in the NAIM, this change of status meant that they were not in the park anymore and park guards could not impose restrictions on their activities. A recently concluded study of bear distribution in Amboró showed

that nearly half of the best bear habitat of the area was excluded from the more strict protection of the park (Eulert 1995; Rumiz and Eulert 1996).

National parks such as Carrasco have not been zoned in areas of consumptive use. However, many people support themselves in Carrasco by farming for food crops, planting coca, hunting, and cutting timber. Park guards reported the occurrence of the bear in many sites of the park and a field survey is currently in progress. Despite human presence, Carrasco NP and adjacent Amboró NP and NAIM, constitute a site with great potential for bear conservation.

Other protected areas such as Isiboro Sécure, Pilón Lajas, and Madidi have recent reports on bears (Altamirano 1992; D. Robison pers. comm. 1997; M.O. Ribera pers. comm. 1997) while in Tariquía old accounts of bear presence exist but none were confirmed despite recent field trips (A. Blanco pers. comm. 1997). Potential areas such as Cocapata-Altamachi in Cochabamba, and Serranía Los Milagros and Río Azero in Chuquisaca should also be evaluated for bear presence. Bella Vista in La Paz seems not to be a viable protected area for bears due to the alteration it has suffered (M.O. Ribera pers. comm. 1997).

Public education needs

It is essential to ratify the prohibition of hunting and capturing wild bears by official communication to the local authorities in the bear's range, and to start friendly education programs with the campesinos. To accomplish these reasonable objectives, priority areas determined by spectacled bear country specialists, as well as through individual initiatives in other areas, should be considered as a starting point. Launching country-wide programs on environmental education at all school levels and through the media would be a more difficult objective to attain due to limited funds and lack of human resources.

Specific conservation recommendations

Priority actions to develop a sound conservation strategy for the spectacled bear in Bolivia fall within the issues of institutional strengthening, research, training, management of protected areas, policy, and conservation education.

1. Strengthen the Bolivian chapter of the Bear Specialist Group. This will provide the base for a group of interested people to coordinate activities within the country and interact with governmental offices to promote compliance with the "no bear hunting" law. It will also help to propose adequate policy, improve education, and provide research results to implement management. Printing and distribution of a poster could be an initial mechanism to address two of these

issues and to advertise the purpose of the group. An institutional diagnostic for Bolivia, evaluating the availability of human resources and potential degree of involvement in bear conservation, should be attained for better planning. An estimated US\$20,000/year would support such a group in Bolivia, including part-time secretarial work, computers, communications and travel within the country for a director and assistant, and teaching and advertising material. Larger-scale education programs at primary and secondary schools might need an extra US\$20,000/year.

2. Continue field research on ecology and habitat use of bears within and around Amboro NP, and expand the surveys to adjacent Carrasco. Goals should include estimating area used by bears, damage to crops or cattle in surrounding communities, establishing a database of bear records kept by trained park guards, and development of management strategies for bear conservation in both parks and buffer zones. This would be a model project for other parts of Bolivia. Roughly US\$60,000 for two years would buy a good, used jeep, salary for a local biologist, maintenance, and field expenses.
3. Survey natural areas within the bear range in Bolivia. Determine the relative importance of protected areas in the north, such as Ulla-Ulla and Madidi, Isiboro Secure, Cotapata, and Eva-Eva. Assess potential conservation areas in the south, such as Rio Grande-Masicuri in Santa Cruz, Rio Azero in Chuquisaca, and Tariquia in Tarija. Around US\$100,000 would buy a new jeep, pay the salary for a local biologist and part-time assistants, pay field expenses, and cover travel for the advisor over 2–3 years.
4. Conduct preliminary studies of distribution and damage to crops or cattle in communities that have expressed interest in bear conservation (such as the region of Quime, Provincia Inquisivi, La Paz), or in places where joint efforts with rural development programs could improve the conservation of the bear (such as the area of Lambate, Provincia Sud Yungas, La Paz). These pilot studies with local communities should provide models for education, alternative use of resources, and rural development that could be applied more extensively. Need: US\$20,000/yr for two years.
5. Formally train more Bolivian biologists, by implementing programs in Wildlife Biology and incorporating them into the ongoing projects mentioned above. Reinforcing existing programs in Biology in La Paz, Santa Cruz, and Cochabamba is reasonable, and could be accomplished by organizing short-term courses, both in the classroom and in the field. This would need coordination with the local universities to decide a syllabus and to bring in adequate national or external trainers.

Status and management of the spectacled bear in Colombia

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Introduction

Due to a complete restructuring of the Colombian natural resource management system during the writing of this document, it has not been possible to discuss the action plan with all of the appropriate officials. As new officials are appointed and programs are implemented over the next 1–2 years, it will be possible to finalize this plan and incorporate specific research, conservation, and management proposals. During the next few years, it is also anticipated that Colombian conservation NGOs will be able to determine how best to coordinate spectacled bear conservation and management efforts with government officials under the new system.

Historic range and current distribution

Prior to the Spanish conquest that followed the discovery of the New World by Columbus in 1492, Colombia was populated by small groups of indigenous people. While the coastal and Amazonian lowlands were sparsely populated, the Andean highlands were densely populated by the Muisca, Guane, and Loma Cultures (IGAC 1989). Although the highland people cleared large tracts of land for agriculture, due to their limited hunting technology, one can surmise that their impact on bear populations was minimal. Recent human impacts on bear populations, however, are major (see “population and habitat threats”).

The historic and present day distribution of spectacled bears reflect the progressive deterioration of Andean ecosystems in Colombia, a change that has come about primarily in the last 100 years, but which has been intensified in the last 50 years. Historically, the spectacled bear ranged throughout the cordilleras and valleys of the central one-third of the country. As a result of population growth and economic development, large parts of the historical range have been converted to agriculture or grazing. Presently, the best remaining bear areas are the western slope of the Western Cordillera, the eastern slope of the Eastern Cordillera, and the southern portions of the three cordilleras, near Ecuador.

With the almost total conversion of the subtropical forest to agricultural uses, mostly for coffee (*Coffea arabica*) fields, the bears have retreated upwards along forested



Figure 9.3. Historic and present distribution of the spectacled bear (*Tremarctos ornatus*) in the Colombian Andes.

slopes, and now occupy tracts primarily at 2,000–3,000m elevation (Jorge Hernández C. pers. comm.). Various types of development are taking place in the highlands, however, and provide additional pressures to bears and their habitats. The species is in fact presently “sandwiched” between strong development forces from above and below. This process is most severe in the inter-Andean valleys of the Magdalena and Cauca Rivers where the human population pressures now prevent free movement of bears both within and between mountain ranges.

Spectacled bears occur in the three Andean ranges (“Cordilleras”) that occupy the central one-third of the country. These ranges extend from Ecuador in the south to Panama in the northwest and Venezuela in the northeast (Figure 9.3). Perhaps the most stable bear populations in Colombia are situated in the southern half of the Eastern Andean range. This area probably also has the highest population density of spectacled bears, but the northwestern part of Colombia also may have high bear population densities (G.I. Andrade pers. comm.). Spectacled bears, however, are becoming increasingly threatened by human activities, and their populations are decreasing throughout the country.

As a result of social and geological differences in the three ranges, spectacled bear distributions must be viewed in a very local context. The Western Range or Cordillera, geologically quite young compared with the other ranges in Colombia, has an average elevation of 3,000m (IGAC 1989). While the western slope of this range is sparsely populated by humans, the eastern slope is densely inhabited (IGAC 1989). The western slope also retains extensive tracts of montane forest (Cavalier 1993; Figure 9.3). Given the low population density and large extent of forests, the western slope likely has relatively high population densities of spectacled bears in Colombia.

The Central Range, geologically older than the Western Range, has an average elevation of 4,000m (IGAC 1989). While the western slope of this range is densely populated by humans, the eastern slope is less densely populated. The area has a high level of seismic and volcanic activity. Natural vegetation in the Central Range is highly fragmented (G.I. Andrade pers. comm.)

The Eastern Cordillera, geologically the oldest of the three ranges, has an average elevation of 3,500m (IGAC 1989). While the western slope of this range is densely populated by humans, the eastern slope is sparsely inhabited. This range has a high level of seismic activity, but little volcanic activity. The eastern slope also retains extensive tracts of montane forest (Cavalier 1993; Figure 9.3). Given the low population density and large extent of forests, the eastern slope likely has relatively high population densities of spectacled bears in Colombia.

The three ranges of the Andes are separated by two major river valleys. Situated between the Western and Central Ranges, the Cauca River Valley is a major population center. About three million people inhabit the Cauca River Valley. The Magdalena River, situated between the Central and Eastern Ranges, was a major transportation artery to the Caribbean coast, but rarely is used by shippers today due to sedimentation problems caused by deforestation of the adjacent Andean slopes. About three million people inhabit the Magdalena River Valley. The average population density ranges from 10 to 60 people/km², but densities up to 100 people/km² are attained in the metropolitan areas (IGAC 1989:89). Major highways traverse each of the river valleys. The Cauca and Magdalena Rivers join before reaching the coast.

The present distribution of spectacled bears in Colombia closely corresponds to the distribution of montane forest $\geq 1,200\text{m}$ (Figure 9.3). This region includes about 18 National Parks and several private reserves with spectacled bears. Potential bear habitat (31,000km²) comprises approximately 5.8% of all forested areas of Colombia, and 45% of the estimated 68,400km² of forests in the three Andean ranges (Inderena–FEN 1986). We recommend that these areas be managed for conservation purposes. The forests in the Amazon Basin, the Choco, and the Eastern Llanos are not suitable bear habitat due

to their low elevation (e.g., ca. 100m) and high temperatures (e.g., 35–40°C).

Three major geographic areas, which correspond to the three Andean ranges in Colombia, can be considered as suitable habitat for spectacled bears. Of a total of 68,400km² of Andean forest (Pombo 1989), some 31,000km² are highlighted in this report as suitable habitat for spectacled bears, while the 15,000km² of cloud forest may be absolutely critical for bear survival. Approximately 30% of the suitable forested habitat are within National Parks that form part of the Colombian System of Protected Areas.

Western Andes Range

Five subunits comprise this area (listed north to south) (Table 9.4):

1. Los Katíos NP and the Darien Region along the border with Panama.
2. Paramillo and Las Orquídeas NPs comprise Area 2 and extend west to the Chocóan lowlands and south to the headwaters of the Atrato River.
3. Macizo de Tatama NP, the area surrounding the Park, and the Cali–Buenaventura road. The Tamana and Cordillera Paraguas regions occur here and have been proposed as national parks.
4. Farallones de Cali and Munchique NPs. These areas contain extensive wilderness areas with a large range in altitude (up to 3,000m) that favor spectacled bears.
5. The southern portion of the Western Andean range includes the watersheds of the Patía, San Juan de Micay, and Mirá (Güiza) Rivers. This area is home to the Emberá, Wuanana, and Awa Indigenous populations (C. Valderrama pers. comm.). A substantial portion of lands in the Güiza area of southern Nariño, a region traditionally used by the Awa people, has been declared by the national government as Indigenous Reserves (“Resguardos”).

6. Approximately 14 bears are known to occupy the La Planada NR (32km²; 1,200–2,100m elevation), about 80km west of Pasto, with additional bears in the surrounding area (C. Valderrama pers. comm.). Since the early 1980s, the reserve has been managed to take into account the needs of bears, as well as those of the local Awa residents.

It is estimated that some 9,000km² of the forests of the Western Andes Range are suitable for bears. The region also has an unusually high level of biological diversity (Andrade 1992, 1993). Supporting this diversity are probably some of the largest, best-preserved forests in the Neotropics, including Los Farallones de Cali (1,500km²). Forty percent of the forests in the Western Andes Range have been designated as National Parks. Additional portions are categorized as Indigenous Reserves or as areas protected for hydroelectricity generation. The immediate prognosis for spectacled bear populations in the Western Andes Range, however, is poor due to poor park management, hydroelectric development (e.g., Micay Project), and road construction (e.g., Cali–Buenaventura, Pereira–Bahía Solano, and Popayán–Guapi).

Central Andes Range

Given its position between two major valleys, the Central Andean Range has the most severe and most extensive habitat degradation. As a result, bear habitat today in this region consists of many small- to medium-sized forest fragments, a few hectares in size. Six general areas can be considered for conservation action in this range (listed south to north):

7. Purace NP and the surrounding Colombian Massif.
8. Nevado de Huila NP and the surrounding wilderness harbor, the largest tract of cloud forest in the range. Large tracts in these areas, however, are being cleared



Cloud forest: western Nariño, Colombia.

J. Orejuela

Table 9.4. Size and amount of spectacled bear habitat in priority research and conservation areas of the Colombian Andes (Inderena pers. comm.)

Area number	Conservation unit name	Year established or expanded	Park area (km ²)	Available bear habitat (km ²)
Western Andes Range				
1	Los Katíos National Park	1980	720	180
	Darién Wilderness			1000
2	Paramillo National Park	1977	4600	1150
	Las Orquídeas National Park	1974	320	80
	Associated Frontino Wilderness			1500
3	Macizo de Tatamá National Park	1987	519	130
4	Farallones de Cali National Park	1968	1500	380
	Munchique National Park	1989	440	110
	Associated Wilderness			1000
5	Mirá (Güiza), Patía, San Juan de Micay Wilderness			3500
6	Reserva Natural La Planada	1982	32	32
Central Andes Range				
7	Puracé National Park/Colombian Massif	1977	830	210
8	Nevado de Huila National Park	1977	1580	400
9	Las Hermosas National Park	1977	1250	380
10	Los Nevados National Park	1974	380	30
11	Sonsón Wilderness			500
12	San Lucas Range/Nechi Wilderness			3500
Eastern Andes Range				
13	Perija, Los Motilones Wilderness (part)/Catatumbo National Park	1989	1581	1581
14	Tamá National Park	1977	480	120
	El Cocuy National Park	1977	3060	770
15	Guanenta–Alto Río	1993	104	104
	Fonce Sanctuary and associated wilderness		(500)	(500)
16	Pisba National Park	1977	450	110
17	Chingaza National Park	1978	503	133
	Associated Wilderness			500
18	Sumapaz National Park	1977	1540	390
	Cordillera Los Picachos National Park	1988	4390	1100
	Sierra de La Macarena National Park	1987	6293	1580
	Tinigua National Park	1989	2080	500
	Associated Wilderness			800
19	Caguán, Caquetá Putumayo and Associated Wilderness			9000

to plant illegal crops, especially opium poppies between 1,000–2,000m.

9. Las Hermosas NP still contains forested tracts that offer adequate habitat for bears.
10. Los Nevados NP and surrounding wilderness possibly include a small population of bears.
11. An isolated region of cloud forest persists in the southeastern corner of Antioquia Department, near Sonsón, and probably sustains a stable population of bears. The southern part of Antioquia is threatened with development via the Bogotá–Medellin highway and the La Miel hydroelectric project.
12. San Lucas Range, a tropical/subtropical wilderness treasure, located between the Cauca and Magdalena Rivers near the Caribbean Coast, is rapidly being transformed and degraded by a combination of forces, including guerrillas, gold miners, poachers, and wealthy farmers-ranchers who graze cattle and practice agriculture. As a result, spectacled bears there have

been subjected to at least 25 years of major human disturbances. Despite these problems, the range is still important for conservation purposes as it reportedly includes a substantial bear population (J. Hernández C. pers. comm.).

About 5,000km² of the Central Andes Range offer adequate habitat for bears. These critical wilderness areas are also important for human welfare due to the environmental services they provide. About 4,000km² (48% of the total forested area of the range) of this area is already part of the Colombian National Park System. The status of this area is tenuous, however, as large plots of forest are being cleared to plant illegal crops.

Eastern Andes Range

Due to lengthy human occupation, the western slopes of this range generally lack adequate forest cover to sustain bear populations. The eastern slopes, however, contain

some of the most extensive bear habitats. Six general areas can be distinguished in the range (listed north to south):

13. The northernmost portion of the Andes, along the border with Venezuela, includes the remaining forests of the Perijá and Los Motilones Ranges and the upper reaches of the Catatumbo–Bari NP. This area includes a wide variety of forest types.
14. Two national parks, Tama and Sierra Nevada del Cocuy, provide ample habitat and a wide altitudinal range for bears (>4,000m). The surrounding wilderness also is extensive, but the former high levels of biodiversity are declining due to human activities (Andrade *et al.* 1991).
15. The Guanenta–Alto Río Fonce Sanctuary (including the Páramo de La Rusia) and the Los Cobardes region (both in the Department of Santander) provide bear habitat in the Magdalena River Valley. The sanctuary and surrounding area include about 500km² of páramo and upper montane forest, including small remnants of oak forest (*Quercus humboldtii*), a potential bear food item.
16. Pisba NP, and to a greater extent, Chingaza NP have several forest fragments of importance for bears. Additional forested areas, for example, Carpanta NR (formerly managed by Fundación Natura, but now managed by CorpoGuavio, a regional development agency), occur adjacent to the parks and enhance spectacled bear populations. Compared with other large national parks, the relative proximity of Pisba and Chingaza NPs to Santafé de Bogotá, the national capital (population six million), makes these two areas especially important as research sites and as locations for environmental educational activities.
17. The triangle formed by Sumapaz, Cordillera los Picachos, and Sierra de La Macarena NPs forms one of the largest and most diverse wilderness regions of the world (12,220km²). The close proximity of this area to Tinigua NP makes it especially important for bear conservation as bears can easily cross the cordillera.
18. The upper reaches of the Caguán, Caquetá, and Putumayo Rivers provide about 9,000km² of bear habitat. This region already has been recognized as critical habitat for conservation of the woolly tapir (*Tapirus pinchaque*) and several deer species (C. Downer pers. comm.).

The Eastern Andes Range comprises 17,000km² of bear habitat and represents a magnificent conservation area. About 18,800km² (61%) of this region already is included in the Colombian National Park System. As in the Central Andes Range, the forests in this range are rapidly being converted into areas to cultivate illegal crops.

Changes in the distribution of the spectacled bear in Colombia are closely tied to the changes in the distribution

of montane forest. The best available data are for forests above 1,200m (Cavelier 1993; Figure 9.4). Recognizing present development trends, the future distribution of the spectacled bear likely will be less than at present. The greatest reduction will occur in the Central Cordillera. Range reductions will be less in the Western and Eastern Cordilleras due to their isolation. Bear populations in the northwest and northeast, however, likely will be greatly reduced to a few national parks and the surrounding wilderness areas. Bear populations between the Ecuadorian border and the cities of Cali (Western Cordillera) and Villavicencio (Eastern Cordillera), have the best long-term prospects for survival.

There are about 30 spectacled bears in captivity in Colombian zoos (C. Valderrama pers comm.; Weinhardt 1994). Additional bears likely are kept as pets by rural farmers and by wealthy individuals in private menageries, but the total number in these two categories probably does not exceed five individuals.

Status

Although already reduced to critical levels, the Colombian population of spectacled bears is second only to that in Peru. While no population estimates for spectacled bears in Colombia have been calculated, a reasonable estimate [based on home range sizes for American black bears (*Ursus americanus*) in prime bear habitat, approximately 0.11 individuals/km² (Yerena 1994)], would be a total of about 4,000–5,000 spectacled bears in Colombia.

Legal status

The spectacled bear is protected at the international and national levels. Internationally, the species is listed as Vulnerable by the IUCN Red List of Threatened Animals (IUCN 1996). Colombia also is a signatory to CITES. This treaty regulates international trade in live spectacled bears as well as their parts, products, and derivatives. Colombia also has ratified the World Heritage Convention. Under this convention, the three (two with bear populations) Biosphere Reserves (MAB Program of UNESCO) are managed to conserve resident wildlife and plant populations. Colombia is also a signatory to the 1992 Convention on Biological Diversity. Under this convention, each country must devote full attention to the protection of species. The impact of these international programs on bear conservation has not been evaluated, but probably the benefits have been minimal.

At the national level, the spectacled bear is listed as an endangered species. Under Colombian legislation, it is forbidden to hunt, capture, or kill bears (Código de Recursos Naturales y del Ambiente, Decreto 2811, 1974).

Despite this legislation, spectacled bears frequently are killed or taken as pets, and their habitat continues to be converted to human uses.

Population threats

The distribution of the spectacled bear on mountain slopes at mid-level elevations coincides with the area of greatest socio-economic development of the country. The consequence of this development is large-scale destruction of ecosystems and the restriction of bears to forest habitats fragmented vertically and horizontally. Under these circumstances, spectacled bears are especially vulnerable to local hunters and temporary workers as they move from area to area seeking refuge. Agriculture, livestock grazing, and timber harvest are the main population threats.

Considered together, the factors of agriculture, livestock grazing, timber harvest, and hunting probably result directly in the death of 50 bears and the loss of 300–500km² of potential bear habitat annually. Sport hunting also accounts for a small number of bear deaths (perhaps 10 deaths/year), but accurate figures are difficult to obtain since this hunting is illegal. Spectacled bears, given their habitat needs and low reproductive rate, likely cannot sustain such mortality over a long period of time. Based on experience at La Planada, an adult female can produce 1–2 young per year. A female reaches maturity at the age of four years and remains reproductively active for 6–8 years (C. Valderrama pers. comm.).

A new population threat is poaching and illegal international trade of bear parts, particularly claws, teeth, and gall bladders, to supply the demand for traditional

east Asian medicine. Although it was not possible to confirm the extent of this trade in Colombia, it probably is not yet a major problem here. This trade, however, is a major problem in Ecuador (L. Suárez pers. comm.).

All of the factors mentioned above are proximate population threats. Spectacled bears, however, also are threatened by the ultimate population threat of a national development model based on economic progress mainly through urban-industrial growth. This model is based on resource exploitation. The opportunities to exploit the natural resources, however, are not equally distributed between the different social and economic groups in Colombia. As a result, severe cultural and environmental problems have developed. Until this ultimate threat is resolved, the proximate threats will continue to reduce spectacled bear populations in Colombia.

Habitat threats

Given the nature and extent of many human activities in Colombia, their negative impact on spectacled bears often is unavoidable. The problem is especially difficult as the region of densest human population (low to middle elevations of mountain slopes) is generally coincident with the distribution of the bears. Competition for space between humans and bears can only increase as humans are now exploiting the last remaining bear refuges, including the cloud forests and “páramos” in the high elevations, for agriculture and cattle grazing. Human impact on cloud forest habitats and on the few remaining subtropical forests in Colombia continues to be severe as the human population (a projected 34 million in 1993) continues to



“Fermina”, female spectacled bear (*Tremarctos ornatus*) in La Planada island habitat, Colombia.

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increase at an annual rate of 1.5% (IGAC 1989). Ways must be developed to accommodate bears, as well as humans.

The agricultural/timber harvest frontier is expanding into primary bear habitat. This is due particularly to the planting of tree plantations on former pasturelands and the felling of non-precious trees to meet the pulpwood and minor industrial needs of an expanding human population. The area used for commercial tree plantations is about 1,800km² (Pombo 1989; 1984 data). New tree plantations are being planted with alder (*Alnus* spp.), conifer (*Pinus* spp., *Cupressus* spp.) or eucalyptus (*Eucalyptus* spp.). While native forest rarely is used for plantations, the conversion of pastureland is permanent as little or no natural regeneration is undertaken.

Colonization of undeveloped areas by humans also fragments bear habitat. In Colombia, colonization occurs as an independent process when squatters move into unsettled areas, as well as a dependent process as these people follow work camps along new road sites. In either case, colonization contributes to a massive conversion of forests into pastures for agriculture and cattle grazing. About 73,000km² are involved in this process in the Andean and Piedmont regions (Pombo 1989). Due to the low fertility of these soils, lands repeatedly are colonized and abandoned. During 1962–1989, about 3,000km² of public lands were deeded to colonists annually. Due to jurisdiction problems between government agencies, it has been very difficult to control colonization.

Colonization is an especially pernicious problem because it often is stimulated by wealthy or powerful people in a covert manner. Politicians, for example, often stimulate colonization in the districts they represent in order to concentrate wealth, land tenure, and votes. Land developers also benefit by selling at high profits lands they had previously purchased on speculation. This problem likely will not be resolved soon.

Deforestation is a major problem throughout the country and contributes substantially to the loss of prime bear habitat. Nationally, about 6,000–7,000km² of forests are cleared annually (1.7–2.8% annual deforestation rate; Myers 1989; Pombo 1989; WRI 1990). It is estimated that about 600–1,000km² of Andean forests are converted each year to other land uses. This loss of forest not only reduces available bear habitat but also limits future opportunities to reintroduce bears, as their former areas no longer exist.

During the past 10 years, economic development and the exploitation of natural resources have increased dramatically in Colombia. Timber harvest, gold mining, mineral extraction, and commercial agriculture, for example, have become widespread throughout the country (Pombo 1989). These activities naturally attract workers and their growing families to previously undeveloped areas. Previously unoccupied areas (prime bear habitat) are converted to agricultural fields, cattle pastures, and

house sites. As a result of this development, spectacled bears move into marginal habitats where their survival rates are reduced.

Forest conversion also occurs to promote the illegal drug trade. This conversion can destroy substantial quantities of potential bear habitat. An estimated 500km² of Andean forests were cleared, primarily during 1991–1992, to plant opium poppies (*Papaver somniferum*). Additional forests were cleared to plant marijuana (*Cannabis sativa*) and coca (*Erythroxylum coca*) (Anon. 1992b). These products have a high value in the illegal drug market and presently are being used by Colombian farmers and entrepreneurs to substitute for traditional crops that have a low market value. Given the international aspect of this trade and the high potential for profits, farmers engaged in the drug trade are now clearing much more forest than they would have cleared previously for subsistence purposes. Governmental efforts to eradicate these crops rely heavily on massive spraying of herbicides, such as glifosato (Roundup, produced by Monsanto). The potential dangerous ecological consequences of this spraying on plants, insects, and higher vertebrates in the areas surrounding the illegal drug fields have been ignored by government officials. Despite about 10–15 years of concerted efforts by the Governments of Colombia and the United States of America to control drug production, there is no visible end to the annual increase in areas converted to this use.

In the quest for increased economic development, Colombian businessmen are looking west, to the Pacific Basin markets, and east, to the Amazon Basin and its rich mineral and petroleum resources. The construction of roads and oil pipelines to promote this development often degrades potential bear habitat. These roads and pipelines are especially susceptible to attacks by guerrillas (active since about 1975) attempting to destabilize the government. During 1994, about 3–5 attacks per month nationally were reported in the press.

With respect to roads, many routes are being constructed, while other routes are being expanded or rebuilt. In the Western Andes Range, three new routes are being constructed across the cordillera to join major cities of the interior with coastal towns. In addition, a coastal road is being constructed to connect the city of Tumaco with Esmeraldas (Ecuador). Along the Eastern Andes Range, the “Marginal Jungle Highway” (Carretera Marginal de la Selva), a 1,300km-long road between Mocoa, the capital of the Department of Putumayo, and the city of Saravena, in the Department of Arauca, for example, provides increased access by humans to large tracts of potential bear habitat and important conservation areas (especially between La Uribe and San Vicente, Caquetá).

Construction of new roads from the interior of the country to the Pacific Ocean attracts new settlers to the

region and is increasing the fragmentation of former large tracts of Andean forests of prime importance to bears. Road construction also is proceeding in the central part of the country (near Las Hermosas NP and between Bogotá and Medellín), as well as in the eastern plains and Amazonia. Road construction also results in the killing of spectacled bears as they wander through work sites.

Roads fragment many previously continuous forest habitats and also degrade bear habitat by providing corridors for the establishment of new settlements by illegal colonists. These colonists frequently derive their subsistence from forest resources, especially timber resources. Large tracts of roadless forest urgently need increased protection by the department and national governments. Bear conservationists need to take into consideration these factors when developing management plans. Government planners, likewise need to take into consideration potential bear habitat when developing their economic plans.

The long-term survival of spectacled bears in Colombia is dependent upon the conservation of large tracts of Andean cloud forests. In turn, the survival of these forests is intimately tied to the provision of ecological services to human populations centers which are generally located at lower elevations. The strategy of ecosystem conservation for human welfare, with continued supply of basic ecological services, such as potable water, soil conservation, and electricity (80% of the energy used in Colombia is derived from hydroelectrical plants), should be linked to the conservation of the spectacled bear and other charismatic wildlife species. In this way it will be possible to show that both humans and bears can benefit from the same conservation practices.

Management

The Colombian National Park System has 45 units which encompass an area of 90,316km² (8% of the total land area; Inderena pers. comm.). Of these protected areas, about 18 help to protect spectacled bear populations. This subset of parks has an estimated area of 31,000km² (34% of the total area in National Parks).

Natural resource protection and management within National Parks is uneven, being best in the remote units with steep terrain and difficult access. Most of the parks have ongoing problems with residents who were not properly compensated for their land when the area was declared a park. Many of these people continue to reside in their homes as if the park did not exist. In addition, most of the parks have problems with adjacent residents who graze cattle and burn pastures in the parks. Under these circumstances, spectacled bear conservation and management is a secondary concern for many park managers.

Only a few of the 45 parks have management plans. Implementation of these plans often is restricted due to limited funds and poorly-trained park personnel. Thus far, the main accomplishment of the National Park System has been a limited degree of habitat protection.

The benefits of habitat protection through the mechanism of National Parks is becoming more apparent as the demand for drinking water and hydroelectric power exceed the supply in many areas. Where National Parks include major watersheds in close proximity to human populations, their protection is enhanced because the benefits are more obvious to the adjacent residents. For example, Chingaza NP is within 20km of Santafé de Bogotá, the capital, and provides water and electricity for about six million residents. Elsewhere, Los Farallones de Cali NP supplies water to about two million people, while Los Nevados NP supplies water to about 2.5 million people and sustains about 40–60% of the coffee production in the country (total production: US\$1,606,000,000 in 1988; Pombo 1989). Given their large size and economic value, these sites increasingly are becoming attractive targets for guerrillas. Due to recent terrorist threats to destroy the dam in Chingaza NP, the military recently began patrols there and has restricted access to the zone. This action shows the extent to which the Government of Colombia will respond when the national security is threatened.

The mechanism that has afforded the best protection of wilderness (National Parks included) and potential bear habitat is to focus on the conservation and management of watersheds. These provide water and energy to the major cities of the country, and indirectly protect potential bear habitat. Colombia is a country of many medium- to large-sized cities, and about 70% of the human population lives in these areas. This relationship should provide bear managers with numerous opportunities to protect forest.

The management of watersheds is under the Regional Development Corporations (36) and the Municipal Utilities Companies (“Empresas Públicas” for major population centers with >100,000 residents). Land use planning in each municipality is the responsibility of the council. There are between 500–600 municipalities in the Andean region. Usually these agencies are well funded and adequately organized to fulfil their mission. The natural areas which are managed by regional corporations and utility companies (excluding national parks under their jurisdiction) is about 25,000km². Generally these areas are adequately protected.

Indigenous Reserves often contain large areas of wilderness. While some of these wilderness areas are adequately protected and conserve large tracts of potential bear habitat, others are not. Indigenous Reserves for the Awa (Western Andes); Paez (Central Andes); and the Inga, Ingano, Sibundoy, Kamsa, and Kofan (southeastern Andes) contain large tracts of forest and substantial bear

populations. The Paez Indians, however, hunt spectacled bears (G.I. Andrade pers. comm.).

In 1993 a major change occurred in how watersheds and natural resources are managed in Colombia. One element of the change was the establishment of the National Environmental System and the creation of the Ministry of Environment (December 1993) to manage natural resources at the national level. Under "Ley 99," 36 administrative units were created or modified to manage natural resources at the local level. These regional corporations were given broad powers and adequate funding to meet their responsibilities.

Under the new legislation for environmental matters, the 36 Regional Development Corporations and 1,038 Municipalities now are responsible for developing local management plans for their natural resources. This presents a tremendous opportunity for spectacled bear conservation and management because decisions will be made at the local level by local officials.

This change from national to local administration will retain a broad, national perspective on natural resource management, especially in National Parks. In addition, this change will also focus natural resource management efforts at the local level. Governmental attention to the conservation of watersheds and potential bear habitat will definitely be reinforced because the matter will be treated as a local issue. On matters of joint concern, the Regional Development Corporations will become the implementation arm of the Ministry. The role of the National Park Agency with respect to bear conservation; however, is unclear because park management has been assigned to a Special Administrative Unit within the ministry. (While the wildlife section of Inderena was dissolved in 1994, the parks section still has not been completely terminated.)

The best option for effective management of habitats and species thus far may result from the indirect protection of watersheds and those parks under the jurisdiction of the Regional Corporations. It is anticipated that there will be an increased level of cooperation between the Regional Corporations and NGOs, with both making a more concerted effort to cooperate with the rural communities. This is one of the reasons for waiting 1–2 years to submit the Colombian Action Plan to public comment.

Colombian natural resource officials are in great need of additional field data on which to base their management decisions about spectacled bears. Field studies to date in Colombia have been few in number and short in duration. Manaba and Fundación Natura (two NGOs with interest in spectacled bears), for example, have conducted bear surveys in El Cocuy and Chingaza NPs respectively, and have undertaken environmental education programs with residents adjacent to these sites (Lozada 1989; Lozada nd. *Status of knowledge on the spectacled bear in Colombia: a preliminary report*. Univ. Tennessee, Dep. For., Wildl.



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Spectacled bear (*Tremarctos ornatus*) in enclosure at La Planada Nature Reserve, Colombia.

and Fish., Knoxville), but neither group has been active in bear conservation for the past several years. Jorgenson and Rodríguez (1986b) conducted a nationwide bear census and identified many key bear areas, but could not visit many of the best sites due to security problems. Rodríguez (1991) conducted a bear distribution and habitat use study at Las Orquídeas NP, but has been unable to extend the research to other areas.

Formal breeding and conservation programs have been established in three sites. At La Planada NR, Fundación FES has an active captive-breeding program complemented by local environmental education campaigns. During 1989, María Teresa Zequera conducted a study of bear reproductive behavior, but the results have not been published. The Regional Development Corporation of Risaralda (CARDER) recently implemented a captive breeding and education program in the buffer zone around Los Nevados NP. The third site is managed by Fundación Jaime Duque and consists of two captive bears at a compound at the city of Sopo, just north of Bogotá. In addition to these efforts, an animal rescue group at the Universidad Nacional is working on bear rehabilitation. Ecological field studies are urgently needed to complement these studies of captive animals.

Human-bear interactions

The relationship between humans and bears is multifaceted and based on thousands of years of contact. Hate, fear,

awe, and respect are some of the terms used to describe the feelings that many humans have for bears. Today, as a result of human incursion into bear habitat, Colombians increasingly are coming into contact with spectacled bears.

In Colombia, the spectacled bear is an important cultural element of many Indigenous groups. This relationship is founded upon respect and admiration for the powerful nature of the bear (Rodríguez *et al.* 1986). By relating myths and legends that focus on bear encounters from one generation to another, these people hope to acquire for themselves the desired properties so revered in the bears. They also hope to transfer these characteristics, such as strength and cunning, to their descendants. Sometimes, the enactment of the legend requires the killing of a bear to collect fat tissue to spread over a newborn baby. Great care is taken, however, not to offend the spirits of the dead bear or over-exploit living bears. These cultural beliefs, thus can have an important conservational benefit to spectacled bears.

While colonists have always killed bears when encountered, many Indigenous peoples exhibited a respectful attitude toward bears. As human encroachment of Indigenous territories increases, however, encounters with bears will become more common and the relationship is changing. Both colonists and Indigenous people kill bears, for example, when they predate crops, especially maize (*Zea mays*). This crop is particularly susceptible to predation for at least two reasons. First, maize gardens are not tended on a daily basis. Second, gardens usually are located in distant forest plots, away from the dwelling and protection of the gardener. Thus, maize gardens are frequently and severely predated by bears. Crop predation is a major economic hardship to a poor farmer who has invested time and money in a maize garden.

Sport hunting of bears is another form of human-bear interaction. For this kind of individual, the hunting process itself is important, rather than for the trophy or meat. Sport hunters frequently collect the paws and skin and give the meat to the local guides or residents. While sport hunting of bears is illegal throughout the country, hunting is usually more severe in areas of human colonization, where enforcement of wildlife laws is difficult. Thus, these hunters usually are not apprehended by the police or wildlife officials. There is also limited hunting of bears for display purposes (for example, circuses, zoological parks, and private collections). Unfortunately, enforcement of Colombian laws protecting endangered species is limited as these activities are frequently carried out by organized criminals who are able to evade these efforts.

During the past 20 years, no bear attacks against humans have been reported in the press (C. Valderrama pers. comm.). Given the timid nature of the spectacled bear, attacks against humans likely will remain rare.

Public education needs

Over the past ten years there has been a growing awareness of conservation issues by government officials as well as by the general public. The creation of the Ministry of the Environment, for example, with strong legislative and economic support, is proof that environmental affairs now are commonly viewed as important. In addition, the cause of the spectacled bear has been featured in numerous venues. Much needs to be accomplished, however, by NGOs as well as government officials.

The action of NGOs has been particularly critical in complementing the efforts of the official natural resource sector. Several organizations and recent events are especially important with respect to spectacled bear conservation and management. In 1991, a meeting of NGOs resulted in the creation of Ecofondo and the identification of more than 500 environmental groups in Colombia. Several institutions interested in spectacled bear research and conservation sent representatives, including:

1. Fundación FES (Fundación para la Educación Superior; active in bear conservation since about 1983), with regional offices in eight cities and a private nature reserve that includes bears (Reserva Natural La Planada);
2. Fundación RenaSer (active since the early 1980s), with a nation-wide environmental education program funded through a World Bank loan;
3. Fundación Natura (active since about 1985), which formerly managed the Carpanta Reserve, administers the Parks in Peril Program in Colombia (grant from USAID to The Nature Conservancy), sponsors environmental education campaigns that often include references to spectacled bears, and jointly manages three national parks with the Ministry of the Environment (formerly INDERENA).
4. Fundación Farallones, which assists in the management of the Los Farallones de Cali NP; and
5. Fundación Herencia Verde (active since about 1983), which likewise assists with the management of wilderness areas surrounding national parks (for example, Los Nevados and Farallones de Cali NPs).

Manaba has been conducting environmental education programs, as well as field research, for approximately ten years.

National Federation of Coffee Growers, which sponsors a program called "The Adventures of Professor Yarumo" on an education television channel [note: the yarumo or cecropia tree (*Cecropia* spp.), a bear food item, is a species that occurs in areas undergoing secondary succession]. This outstanding environmental series recently devoted a program to spectacled bear conservation and captive management activities underway at the La Planada and Ucumari Reserves.

In addition to traditional conservation organizations, new entities have become important in bear conservation and management in Colombia. The press, for example, has recently begun to publish articles on a regular basis in the areas of conservation, environmental education, and ecological tourism. Colombian journalists have traveled to national parks, private reserves, and wilderness areas, for example, in order to prepare special newspaper issues featuring topics such as endangered species and the importance of habitat conservation. Most newspapers, as a result, now have an ecological page and a specialized environmental journalist; and hardly a day goes by without an ecologically important feature article being published. This effort has substantially raised the consciousness of the public in environmental matters.

Efforts to educate the public about environmental matters are not limited to the media. For example, the official education curriculum for public schools also has a strong environmental component. The curriculum, for example, includes sections on ecology and endangered species. In addition, the New School Program (“Escuela Nueva”), a component of the national system, teaches primary-level students about natural resource conservation. Other national programs support environmental projects by local school districts (“Nueva Ley de Educación” and “Proyectos Ambientales Educativos”). While these programs do not deal specifically with spectacled bears, they could be easily modified to introduce bear-related information to youngsters. These kinds of education programs will be important to future bear conservation efforts.

Zoos, especially those at Pereira and Cali, have also become active in the environmental education area. These programs generally focus on endangered species of Colombian fauna, including spectacled bears, and are especially popular with children. The zoos also are attempting to improve animal husbandry methods (G. Corredor pers. comm.).

Despite the recent, nationwide increase in environmental awareness in Colombia, much needs to be accomplished. It is especially important to recognize a growing interest by politicians and government officials at the local and national levels to conduct effectively the necessary habitat and species conservation programs. In this regard, the public and active participation of Ecofondo (in association with about 300 Colombian NGOs) in environmental matters in the political arena is critical.

There is likewise a critical and continuing need in Colombia to develop and air programs that educate the public, particularly those people in areas rich in wildlife. These people, usually the most poor, often do not realize that wild plants and animals in many areas are disappearing. These people also are among those who most use wildlife, especially those who practice subsistence hunting. To accomplish their purpose, these programs also need to consider and complement sustainable, socio-economic

development activities, as well as present a conservation message. In this manner, conservation will be tied to the satisfaction of basic human needs, such as food, shelter, and drinking water.

All of the municipalities and departments of Colombia, by law, must prepare a Municipal Development Plan that includes a component for environmental planning. It is a requirement of the planning process to have community participation. Thus, there is now a good opportunity for local people and organizations to plan the present and future of their regions and to make sure that adequate funds are assigned to habitat conservation and environmental education programs.

Given the present opportunities, it is absolutely essential for individuals and organizations interested in spectacled bear conservation and management to assist rural communities as they organize themselves and begin to participate in programs which seek autonomous integrated development. By working together, bear biologists and an organized and educated populace can achieve their common goals.

Specific conservation recommendations

1. Promote ecological and behavioral research of spectacled bears and their habitat in Colombia in order to understand the factors that affect bear survival. This research should be undertaken in parks as well as on private lands and should include the following elements:
 - a. Status surveys to determine the distribution and abundance of bears throughout the country.
 - b. Field research to determine bear food habits, habitat use, and daily activity cycles. This research should include the use of radio telemetry as well as ground surveys in areas used by bears.
 - c. Studies to determine the impact of human activities on the ecology and behavior of bears. These activities include hunting, agriculture, cattle grazing, selective logging, fuel wood harvest, and the construction of roads, oil pipelines, and hydro-electric plants.
 - d. Research on the reproductive biology of captive as well as free-ranging bears to determine basic life history parameters, such as: age at first reproduction, number of young per year, age at last reproduction, and timing and duration of gestation.
 - e. Studies to determine minimal and optimal values for size, composition, and structure of bear habitat. These studies should take into account seasonal differences as well as variations due to bear densities and the nature and extent of human activities in the area.

Based on our knowledge of Colombia, we suggest the following potential research sites: Reserva Natural La

Planada/Awa Indigenous Reserve (Nariño), Guanenta–Alto Río Fonce Sanctuary (Santander), Farallones de Cali NP (Valle), Puracé NP (Cauca and Huila), Los Nevados NP (Caldas, Quindío, Risaralda, Tolima), Chingaza NP (Cundinamarca and Meta), and Sierra Nevada de Cocuy NP (Boyacá and Arauca). These recommendations are based on the known occurrence of spectacled bears at the sites, local support for bear research and conservation activities, and a relatively large potential study area (protected zone plus surrounding area).

We propose that these studies be undertaken by university level researchers, biologists from conservation NGOs, and university-level students doing thesis research. In this regard, Jorgenson has submitted for funding a proposal to conduct three short-term field studies at Guanenta–Alto Río Fonce Sanctuary. Additional funding will be sought in cooperation with Fundación FES to conduct similar studies at Reserva Natural La Planada. These studies will serve as the basis for a long-term study at each site to investigate bear ecology and behavior using radio telemetry.

2. Develop a conservation strategy for spectacled bears in Colombia. This strategy should be undertaken in parks as well as on private lands and should be based on the following elements:
 - a. Environmental education programs to inform the public as well as government officials at the local and national levels about bears, their role in the montane ecosystem and potential public benefits of maintaining these ecosystems.
 - b. Effective legislation designed to protect the species and its habitat from direct population threats as well as indirect threats through regional economic development programs that focus on resource exploitation.
 - c. Strengthen park management and infrastructure to meet the needs of park visitors, researchers, the included flora and fauna, and teachers involved in environmental education programs. Cooperative programs with conservation NGOs should be promoted until adequate financial support is available from the local and national governments.
 - d. Promote habitat restoration and the construction of corridors between fragmented forest areas to increase the amount and quality of habitat available to spectacled bears.

Based on our knowledge of Colombia, we suggest the following activities and organizations: production of educational materials for schools and community groups, promotion of visits to local national parks and protected areas, local campaigns to plant trees and restore degraded areas, and conducting local public

hearings to discuss proposed legislation and natural resource management policy. Several NGOs already are engaged in these activities or would have an interest in participating, including: Fundación FES, Fundación Natura, Ecofondo, Proyecto BioPacífico, and Herencia Verde. These activities will have to be coordinated with other programs already underway, including: Parks in Peril (Fundación Natura and The Nature Conservancy), the World Bank/Global Environmental Facility (Ecofondo), and protected areas management in the Chocó (BioPacífico).

3. Support community development programs that either improve local socio-economic conditions without depleting local natural resources or increase the role of the public in determining local policies for natural resource management. These programs need to be cooperative in nature in order to benefit from resources and expertise at the national level and local interest in implementing efficient projects.

To evaluate these three objectives and identify specific projects, we suggest that a national meeting be held to set priorities and establish evaluation criteria for the various activities undertaken under this action plan. The following organizations should be invited to attend: a) Ministry of the Environment (parks and wildlife officials), b) representatives of the Alexander von Humboldt and John von Neumann Institutes (national research centers), c) university professors and researchers (including Universidad Nacional, Universidad del Valle, Pontificia Universidad Javeriana – Biology and PUJ/Ideade, and Universidad de los Andes), d) representatives of the appropriate regional development corporations and municipalities, e) representatives of conservation NGOs (including IUCN, WPSA, Manaba, Fundación FES, Fundación Natura, Proyecto BioPacífico, Herencia Verde, and Fundación Pro-Sierra Nevada de Santa Marta), and f) representatives of zoos (including Santa Cruz, Cali, and Medellín).

Status and management of the spectacled bear in Ecuador

Luis Suárez

Status and distribution

Spectacled bears in Ecuador occur in the cloud forests and páramo habitats, from 900 to 4,250m, in the western and eastern ranges of the Andes (Peyton 1985; Suárez 1985, 1989). The majority of bears reside on the eastern slopes from the border of Colombia to Perú. The areas where bears occur are broken intermittently by settlements along the roads that descend to the Amazonian region. On the

western slopes, bear populations are fragmented and isolated. Bears are absent from the inter-Andean region that separates the two Andean ranges in Ecuador.

Spectacled bears are present in at least 15 protected areas throughout the country. Bear survival however, is threatened due to habitat loss in the areas surrounding the reserves and on the reserves themselves (Suárez and García 1986; Downer 1993). The rapidly increasing human population in the inter-Andean valleys, which are already densely settled, is producing a mobile population of landless farmers who seize every opportunity to colonize the Andean slopes where bears occur. Government policies still favor the expansion of the agricultural frontier (Southgate *et al.* 1989). As a result, most of the forested areas of the country are being threatened. In addition, agriculture in bear habitat has resulted in increasing crop predation by bears, which has increased hunting (Adams and Mazariegos 1994; Suárez, unpubl. data).

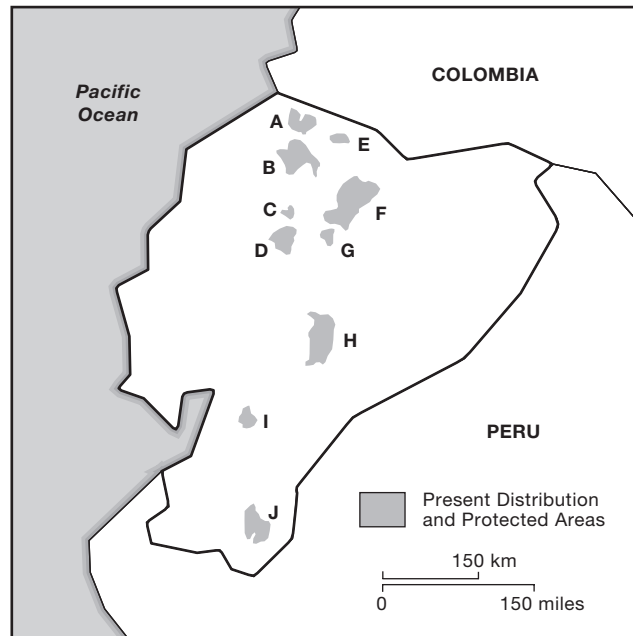
Although no population estimates are available for the spectacled bear in Ecuador, this species is found in the following areas (Figure 9.4):

1. The largest spectacled bear populations are found along the eastern slope of the Eastern Range of the Andes. Bears are relatively abundant at Cayambe-Coca Ecological Reserve (ER) (4,031km²), Antisana

ER (1,200km²), and Sangay NP (5,177km²). These areas are also the most suited to protect the endangered woolly tapir (*Tapirus pinchaque*), and the Andean condor (*Vultur gryphus*) (Peyton 1985, 1986; Downer 1993). Bears have also been reported in the highlands of Sumaco Napo–Galeras NP (2,052km²) and Llanganates NP (2,197km²), where difficult terrain and harsh weather conditions limit human occupation (Downer 1993).

2. In western Ecuador, spectacled bears occur in three ecological reserves: Cotacachi–Cayapas ER (2,044km²), El Angel ER (300km²), and Illinizas ER (1,499km²). Bears also have been recorded at Mindo Protected Forest (192km²) on the western slopes of the Pichincha volcanoes, and at both Toachi–Pilatón Protected Forest (2,120km²) and Río Zarapullo Protected Forest (216km², Mauricio Castillo, Fundación Antisana, pers. comm. 1993). Also, bears probably occur in the Awá Ethnic Forest Reserve (1,010km²) located on the northwestern slopes of the Andes on the border between Ecuador and Colombia.
3. In southern Ecuador, the largest bear reserve is Podocarpus NP (1,463km²). A small population of bears probably inhabits the western forests of Cajas NP (288km²) and Molleturo–Mullopungo Protected Forest (380km²).

Figure 9.4. Present distribution in protected areas of the spectacled bear (*Tremarctos ornatus*) in Ecuador. Protected areas A–J are: A) Awa Ethnic Forest, B) Cotacachi-Cayapas Ecological Reserve, C) Mindo Reserve, D) Toachi-Pilatón and Río Zarapullo Protected Forests, E) El Angel Natural Monument, F) Cayambe-Coca Ecological Reserve, G) Antisana Ecological Reserve, H) Sangay National Park, I) Molleturo-Mullopungo Protected Forest and Cajas National Recreation Area, and J) Podocarpus National Park.



Population and habitat threats

The main threat to the long-term survival of the spectacled bear is the conversion of cloud forests to other land uses. Bear habitats are becoming fragmented by the construction of roads and the establishment of human settlements on the Andean slopes (Peyton 1985, 1986; Suárez and García 1986).

Increasingly, agricultural activities are reducing suitable habitats and forcing bears to predate crops, such as corn, to survive. Crop predation is increasing the hunting pressure of farmers. Many farmers now consider the spectacled bear as a pest (Suárez, unpubl. data).

Sport hunting and the use of bear parts in traditional medicine also threaten bear populations in Ecuador (Adams and Mazariegos 1994; Romero and Suárez in prep.). Although hunting is prohibited, bear parts are openly sold in rural markets throughout the country. The fat is used to heal bruises and broken bones. The meat and baculi are used to enhance health and vigor. Skulls, claws, and hides are sold too. Adams and Mazariegos (1994) gathered reports of 15 bears being killed in 1993 to supply the demand for grease in two communities adjacent to protected areas. They estimated an annual kill rate of 70–120 bears on a national scale. This figure does not include cubs, some of which are killed along with their mothers. Hunting of spectacled bears is also increasing due to the

international trade of bear gall bladders. Recently, farmers living adjacent to Cotacachi–Cayapas and Cayambe–Coca reported that Asian merchants offered economic rewards for bear gall bladders (Mauricio Castillo, Fundación Antisana, pers comm. 1993; Suárez unpublished data). In December 1992, a Korean offered farmers US\$150 (five times the minimum monthly salary in Ecuador) for a bear gallbladder and US\$10–15 for each paw (Adams and Mazariegos 1994).

This combination of increasing habitat destruction and poaching makes the spectacled bear's future bleak. It is likely that long-term conservation of bears in Ecuador must be based on large protected areas, where rugged terrain and dense cover can provide protection against human activities.

Western Ecuador

On the Pacific slopes of the Andes, between approximately 1,300m and 3,500m, montane cloud forests still exist, especially in the extreme north. The páramo vegetation, above 3,500m, has been extensively modified by human activities, particularly by seasonal burning and grazing. The main conservation problem is the loss of cloud forests as a result of uncontrolled shifting cultivation, which occurs even inside protected areas (Cifuentes *et al.* 1989). Bear habitats are becoming fragmented and predation of cornfields by bears is increasing in areas bordering nature reserves, such as Cotacachi–Cayapas and Mindo.

Eastern Ecuador

The eastern cloud forests are relatively contiguous, but colonists are now moving into these areas along the expanding network of roads which are being constructed to give access to the Amazon Basin. The habitat available to the bear is shrinking annually by the establishment of human settlements on the Andean slopes and overgrazing by cattle in the highlands. Bears are also threatened by habitat destruction from gold mining activities. In addition, crop predation by bears is increasing along the borders of Cayambe–Coca, Antisana, and Sangay. Bears also are poached inside these reserves (Peyton 1985, 1986; Cifuentes *et al.* 1989; Downer 1993).

Southern Ecuador

The main conservation problems in southern Ecuador are habitat fragmentation and poaching. Bear habitat is being fragmented by the construction of roads and the conversion of montane forests to agricultural uses. Gold mining operations, timber extraction, and poaching are reducing bear populations within nature reserves. Crop predation by bears is also a serious problem along the western border of the Podocarpus NP (Romero and Suárez *in prep.*). In the Cordillera del Condor, spectacled bears are harmed by cloud forest destruction and hunting (Downer 1993).

Management

Actions to protect Ecuador's wildlands started in 1936 when the government set aside several islands of the Galápagos Archipelago as the first National Park (Figuroa 1983). The first National Strategy for the Conservation of Outstanding Natural Areas was completed in 1976. It identified priority areas and provided guidelines for their management (Putney 1976). The adoption of this strategy was a milestone in Ecuador's conservation efforts. Currently, the National System of Protected Areas includes 24 reserves, managed by the Division of Natural Areas and Wildlife of the National Forestry Institute. Not counting the Galápagos, about 49,190km² are now legally protected (approximately 17% of the national territory).

Two treaties are relevant to bear conservation in Ecuador. Ecuador has ratified CITES and the World Heritage Convention. An important bear reserve, Sangay NP, was included on the World Heritage List in 1983.

Recent domestic measures have improved bear conservation in Ecuador. First, Sangay NP was extended from 2,719 to 5,177km² to protect the headwaters of the Paute River, a critical water source for the country. Also in 1992, El Angel ER was established, which protects bear ranges in northern Ecuador. In 1993 the government created the Antisana ER, which protects bear habitat on the eastern slopes of this volcano. More recently, the government established three protected areas with substantial amount of bear occupied habitat: Sumaco Napo – Galeras and Llanganates NPs on the eastern slope of the Andes, and the Illinizas ER on the western slope.

Unfortunately, Ecuadorian conservation areas are severely threatened and poorly managed. Although the parks and reserves are legally protected, the conservation legislation often conflicts directly with other Ecuadorian legislation, such as the mining and hydrocarbon laws, under which mining and oil concessions have been granted access inside national parks and other protected areas. The Departments of Defense and Public Works, as well as other government agencies, also develop infrastructure inside nature reserves without consultation with the Division of Natural Areas and Wildlife. The problems are compounded by the invasion of protected areas by colonists, the extraction of wood and fauna, the pasturing of livestock, and deliberate burning. These conflicts are the result of inadequate funding, insufficient protection and management, poorly conceived and contradictory legislation, minimal coordination between public and private institutions, and lack of trained park personnel and suitable infrastructure (Cifuentes *et al.* 1989).

A number of local NGOs are actively campaigning for the conservation of spectacled bears. EcoCiencia is developing research and education projects in collaboration with WCS, in Podocarpus, Cayambe–Coca, and Cotacachi–

Cayapas. Fundación Natura is supporting the Division of Natural Areas and Wildlife by assisting with the establishment of boundaries and the provision of critical infrastructure and equipment for several protected areas, through a debt-for-nature swap sponsored by WWF-US and The Nature Conservancy. Fundación Natura is also promoting conservation activities in several areas on the western slopes of the Andes where bears occur (Oswaldo Báez, Fundación Natura pers. comm. 1994). Other local organizations, such as Fundación ArcoIris and Fundación Ecológica Mazán, are actively involved in conservation projects in Loja and Cuenca, respectively. Likewise, Fundación Antisana is developing conservation activities at Antisana and Cayambe-Coca ERs.

Specific conservation recommendations

1. The integrity of present reserves containing spectacled bears should be maintained and their areas extended where possible. It may be possible to combine bear conservation with watershed protection. A large proportion of the bear's geographic distribution in Ecuador coincides with critical water catchment areas which determine the yield and quality of water supplies for much of Ecuador. Highest priority should be given to the conservation of the most important watersheds: Cotacachi-Cayapas, Cayambe-Coca, Antisana, Sangay, and Podocarpus.
2. A long-term ecological research project using radio marked bears should be implemented to generate data on bear behavior, reproduction, space requirements, and diet. This would provide basic information needed to assure the continued existence of this species. According to Peyton (1986), Antisana and Cayambe-Coca have the best mix of accessibility, good bear and woolly tapir populations, competent human resources, and potential for large mammal protection in Ecuador.
3. Forest corridors should be established to link the Cayambe-Coca reserve to the cloud forests of Antisana and Llanganates. This would create the largest reserve for spectacled bears in Ecuador.
4. A detailed survey and long-term monitoring of all protected areas with spectacled bears should be conducted to assess their conservation status. The survey should also include the highlands near the Colombian border, the eastern side of Cotopaxi volcano, the eastern Andes of Azuay, and the southern cloud forests near the Peruvian border. The long-term monitoring, using geographical information systems (GIS), would generate basic data on habitat availability as well as habitat loss due to human encroachment. This information can be used to avoid or reduce the negative impacts of population isolation.

5. The impact of crop predation by bears should be evaluated to design compensation mechanisms or land management alternatives for local farmers.
6. Resources, including better legislation and additional park rangers, should be provided to improve anti-poaching measures, especially within nature reserves and the surrounding areas. Law enforcement is especially needed to control poaching activities that supply bear body parts.
7. Educational programs should be designed to promote the conservation of Andean forests. These programs could use the spectacled bear as a flagship species.
8. Training programs should be established to strengthen local research capacity and conservation programs.

Acknowledgments

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Status and management of the spectacled bear in Perú

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Status

The number of bears in Perú is unknown. Albert Erickson (1966), after a six week survey in 1965, estimated there were 2,500 spectacled bears in Perú. Grimwood (1969), who traveled throughout Perú, estimated that there were 800–2,000 spectacled bears in 1968. Peyton (1981), after a more extensive survey in 1977–1979, placed the population at 2,000–2,400 bears. These numbers probably underestimate Perú's bear population. Surveys in the southern half of Perú's bear range from 1980–1990 revealed Perú had more bear occupied habitat than previously thought. Perú has approximately 82,200km² of bear occupied habitat, or 1/3 of the species' range in the Andes (Peyton *et al.* 1997). If population densities of spectacled bears are as low as the least dense North American black bear population (low=seven adult bears/100km², Garshelis 1994), then the

area bears occupy in Perú would translate to a minimum population of 5,750 adult bears. These statistics should be used with extreme caution.

Historic range and current distribution

The spectacled bear inhabits the greatest range of habitat types and elevations in Perú of any bear species found in any other country. Bears in Perú are found in all three Andean ranges from 250m in the coastal deserts to just below permanent snow at 4,750m. Between these elevations spectacled bears inhabit steppe lands, subtropical dry forests to tropical montane rain forests, elfin forests, and high elevation grasslands. Bears are not permanent residents of low mountain tropical forests where they are rarely found at elevations as low as 650m on the eastern slopes of the Cordillera Oriental (Peyton 1980).

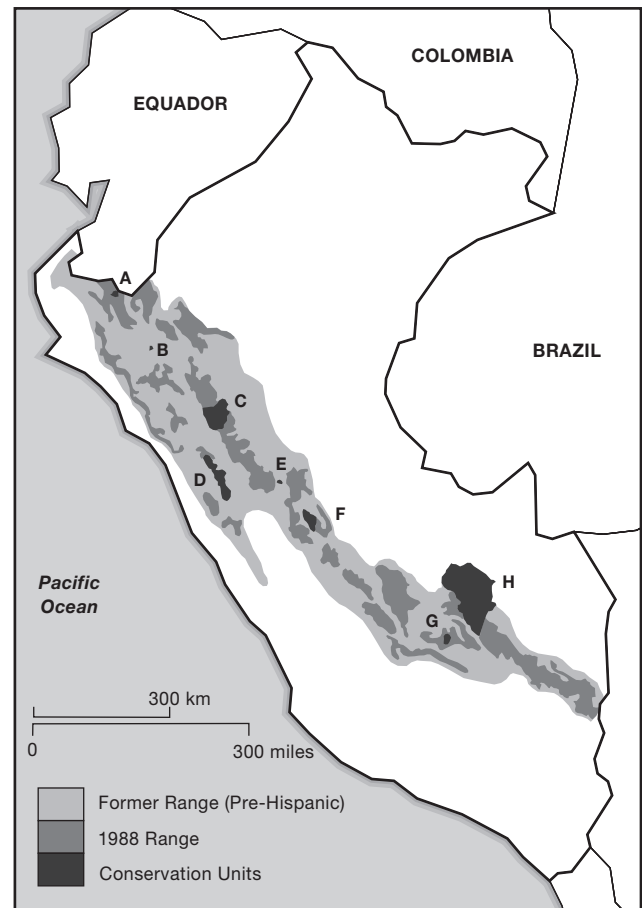
Given the range of habitat the species can exploit, it is a safe assumption that at some point before Colonial times spectacled bears occupied the entire Coastal Range down to 250m and as far south as Lima, the Central Andes to the headwaters of the Santo Tomas River, and the entire Oriental Range (Figure 9.5). Cities have been present in Perú for at least the past 7,700 years (New York Times, 28 April, 1981). From then until the Spanish conquest of the Incan Empire in the 1530s, bears probably did not compete with humans for food or threaten their survival. The evidence for this is the lack of bear imagery in the tapestries and ceramic vessels of Perú's pre-Hispanic cultures (Peyton 1981, 1987b). The change in land ethic and ownership from the 1550s to 1790 set the stage for the bear's future population decline. The mestizo descendants of the Spaniards acquired large land holdings, made only larger by the depopulation of vast highland areas due to wars, introduced disease, and poisoning of native Peruvians in silver mines. The inequitable land ownership (0.2% of farmers owned 69% of the farmland in 1960) forced farmers to abandon land that could no longer support their families. Thus by 1961, 23% of Perú's population was migrant (2.28 million people, see Eckstein 1983). Most migrants went to Lima, and other large cities where they tried to enter the industrial class. A smaller proportion traveled over the Andes in search of land they could farm informally. Their efforts were facilitated by new roads built over the Andes by President Fernando Belaunde Terry (1963–1968) with the help of foreign aid. His goal was to relieve the overcrowded urban environment and provide labor to develop jungle resources. The Agrarian Reform he initiated failed to redistribute more than 4% of the farmland. The road building and exodus of farmers to the montane forests continued during the military regime (1968–1980) that followed. Although the generals managed to redistribute almost all of the privately held land, only 28% of the peasant population received it (Eckstein 1983).

Many of the 860,000 families left to fend for themselves had no other choice but to join the throngs that had previously migrated into cities and over the Andes toward the jungle. Bear habitat that was once protected by impenetrable cloud forests was now under attack by shifting cultivars. The combined effect of lack of land, increased access, deforestation, and hunting promises to eradicate wild bear populations in Perú unless a range of solutions are initiated (see Specific Conservation Recommendations below). Nobody knows the exact cumulative impact of these threats, but it is believed to be severe. Hunters interviewed during field surveys of 1977–97 claim bear populations have declined to a third of their former level since the 1960s.

Spectacled bear populations are now very small, fragmented, and disappearing in the Coastal or Occidental

Figure 9.5. Present and estimated pre-Hispanic range of the spectacled bear (*Tremarctos ornatus*) in Perú.

The estimated range is a map of the habitat types that presently are known to support spectacled bear populations. Location of National Parks (NP) and Historic Sanctuaries (HS) that now contain bears (within present range), or formerly had bears (outside present range), are indicated by letters: A) Tabaconas-Namballe NS, B) Cutervo NP, C) Rio Abiseo NP, D) Huascarán NP, E) Tingo Maria NP, F) Yanachaga-Chemillen NP, G) Machu Picchu HS, H) Manu NP



Andean Range, where there are probably less than 300 bears. The best Occidental bear population occupies montane forest and paramos north of the towns of Huancabamba and Ayabaca to the Ecuador border where the Occidental and Central Andean Ranges converge. Included in this area is the recently established National Sanctuary of Tabaconas–Namballe (1988, Figure 9.5). The Cutervo NP (Figure 9.5) and humid forests south of Porculla pass to the town of Chota are not large enough to contain viable populations of spectacled bears. These areas are also home to drug traffickers which has curtailed forestry and wildlife management for the past two decades. An estimated 10–20 bears occupy the humid forests and paramos in each of the populations south of Chota. Fewer than 100 bears inhabit the coastal deserts and thorn forests from Pativilca River (10°42'S) to the town of Canchaque (5°24'S). The upper elevational limit to these populations is where annual precipitation is high enough (e.g., > 500mm) to support permanent human settlement. Agriculture and villages occur in a broad band from 2,750–4,400m elevation in the south and 1,675–2,300m in the north, thereby separating the desert bear populations from bears that occupy humid forests. Desert bear populations are further isolated from each other by human settlements along the major river valleys that descend to the Pacific Ocean. The largest of these bear populations are on steep topography that prevent human access along the rivers Pativilca, Huarmey, Santa, Viru, and La Leche. Bears infrequently use the subalpine paramo and steppe habitat above 4,000m on the northern boundary of Huascarán NP (Figure 9.5) between Nevado Champarra and Cerro Alto Santa Cruz.

Spectacled bears live above 1,800m elevation in montane forests on both sides of the Marañon River north of 10°S latitude and between 1,675 and 2,900m in the provinces of Tarma, Satipo, and Huanta. The high annual precipitation of 2–7m makes this the wettest and consequently the most species-rich bear habitat in Perú. For example, the spectacled bear's range in Río Abiseo NP in the northern central Andes (Figure 9.5) is home to 36 endemic vertebrates. This is 9% of Perú's endemic vertebrates (n=272) and 29% of those that live in Perú's montane forests (n=126, Leo 1993). Undisturbed parts of the range have the highest density bear populations found in Perú as evidenced by copious amounts of fresh spoor seen throughout the year. Local reports of litter sizes were consistently two or more cubs with litters of four cubs occasionally reported (Peyton unpubl. data). Population numbers in these regions are unknown.

A small population of perhaps fewer than 50 bears inhabit the thorn forests and deserts between the towns of Ocos and Chulpi along the Pampas–Apurimac–Santo Tomas drainage. The near vertical habitat and the unstable political situation has prevented land managers and researchers from entering bear habitat here since 1979.

The Sendero Luminoso terrorist movement that has crippled the economy of Perú for the past decade had its origin in Ayacucho above the Apurimac River. The highlands south of Chulpi in the Central Andean Range has been farmed since pre-Hispanic times. Consequently the southern end of the range is unsuitable for spectacled bears. Human settlement along the Marañon and Apurimac Rivers form effective barriers to bear movement between the Central and Oriental Andean Ranges.

Spectacled bears have their largest and most contiguous populations on the eastern slopes of the Oriental Andean Range. Some areas offer bears over 3,500m of elevation from high elevation paramos to lowland forests. Extensive agricultural areas exist on the western slope of the Carabaya Range; below 1,750m in the Vilcanota Range, and along the Urubamba, Huallaga, Perene, and Apurimac Rivers. These areas are unsuitable to bears and fragment the eastern slope bear population into at least seven subpopulations. Population numbers are also unknown for these areas.

Status of protected areas

Although Perú has 31.5% of the total range of the spectacled bear in Latin America, only 7% of that range is included within park boundaries. The Tabaconas–Namballe National Sanctuary might sustain a bear population if its 295km² area and the adjacent forest of El Chaupe (490km²) were placed under strict management. Both areas have tall forests of commercial grade lumber (*Podocarpus* sp.) that have been cut down on the Ecuadorian side of the border. Local communities stopped a Peruvian lumber company from logging an area adjacent to the sanctuary in 1992 (A. Luscombe *pers. comm* 1993). The Huascarán, Cutervo, and Tingo Maria NPs (Figure 9.5) are not important conservation units for bears. The latter two parks are surrounded and impacted by coca fields (Young 1992). Four conservation units with bears exist on the eastern slopes of the Oriental Andes (Figure 9.5). Three of these give the spectacled bear their best chance of survival in Perú: the Río Abiseo NP in the north, Yanachaga-Chemillén NP in central Perú, and Manú NP in the south. All have over 1,200km² of bear occupied habitat which was found to be the minimum necessary to contain a spectacled bear population that was reported to be stable by hunters (Peyton 1989, Table 9.5). Only 5% of the spectacled bear range above 1,500m on the eastern Oriental slope is included within the boundaries of these three parks (Young 1992). The parks are separated from each other by >250km of unprotected wilderness. More of eastern slope of the Oriental Andes needs to be preserved. Protected land bridges that connect parks and forest reserves should be established even though initially they will not be functioning institutions. Forested corridors

Table 9.5. Size and amount of spectacled bear habitat in national parks (NP) and historical sanctuaries (NS) in Perú.

Conservation unit	Year established	Total area (km ²)	Bear occupied area (km ²)
Cutervo NP	1961	25	0
Tingo Maria NP	1965	180	0
Manú NP	1973	15,328	2,300
Huascarán NP	1975	3,400	150
Machu Picchu HS	1981	326	89
Río Abiseo NP	1983	2,745	1,920
Yanachaga-Chemillén NP	1986	1,220	1,000
Tabaconas-Namballe NS	1988	295	295
Total		23,314	5,754

adjacent to these parks extend for >3,000m of elevation and >200km along the Oriental Andes. Recently Río Abiseo NP and areas adjacent to Yanachaga–Chemillén NP (Bosque de Protección San Matías–San Carlos and the Cordillera El Sira) are experiencing incursions by coca growers, the plant from which cocaine is derived (Dr. Antonio Brack-Egg pers. comm. 1994). This development is threatening to both parks and their management. The fourth conservation unit, the Historical Sanctuary of Machu Picchu is too small to protect bears without intensive management of adjacent land. Of its 326km², only 89km² was found by Peyton (1987a) to be of good quality for the species. However, its status as one of the most prominent tourist attractions in the world make it too important to ignore for bears.

The spectacled bear is one of a few species that can serve as an umbrella under which conservation can affect the greatest number of conspecifics. This is especially true in Perú which is considered to be one of the 12 most diverse countries in the world (UNEP 1991). Perú's Andean taxa are characterized by unusually high endemism (Table 9.6) and high turnover rates in species composition. The cloud forest above 1,500m in Perú where bears live contain an estimated 15% of vertebrates and vascular plants, and 32% of Perú's endemic species in only 5% of Perú's landmass. On a unit area basis that level of endemism is 5.75 times greater than it is in Perú's Amazonian forests (Leo 1993).

Under optimal management the three largest national parks in Perú's Oriental Andes would preserve only a fraction of that diversity because of the high turnover rates in flora and fauna between them. For example, half the flowering plants found in Río Abiseo NP have not been found in Yanachaga–Chemillén or Manú (Young 1988). If these three parks become habitat islands in a human altered landscape, many or possibly most of the species they contain would be unreplicated anywhere in the world. Management is far from ideal for these three parks to exist in the future, let alone the 250–400km of land between them. Perú's government currently employs approximately 35 forestry guards to protect the entire eastern slope of the Oriental Andes. The level of protection translates to 5,700km² of spectacled bear habitat/park guard (Young 1992).

Legal status

On the basis of Albert Erickson's 1965 survey, the spectacled bear was listed as Vulnerable in the IUCN Red Data Book (Peyton 1987b). Hunting and other forms of take of spectacled bears are prohibited in Perú by the Forestry and Wildlife Law (Decree Law No. 21147, 1975). Perú ratified CITES in 1975. The spectacled bear is listed on Appendix I of CITES which further prohibits the trade in spectacled bears and its parts by signatory nations. Both legal instruments were weakened by subsequent legislation. On 30 May, 1992 the Peruvian government enacted legislation that defined conditions for the take of endangered species from the wild for captive breeding (D.S. 018-92-AG). A Ministerial Resolution on 18 May, 1993 (R.M. 0164-93-AG) established fees the government would collect for each animal taken under the former provision. The eligible list included spectacled bears and other Appendix I and II species of CITES (K. Young pers comm. 1993). Take of a spectacled bear under this provision would cost US\$1,000 (Daniel Aguilar 1993, pers. comm.). Although the Director of Wildlife confirmed that fees would be paid only by zoos (Mariella Leo Luna pers. comm. 5 April, 1994), the legal provisions do not prevent the commercialization of endangered wildlife by either the recipient or the government. The exploitable loopholes in

Table 9.6. Biodiversity (number of species) of various taxa in Perú as a whole and that portion contained in Peruvian cloud forests above 1,500m elevation in the Oriental Andes (OA). Percentages of species totals appear in brackets.

Taxa	All species		Endemic species		References
	Perú	OA	Perú	OA	
Vascular plants	20,000	>3,000 (15)			Gentry 1980, Young 1991
Anurans	295		110	42 (38)	Leo 1993 and references therein
Mammals	460		52	17 (33)	Leo 1993, Pacheco <i>et al.</i> 1995
Birds	1,702	930 (55)	112	29 (26)	Parker <i>et al.</i> 1982, O'Neill 1992

the provisions include the lack of restrictions on how bears and other wildlife are caught and how “registering and marking” captive offspring (article 4c of D.S. 018-92-AG) will guarantee wild bears will not be taken. Lacking are provisions requiring sufficient background checks on recipients and monitoring what happens to transferred wildlife. These laws enable the government to partake in the illegal sale of wildlife, whether intentional or not.

Perú ratified the World Heritage Convention in 1982. Four sites with spectacled bears were inscribed: Machu Picchu Historical Sanctuary (1983), Huascarán NP (1985), Manú NP (1987), and Río Abiseo NP (1990). In 1977, Perú had three biosphere reserves accepted in the UNESCO Man and the Biosphere Programme, among them the Huascarán and Manú NPs. The Biodiversity Convention signed by Perú in 1992 was ratified a year later by the Peruvian National Congress.

Population and habitat threats

The combination of rural population growth, lack of land ownership, and increased road access through bear habitat is the most serious threat to bears in Perú. Currently an estimated 1.5 million people (< 10% of Perú’s population) live in the montane forests of the Oriental Andes where the best bear populations are found (Young 1992). Their ranks are augmented yearly by people fleeing from terrorism or meager employment in the coastal cities and highland Departments of Cajamarca, Junin, Ayacucho, Cusco, Pasco, and Puno. These migrants cause more damage than residents because they are unfamiliar with the fragile ecological conditions that discourage permanent agriculture in montane environments.

Roads are the axes that define the major breaks in the spectacled bear population. Coastal desert bear populations are isolated from one another by the settlements along roads built to exploit the Amazon basin. Settlements and agriculture now occupy most of the inter-Andean valleys. Bears are thus prevented from crossing between the three Andean ranges and populations are increasingly fragmented within ranges. The economic pressure to build roads has threatened the integrity of the largest national parks with bears. Within the past 15 years conservationists have brought enough pressure on politicians to halt the construction of roads that would bisect both Río Abiseo and Manú NPs. Huascarán NP had a road built through it in the early 1980s along the southern end of its bear habitat. The nearly absent regulatory presence in national parks to protect bears (discussed below) is another reason why road access is such a severe threat. Parks with bears offer only passive protection against the encroachment of humans that roads allow.

Of the products of increased access, habitat loss has had a more significant impact on Peruvian bear populations than has hunting. The two impacts are related. Spectacled bears increasingly adapt to feeding on crops that replace their natural foods. The reliability of finding bears in cornfields has made them easy targets for hunters. Peruvian farmers compensate for their lack of weapons by bringing in professional hunters to eradicate depredating bears. Until now, hunting has been an additive source of mortality to bears. The trend in Perú is for hunting to have a more significant impact on spectacled bear populations than habitat loss. This is evidenced by the disappearance of bear sign over the last three decades in the Occidental and Central Andean Ranges where good quality habitat remains. The most severely impacted areas are where



Rare photograph of a spectacled bear (*Tremarctos ornatus*) at a water hole in the Peruvian desert of Cerro Chaparri, Department of Lambayeque. Once easily lassoed and clubbed by mestizo hunters on horseback, these desert bears are rarely seen by local inhabitants if at all. They are now the most endangered spectacled bear population in South America.

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people have reduced the core habitat for bears to less than 500km². Another indication of the severity of hunting has been the recent improvement of bear populations in the central and southeastern parts of the Andes since 1985. Less bear hunting occurred because people were inhibited from carrying firearms that might increase their chance of being killed by Sendero Luminoso guerrillas or the Peruvian army sent to combat terrorism (A. Begazo, R. Marin, and A. Luscombe pers. comm. 1993).

The most severe habitat threat to spectacled bear populations in Perú is their restriction to poor quality habitat. Montane forest is being replaced with cornfields and pasture in the lower elevations (600–2,000m) of the bear's range. Livestock are also grazed in the highlands (above 3,000–3,500m). The net effect is to limit the spectacled bear to poor quality habitat in between. The elevations of 2,700–3,300m are choked with bamboo species (*Chusquea* spp.) the bear does not eat. Preferred fruit sources are rare to nonexistent. Trees with their associated bear foods of epiphytic bromeliads and orchids are also less abundant. And finally the energetics of moving in the environment is higher due to increased slope inclination and higher vegetation density in heights above the ground occupied by the bear's body (Peyton 1987c). It is not known whether bears can survive if limited to these elevations. They might not because there are no known bear populations in the bamboo forests of the Andes that do not have access to fruit sources either above or below. Most of the bear habitat below 1,800m has been replaced by cropland in all three Andean ranges in Perú except on the east slopes of the Oriental Range.

The removal of seasonally available fruit from the spectacled bear diet could severely impact recruitment. The timing of ripe fruit coincides with the time of cub rearing and may be important in bringing potential mating pairs of bears together. These effects are expected to be most pronounced in the Apurimac valley where for most of the year bears have little to eat other than terrestrial bromeliads (*Puya* spp.). People occupy elevations above the bears (2,700–3,000m) where precipitation is sufficient for agriculture. The boundary area between bears and humans support cactus groves (*Opuntia ficus indica*, *Trichocereus* spp.) which provide bears with fruit. As many as nine bears have been seen feeding in close proximity to one another in cactus groves (Peyton 1981). Increased cattle and goat grazing in this habitat has trampled the cactus and caused bears to avoid the habitat. Poor nutrition may be one reason why adult female bears here weigh approximately 35kg and are reported to have only 1 young (Peyton 1981, unpubl. data). Genetic effects due to inbreeding could be another factor to explain the apparent low viability of Apurimac bears. If so, the near vertical topography of the elevations below 3,000m to the Apurimac River that prevents human access may not be sufficient to save the species here.

Food is not nearly so limiting for bears in the coastal desert. Bears here have been seen with two young and killed in excess of 100kg in weight. Unlike the Apurimac situation, human encroachment is proceeding from the lower elevations as well. Bears, particularly sows with cubs, make extensive use of riparian and cliff habitat in the desert for food, water, and day bedding (Peyton 1980). Habitat threats here include the cutting of forests in riparian areas to make crates for agricultural produce, housing, and firewood. The loss of tree cover causes year-round water sources to evaporate which may limit the bear's ability to exploit nearby areas.

Fires set in the dry season by farmers to fertilize and clear fields for crops or cattle can alter bear habitat kilometers from where they are set. A fire set by railroad employees in the Machu Picchu Historical Sanctuary in 1988 raged over 34km² of bear inhabited wilderness (Diaz 1989). The long-term effect is not known, but the short-term effect was to reduce the quality to bears of approximately 40% of their best habitat. The increase of smoke in all valleys has reduced the scenic value tourists place on Perú to the point of arousing concern by local and central government officials. In the past two decades 5–9% of Perú's gross national product was derived from tourism. Most of the tourists went to the Historical Sanctuary of Machu Picchu where every year the ruins and mountains become harder to see through the haze.

Management

Management focused on the needs of bears is lacking in Perú, but progress has been substantial given the young age of the national park system and its governing institutions. Resource management in Perú during the past four decades can be divided into three time periods. During the first period (1950s–1977) the Ministry of Agriculture established its authority over natural resource use (1956), and defined three management categories of forest reserves and four of protected areas (Forestry and Wildlife Law, Decree Law No. 21147, 1975). Collectively the protected areas comprise the National System of Conservation Units (Sistema Nacional de Unidades de Conservación) (SINUC). Policy formation and administration of SINUC was given to the General Directorate of Forestry and Fauna (Dirección General Forestal y de Fauna) (DGFF) a division within the Ministry of Agriculture. Since the establishment of the first conservation unit in 1961, SINUC today comprises 25 units totaling 4.29% of Perú's landmass (IUCN 1992). Six of these units contain bears and approximately 5,750km² of bear habitat (Table 9.5).

During the second period (1977–1987) policies originating from the central administration split the authority over conservation units between the DGFF and the National Forestry and Fauna Institute (INFOR,

Instituto Nacional Forestal y de Fauna), a public institution that conducted agroforestry research. The ill-defined hierarchy left Perú without an autonomous institute to manage protected areas and enforce forestry law (Injoque *et al.* 1991). Consequently, human encroachment occurred in all conservation units by both landless peasants and by the more powerful development interests of the Ministries of Transport, Fisheries, Mining, and Tourism (Ferreyros 1988). The Cutervo, Tingo Maria, and Huascarán NPs lost their conservation value for spectacled bears during this period.

Consolidation and decentralization of administrative bodies has occurred since 1987 when INFOR was dissolved. Its responsibilities and those of the DGFF were incorporated into a National Institute of Natural Resources (INRENA, Instituto Nacional de Recursos Naturales). District forestry units (distritos forestales) and forestry development centers (centros de desarrollo forestal) were integrated into 12 Agrarian Units, now the sole regional offices with greater autonomy. The SINUC and all other state controlled lands such as national forests were incorporated under one organization, the National System of State Protected Natural Areas (SINANPE, Sistema Nacional de Areas Naturales Protegidas por el Estado). Perhaps most critically important to bears, an Environment and Natural Resources Code (Legislative Decree No. 613 of 1990) was passed which consolidated all previous legislation into a cohesive document. Among the provisions was one that recognized the rights of native communities to own land, and one that repealed the Law for the Basis of Rural Development of the Peruvian Amazon (No. 24994 of 1989). The latter had promoted extensive agricultural development in the Amazon basin (IUCN 1992). Together these measures allowed authorities to implement “sustainable yield” principles, without which forests where bears lived would be continually mined without replacement. Subsequent revisions of the Peruvian Penal Code included for the first time sections that specified penalties for violations of laws dealing with wildlife and natural resources (T. Luscombe pers. comm. 1993).

The act of consolidation and decentralization coupled with declining economic conditions in the country at large had severely reduced the staff in the DGFF. For example in the two years from 1991 to 1993, the number of park guards employed by SINANPE fell from 143 to 93. Most of the conservation units within SINUC were not fulfilling their management objectives. The NGOs Asociación de Ecología y Conservación, Asociación Peruana para la Conservación, and Fundación Peruana para Conservación de la Naturaleza did their best to fill the management need by providing conservation units of SINUC with equipment, personnel, and research projects. SINUC and SINANPE have continued to receive little support by the government which results in inadequate salaries and training (Ferreyros 1988). Conservation of bears and habitat both in and

outside management units will continue to decline unless this infrastructure is supported.

Two conservation units are too small to maintain viable bear populations without bear use of adjacent land (i.e. Machu Picchu HS and Tabaconas–Namballe NS). The rest are becoming that way. Most of the spectacled bear range in Perú (93%, Peyton *et al.* 1997) exists outside parks where the interests of local communities prevail and enforcement of forestry laws is weak. Therefore, the future existence of bears in Perú depends on the support bears receive at the local level. Central authorities must grant community institutions greater authority to manage resources in return for their cooperation in maintaining bear populations and the watershed resources they share with bears. Management authorities have just begun to seriously address this issue.

Human-bear interactions

In pre-Colombian time, the spectacled bear was worshiped as a vehicle for change. Everything from the passage of sickness to health, of the underworld to heaven, of dark into light, and passage of time (one year to the next, adolescence to adulthood) was attributed to the powers of spectacled bears (Randall 1982). The Incas likewise considered the bear to have spiritual value, and sometimes let bears go after capturing them in predator roundups designed to protect their camelid herds from mountain lions (Tschudi 1844). By 1850, the influence of Spanish culture had supplanted these beliefs with one that viewed the bear as a symbol of machismo. The descendants of the Spanish Conquistadores lassoed and clubbed bears from horseback when the latter fed on shrub fruits (*Capparis* spp.) in the open desert (Peyton 1981). During the latter half of the 19th century, dogs were used by hunters, enabling hunters to kill bears in their forest refuges (Osgood 1914). Machoistic identification in the bear is now widespread among local farmers. Like their ancestors they drink the blood of bears as a communion to being more bear-like. Fat, which was once used by the Incas as a salve for tumors, (Baumann 1963) is now used to cure rheumatism and acne (Brack-Egg 1961). Baculums and paws fetch more than a month’s salary to a farmer. Bear scats are fed to cattle (Ricciuti 1983) and smeared on newborns to make them strong. A bear with 10 litres of fat could be worth more than US\$115 to a farmer, or half his annual income. On average between 1–3 bears are killed per year in most valleys of the Cordillera Oriental. Fortunately, the international trade in bears and bear parts has not impacted Perú’s bear population. That is likely to change due to the high presence of Asian companies doing business in Perú.

In addition to the lure of prestige and income from killing bears, the loss of crops and livestock to depredating

bears further motivates farmers to kill them. Of 25 cornfields with bear feeding sign examined by Peyton (1980), five of the fields were half consumed by bears and three were totally consumed. It is common in Perú to hear farmers complain of bears killing their entire herd of livestock. Farmers without guns either make arrangements to have bears shot by the military, police, or sport hunters; or poison them with parathion in baits (Peyton 1987b). There still remains a vestige of the ancestral spiritual belief about bears, but that is likely to disappear with the passing of the current generation. Therefore, policies to save bears in Perú must include means of compensating farmers for losses due to agricultural depredation, reduced use of bear habitat, and loss of income generated by the sale of bear parts. Alternative employment for farmers include tourism, orchid farming, development of hydroelectric power and pharmaceutical products, and preservation of genetic diversity in important food crops. The latter includes more than 3,000 varieties of the potato, a food that originated in Perú. Spectacled bears may be the principle dispersal agent of one of the three most important timber sources in the cloud forest, members of the Lauraceae family (Peyton 1987c).

Public education needs

The most important aspect of a public education program is that it recognizes bear conservation is affected by all sectors of society. The target groups to receive education on environmental issues that affect bears are: policy makers (government officials, law makers), policy implementors (park guards), monitors and educators (NGOs, teachers), students, resource developers (corporations, lending institutions), and resource users (farmers, urbanites). The message to all groups is the maintenance of bear habitat and civilization in Andean nations as we have known it are inseparably intertwined. Spectacled bears by virtue of their cosmopolitan use of the Peruvian Andes are a good thermometer for the health of the environment as well as a flagship representative of it. Their cultural status as a symbol of renewal and endurance provides hope and heritage to Perú's lower classes.

Public education must promote a dialogue between target groups to solve problems together. For example, resource users are rarely consulted by policy makers and don't often become project implementors. Policy makers and developers have as much need to understand the concepts of sustained yield and how to apply it to bear habitat as NGOs need to understand that resource users can not be prohibited from using resources without being compensated. The infrastructure for public education is well developed in Perú. There are more than 80 environmental NGOs in Perú. The projects listed in the next section address specific needs of target groups.

Specific conservation recommendations

These recommendations are organized under the four factors Kellert and Clark (1991) proposed were important for natural resource policies and listed under the social group that would implement them. Varying institutional strength, costs, and time scales over which projects occur make it difficult to prioritize these steps. Generally, steps mentioned first within an outline level have more importance or are pre-conditions for later steps to occur. The overall goal is to reduce negative human impact on bears both in and outside protected areas, and wherever possible improve welfare of people who share resources with bears in return for their stewardship of these national treasures.

Biological

1. *International*: Link Podocarpus NP in Ecuador to Tabaconas–Namballe National Sanctuary in Perú with protected corridors that would additionally extend for another 200km to the northeast to include the Cordillera del Condor.
2. *Central/Regional Government*: a) Discourage new road access through cloud forests; b) Increase the number and size of protected areas with bears on the eastern Oriental slope. Establish buffer zones around significant bear areas and corridors of protected habitat between them; c) Improve conditions for bears within existing parks. Create incentives and pressure to remove miners, settlers, and livestock from core and buffer areas. Deploy park guards, preferably chosen from local communities (target at least one guard/300km² of park); d) Implement policies designed to reduce agricultural damage due to bears (e.g., legislation that allows removal of problem bears, passive and active deterrence, compensation program, etc.); e) Research indicators of ecosystem health in both relatively pristine and severely degraded Andean habitat. Use comparisons to argue for preserving habitat.
3. *Community*: a) Research and monitor bear populations and threats to them. Provide local knowledge to researchers and project planners; b) Improve and maintain bear habitat, especially in buffer areas and corridors, through: removal of livestock, trail closure, prohibition of logging trees bears feed in, controlled burns to improve food abundance and diversity, etc.; c) Reduce bear depredation of crops and livestock by improving yields on land further from the forest refuges of bears and employing crop guards in the fields at the forest edge.
4. *NGO*: a) Research the impact of bears and humans on each other and on shared resources. Identify what behaviors should be changed in both man and bear and risks local people take to benefit bears. Research topics include: bear depredation on agriculture, bear use of

habitat, bear population estimates and status, habitat conversion/loss, hunting, and commercialization of bears and bear parts; b) Provide training and standardize methods to apply them in other areas and draw comparisons.

Social

1. *Central Government:* a) Implement policies that provide land tenure for residents of bear habitat. Build it on informal systems wherever possible. Use arguments generated from pilot projects that demonstrate local capacity, and use comparative studies that show the relationship between degree of resource ownership and ability of Andean areas to provide resources; b) Support private property laws and uphold domestic food prices; c) Encourage agricultural extension, technical support, and facilitate credit on favorable terms to owners of small farms (<0.10km²).
2. *Regional Government:* a) Improve the welfare of those who live near bears (e.g., develop markets and agricultural extension services; improve educational opportunities, transportation, access to credit institutions, and health facilities) in return for community cooperation in sustained resource use; b) Develop and maintain more intensive use of existing land under cultivation around bear areas (e.g., repair and create irrigation systems, terracing, raised crop beds; encouraging multi-cropping and longer fallow periods; plant leguminous crops and shade trees for soil enrichment, vaccinate livestock, etc.); c) promote education to improve the public perception of both protected and unprotected areas.
3. *Community:* a) Research and monitor resource use and the acceptance of goals by the community to improve bear populations; b) Increase public awareness through education programs that build on cultural traditions that teach respect for the environment.
4. *NGOs:* a) Improve community welfare (extend credit on favorable terms, etc.); b) Research aspirations of local communities. Identify incentives or benefits that will compensate changes in their behavior. Research topics include: resource ownership and use patterns, political processes, impact of outside influences, bear depredation on agriculture, sources of livelihood including commercialization of bears and bear parts, labor organization, and agricultural yield per unit effort).

Institutional

1. *International:* a) Foreign governments must cease to support measures that obligate Perú to mine resources without replacement and encourage the spread of informal economies further into bear habitat (e.g., cease support for coca field eradication, control of capital markets, domestic agricultural subsidies, and

unfair tariffs on imports); b) Reduce, write-off, and/or reschedule foreign debt payments; c) Increase foreign aid and technical support; d) Uphold legislation that makes domestic and multinational companies accountable for their activities that degrade the environment within Perú's borders.

2. *Central Government:* a) Promote vertical and horizontal coordination of policies between and within ministries; b) Decentralize authority to manage resources. Form partnerships with indigenous groups, community institutions, NGOs, industry, regional utility corporations, and lending institutions to cooperatively manage resources. Provide regional and community government bodies with a principal role in the decision making process and the authority to prevent misuse of resources. Make these authorizations accountable to the national interest; c) Promote cooperative relationships with Bolivia and Ecuador to cooperatively manage border bear areas; d) Share information and provide technical support; e) Close the loopholes of recently enacted legislation (D.S. 018-92-AG, R.M. 0164-93-AG).
3. *Regional Government:* a) Improve institutional cooperation to maintain parks; b) Revise park management plans to incorporate bear needs (e.g., zone large bear areas by establishing 500–800km² core areas of no human use, establish six kilometer-wide buffers around cores with limited use, etc.); c) Increase park management staff, preferably with employees hired from local communities.
4. *Community:* a) Strengthen local institutional ability to control resource use by community members and outsiders; b) Improve communication between communities, government agencies, and NGOs.
5. *NGOs:* a) Improve role as a neutral interface between communities, government, industry, and other outside interests; b) Broaden the base of financial support for bears both domestically and abroad. Develop alternative sources of capital (e.g., tourism, orchid farming, cottage industry, etc.); c) Improve skills at all social levels to adapt and manage their own development.

Valuational

1. *All levels of social organization:* Establish the spectacled bear as a flagship for the preservation of biological and cultural resources in the Andes.
2. *Regional/Community:* Reduce hunting of spectacled bears by creating an interest in bear protection on the part of local stewards through targeting the military and police, developing a compensation program to reduce the financial loss from crop depredation, using proceeds from alternative and new developments to create employment in resource management sectors, and create educational resources.

3. *NGOs*: a) Research and improve public attitudes towards bears; b) Develop projects based on existing cultural values.

Specific projects

Río Abiseo National Park

- a. *Public awareness campaign, Río Abiseo National Park* (submitted by Mariella Leo, Biologist):

The Río Abiseo NP (RANP) is the most significant conservation unit that protects montane habitats in northern Perú. Residents of the park include the spectacled bear, an animal that makes extensive use of the cloud forest, and the taruka (*Hippocamelus antisensis*), a large deer that inhabits high elevation grasslands above the forest. Although classified in Perú as vulnerable, both species have seriously declined in numbers to the point where remaining populations should be considered endangered. Park guards reduce hunting of these species inside the park. However, they are unable to exert any control on the hunting of these species outside the park boundaries where their natural ranges extend. Here, spectacled bears are killed primarily as revenge for their depredation on crops and cattle. Taruka are killed for meat. A decrease in hunting pressure on these species in adjacent areas to the park would help prevent the extinction of these park residents in several ways. The park populations would be maintained by increased emigration from outside areas and possibly by increased genetic diversity. Also hunting inside the park would be easier to control if it were controlled in the surrounding areas.

Action: Identify people's attitudes towards these species and estimate hunting impact. A questionnaire survey will be conducted to this end in the five districts adjacent to the western border of RANP (Provinces of Pataz and Condormarca). Low cost printing material will be produced and basic information and training will be provided to the park guards to place them on the front end of the campaign to help save these species. Talks and presentations will be given in the rural towns close to the park and to the seven families settled inside the park. Information will be provided to the local police and army. Their support will be requested to avoid illegal hunting by their peers, and to help enforce the hunting prohibition in the area.

Estimated budget: US\$8,000.

Time period: 6 Months

Participating institutions: RANP administration, APECO, APECO-Trujillo, and INRENA

Action: Develop awareness among rural school children, through environmental education programs conducted by local school teachers with NGO technical

support when needed. Rural school teachers have little knowledge about the importance of endangered species and their needs for conservation. Information and adequate materials on wildlife is always lacking. A pilot project that targets school teachers from neighboring towns to the western border of RANP will be started to change this situation. A short workshop will be developed with 20 teachers from different schools to examine the current information about spectacled bears and taruka in the region and the country at large. Products from the workshop will include an outline of a teaching guide and material to be distributed among students. Final production of the material will be done in Lima where official recognition of the efforts of the participants will be requested from the Education Ministry and INRENA. The educational material will be distributed among schools by the RANP administration. An annual prize will be established for the best monograph on these species and awarded after a school contest promoted by the RANP administration. **Estimated budget:** US\$ 10,000.

Time period: 1 year

Participating institutions: RANP administration, APECO, APECO-Trujillo, INRENA, and USE-Pataz (local Education Service Unit from the Education Ministry).

- b. *Monitor the impact of depredations by spectacled bears in neighboring areas* (submitted by Mariella Leo, Biologist):

Farmers and cattle owners from the Province of Pataz (west of RANP) complain that spectacled bears are harmful animals. The argument is used to justify killing bears in the areas adjacent to park boundaries. The real impact bears have on agriculture is unknown here as it is for most areas in Perú. The information is needed locally to strengthen public awareness and the environmental education process, and nationally to formulate a policy on the problems of depredating bears.

Action: Monitor level of depredation. A survey will be conducted to determine the level of impact spectacled bears have on agriculture. The survey will include interviews with farmers and cattle owners and visits to the sites of crop damage and livestock kills. These monitoring activities will be developed with the support of APECO researchers and the park guards who will receive training on gathering and recording data. The park guards will implement the survey with fieldwork expenses covered through this project. APECO researchers will continue to support the process with two visits per year and will analyze the data. The goal will be to have a clear picture of the economic and social impact of bears on human welfare. Annual

reports of the research will supplement information for the public awareness and educational activities.

Estimated budget: US\$10,000.

Time period: 2 years

Participating institutions: RANP administration and APECO

c. *Resettlement of seven families from the RANP* (submitted by Mariella Leo, Biologist):

A few months prior to the establishment of the RANP in 1983, a local farmer set up a farm in the Abiseo River valley. Relatives came to the area during the following years and settled without knowing they were inside a national park. In 1985 an aerial survey of the RANP failed to locate their small village. After the park administration was established in 1986, the Park Chief contacted the settlers and initiated some attempts for their resettlement. Although their impact in the park is unknown, their presence is a constant source for potential violations of park laws (hunting, burning, etc.) and their presence could stimulate other migrant farmers to settle in the park.

Action: Negotiate the resettlement of families who currently reside in RANP on a case by case basis. Alternatives other than cash compensation will be offered to these families. Agreements will be devised according to current laws. APECO staff will monitor the process and facilitate coordination among government organizations and with the farmers.

Estimated budget: US\$10,000.

Time period: 2 years

Participating institutions: RANP administration, INRENA, Dirección Regional Agraria-La Libertad, and APECO.

Tabaconas/Namballe

a. *Human influence on spectacled bear populations in “El Chaupe,” an adjacent forest to Tabaconas-Namballe NS* (submitted by Juan Jose Rodriguez, Oscar Hernandez, and Anthony Luscombe, ECCO):

Stable or increasing spectacled bear populations have not been found in areas less than 1,000km² in size. The 290km² of Tabaconas–Namballe NS are too small to maintain spectacled bears without intensive management; management that might prove too expensive for future budgets and too restrictive of resources that local communities depend on. Without local support for the park it will be overrun by settlements and agriculture. A management model that works well is to create a multiple use zone in areas that surround or buffer a core area where human use is prohibited. Tabaconas–Namballe is too small to include these buffer zones within its boundaries. If the 490km² of adjacent forest known as “El Chaupe”

were included in a park master plan, the combined area would be large enough to preserve watershed products and its species for benefit of both man and bear. The additional land would reduce the cost of sustaining bears exponentially, as well as preserve the greatest number of options for future use of the park.

Action: Research the effect humans and bears have on each other in “El Chaupe.”

The biggest threat to spectacled bear populations is the rapidly expanding human migration into prime bear habitat. Tabaconas–Namballe National Sanctuary has the most promise to sustain bears of any area in the western Andean range in Perú, provided that the forest in the sanctuary and adjacent areas remains intact. The future of these forests depend on their ability to provide benefits for the local communities. For the past two years staff of ECCO have been helping local farming communities stop a logging company from removing trees from “El Chaupe,” a 490km² forest adjacent to the sanctuary. The local communities received no payments or jobs from the logging and thus were against it. There is no guarantee that the forests are safe from future logging. The expanding human populations surrounding these forests will eventually cut them down without replacement unless alternative employment and methods to preserve them can be found. As a first step, field work is needed to learn about how bears and humans use resources in the park. The process of learning the effect each has on the other has many human benefits. Among these are building rapport and capacity with local communities (e.g. training of future park staff, project or industry managers), and identifying resources that can finance the restricted use of enough area to preserve the watersheds and their species. Beside the spectacled bear, the forests on the border with Ecuador that include Tabaconas–Namballe are the only areas in Perú that have the woolly tapir (*Tapirus pinchaque*). The information gathered will be used to convince the Peruvian government of the need to include adjacent forested areas such as “El Chaupe” in a park management plan.

Estimated budget: US \$8,245.

Time period: 1 year

Participating institutions: ECCO and its Bear Working Group, and the Univ. of Cajamarca.

b. *Research bear/human interactions as a first step to maintaining a dispersal corridor for bears between Manú NP., HS Machu Picchu, and the Apurimac Valley* (submitted by Constantino Auca, ECCO):

At the present rate of human population expansion, the spectacled bear in southern Perú will be reduced

to two separate populations within the next 20–30 years: the largest in Manú NP of at least several hundred, and a very small population of under 50 bears in the HS of Machu Picchu. Citing either demographic or genetic causes of decline, no biologist gives either population much chance of surviving. The existence of spectacled bears in southern Perú depends on preserving enough habitat between and adjacent to these parks. In most of the valleys outside parks, local farmers remove the tall forest on the lower slopes for their cornfields at the rate of 100m of elevation every three years. As the best food producing habitat is replaced by corn and cattle, bear depredation on agriculture and the subsequent ire of local farmers increases. In the vacuum of alternative resources or ways to exploit them, farmers will destroy their own livelihood on these slopes if the current use continues. Before that happens, enough habitat will be removed and enough bears will be killed in cornfields to reduce the bear population in southern Perú to a level it cannot recover from. What is needed is a program to teach people to conserve their environment for themselves as well as bears.

Action: Research status of bear and human use around and between the HS of Machu Picchu and Manú NP with the objective of preserving a corridor for dispersal between these parks.

A field team, made up of ECCO coordinator Constantino Auccha and biology students from the University of Cusco, will research the status of bear habitat and its use by bears and humans in the areas between and surrounding Manú and Machu Picchu. Included in the study area are the valleys between the junction of the Pachachaca River and the Apurimac River and the Salcantay range, and the valleys accessed from the Marcapata to Shintuyo road that runs along the eastern boundary of Manú NP. The main objective will be to create a map of bear and human use areas. Agriculture and bear depredation will be thoroughly researched, including estimates of effort, yield, actual damage, and perceived loss to pests that include bears. The products of the study will include capacity building for future managers and technicians in both the university and the local communities. The research results will be used to strengthen arguments to add adjacent land to park management plans, and empower local communities to manage lands between the parks for the combined benefit of both man and bear. The principle interest for bears will be to preserve a corridor between parks and to prevent further isolation of bears in southern Perú.

Estimated budget: US \$10,725.

Time period: 1 year

Participating institutions: ECCO, Univ. of Cusco.

Status and management of the spectacled bear in Venezuela

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Historic range and current distribution

Historical accounts from the 16th to 18th centuries suggest a wider bear distribution than exists today. Past distribution could have extended to mountainous and forested regions adjacent to the southern margin of the Orinoco river and perhaps, although with less probability, to the Interior range of eastern Venezuela (E. Yerena, *Distribución pasada y contemporánea de los úrsidos en América del Sur*. Informe de Seminario EA-7154, Dep. Estudios Ambientales, Univ. Simón Bolívar, Caracas, 1987). Most accounts correspond to animals whose descriptions could resemble those of spectacled bear. Humboldt and Bonpland (1814) and Codazzi (1970) are the first naturalists who refer specifically to the presence of bears (without specifying the species) at the beginning of the 19th century, particularly in the region of Guayana, south of the Orinoco river. Based on the evidence of unconfirmed reports of bear presence, spectacled bears may have existed in the mountain ranges of San Luis (Falcón State) and Aroa (Yaracuy State). Although these regions have Andean biogeographical affinity, it is not likely that areas such as these that are outside the Andean region have bears today.

Present spectacled bear distribution is discontinuous but encompasses humid forests and páramos with little to no human impacts in the Andes mountain range of western Venezuela (Mondolfi 1989, Figure 9.6). This range splits from the Colombian Oriental mountain range into two divergent and isolated branches, the Perijá and Mérida ranges. The Perijá Range heads north and has nearly 8,000km² of forested mountain habitat for bears (Yerena and Torres 1994). The Mérida Range heads northeast. Its 13,300km² of forested mountain slopes are broken into

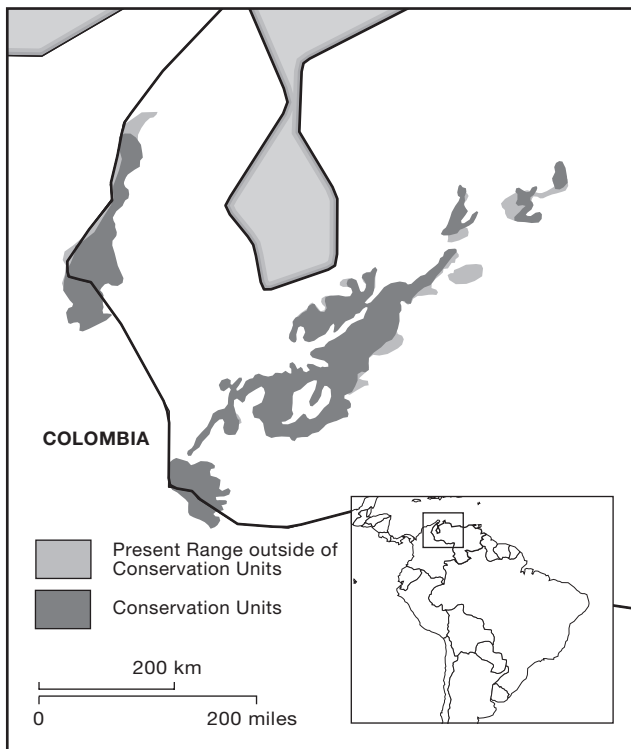


Figure 9.6. Present range of spectacled bears (*Tremarctos ornatus*) in Venezuela and conservation areas.

four wilderness fragments: Tamá, Central, Dinira and Portuguese (Yerena and Torres 1994).

The Perijá distribution is almost exclusively in Venezuela along the eastern slopes of the range. Wilderness areas with bears are scarce on the western slopes in Colombian territory, and more prevalent south of the Venezuelan border in the Catatumbo river basin. The latter region supports a bear population whose range is mostly to the north in Venezuela. The Tamá massif where Colombia's Oriental range terminates, is the starting point of the Mérida range. There the distribution is restricted to the wilderness areas of the massif, from the foothills up to the summit and extending toward the Colombian portion. The distribution becomes discontinuous along the altitudinal depression that separates Tamá from Chorro El Indio NP. From then on to the end of the Mérida range the topography is steeper and higher in elevation. Here wilderness areas (up to Guaramacal NP) are relatively continuous and restricted to the higher portions of the range. These areas have difficult access and are not ecologically favorable for agriculture. The replacement of wilderness by coffee plantations fragment the spectacled bear's distribution at the end of the Mérida range, between Guaramacal and Terepaima NPs (Portuguesa range). In spite of the local extinction of bear populations due to agriculture, bears are reported to seasonally use semi-isolated cloud forest tracts as small as 70km² (Yerena 1992; Goldstein 1990).

The altitudinal range of bears in Venezuela is from 400 to 4,300m. The areas where bears are most often observed at low altitude are in Perijá, Sierra Nevada, and Tamá (Goldstein 1990; Yerena 1988). As in other Andean countries, most bear locations are reported above 1,000m. (E. Yerena, *Distribución pasada y contemporánea de los úrsidos en América del Sur. Informe de Seminario EA-7154, Dep. Estudios Ambientales, Univ. Simón Bolívar, Caracas, 1987*).

Most high altitude vegetation formations are bear habitat. The Venezuelan Andes have two fundamental natural vegetation formations: woody (predominance of shrubs and arboreal life forms) and non-woody (predominance of rosette-like life forms). The latter are alpine meadows above and around timberline called páramos (Vareschi 1970) which generally do not share the same space with woody formations. Most páramos are used by bears (graminoid páramos and Andean páramo). Forest (woody formations with predominance of trees) that support bears are: evergreen dry forest, submontane forest, montane seasonal forest, cloud forest (characterized by scarce sunlight and frequent fogs), páramo forest, and high Andean forest (Yerena 1992, using habitat classification by Beard 1946, 1955; Monasterio 1980; Sarmiento, G., M. Monasterio, A. Azocar, E. Castellano, and J. Silva, *Vegetación Natural: Estudio Integral de la Cuenca de los Rios Chama y Capazón*. Subproyecto III. Facultad de Ciencias, Universidad de Los Andes. Mérida, 1971). Seasonal and semi-arid formations such as dry deciduous forest and thorny scrubs have not been sufficiently studied in Venezuela to determine if they support bears or have that potential. Desert páramo and periglacial desert (Monasterio 1980) are seasonally traversed by bears, but do not support bears year-round. The timberline at around 3,000m is an important habitat for bears (Goldstein 1990). This ecotone is characterized by interspersed forest/shrub/páramos. Its location on mountain slopes is mostly affected by climate, however fire and other human interventions play a key role (Monasterio and Reyes 1980).

In the short term we do not foresee a significant reduction of bear distribution area, except in the Portuguesa range. Here, it is possible bears will go extinct in Terepaima NP, whose forests are isolated from the rest of the forested Mérida range. This process may be caused by a combined effect of poaching and deforestation for agricultural purposes. The low altitude and lack of steep slopes of this relatively small region allow human access. The available habitat to bears may decrease in the northern end of the Perijá range due to coal mining, timber extraction, and agriculture (legal and illegal crops), as well as in the foothills of its eastern slope due to cattle ranching and agriculture. The long-term future of bear populations at Tamá and Perijá NPs relies on the maintenance of bear populations in adjacent territory under Colombia authority. Both national

parks have counterparts in Colombia, but the possibility of maintaining wilderness continuity with other areas in Colombian is unknown. The eventual isolation of these transfrontier populations is worrisome.

Status

Our best estimate is that there are probably no more than 1,000 bears in Venezuela. There is no empirical data on bear population numbers in Venezuela, and direct field estimates have been made (Goldstein 1990). However some densities have been estimated in the central block of the Mérida range, based on the number of hunted bears in relatively confined areas, and on information provided by hunters. The average of these estimates was 0.04 individuals/km² or 1/25km² (Yerena 1992). This density is low considering estimates by Peyton in Perú and comparable data of *Ursus americanus* (Peyton 1984). Extrapolation of this density over the total amount of forested habitat in the central block of the mountain range (approximately 4,600km² in the states of Trujillo, Barinas, Mérida and part of Táchira yeilds a population estimate of 180 individuals (Yerena 1992). Further extension to include all bear habitat in Venezuela (around 21,400km², Goldstein 1990) results in a population estimate of 1,000 bears.

Legal status

In Venezuela there is no specific legislation regarding conservation and management of spectacled bears. Nevertheless the Wildlife Protection Act of 1970 listed the spectacled bear as a species for which hunting, poaching, and commercial harvesting were prohibited. Bear hunting for any reason has been prohibited indefinitely since 1980 (ministerial resolution/DGAA-95 of Jan., 1980). Venezuela subscribed to CITES in 1976, and thus has protected spectacled bears as an endangered species under Appendix I resolutions.

Population threats and human interactions

The main threat to bear populations is poaching. An estimated 2.47 bears/year have been poached during the last 70 years in the surroundings of the city of Mérida situated in the central tract of the Mérida range. This might be an underestimation (Yerena 1992). If this loss is representational of the entire Mérida range, it would be multiplied 10–13 times, a significant impact on the viability of what probably amounts to no more than a few hundred bears. Notwithstanding the lack of data on illegal kills, poaching undoubtedly is exerting deleterious effects on wild populations. The main reasons for hunting are cultural

and economic (Yerena 1988; Mondolfi 1989; Herrera *et al.* 1992; I. Goldstein pers. comm). Manhood is achieved by poachers who kill bears. This could be linked to the fear that the bear's strength inspires. Also bear parts (e.g., fat, bones, baculum, and blood) are valued for healing or magic purposes. In all studied cases poaching has met a double purpose: providing meat and hunting trophies. Bear hunting is most often opportunistic, and thus not planned. Skin and claws are generally conserved as hunting trophies. The main economic incentive that justifies poaching is to eliminate nuisance bears blamed for cattle losses, and not the commercialization of bear parts. Cattle losses encourage organized bear hunting, mainly in páramo habitat (Goldstein 1991).

Habitat threats

Habitat loss is the second largest threat to bear populations in Venezuela. At risk are the remaining wilderness areas (Yerena 1992; I. Goldstein pers. comm.). After European settlers arrived at the beginning of the 16th century, wilderness areas were reduced, especially those located on internal mountain valleys and plateaus. Generally these were areas with moderate and seasonal climates (corresponding to semideciduous and evergreen forests). Agricultural expansion reached its maximum limit during the first decades of the present century. Although the affected areas generally started to recover since the 1940s, large portions of the bear's range did not. The humid forests that were probably bear strongholds above Lake Maracaibo were rapidly transformed into plantations and cattle fields during the 1950s. During the same period an estimated 12,890km² of forest was lost on the Llanos foothills (Orinoco river basin), or 67.5% of the original forest (Veillon 1977). Now agriculture is expanding again, especially in paramo lands. This is occurring due to its profitability in both wilderness areas and formerly abandoned fields. The effect of these agricultural interventions is the fragmentation and isolation of forest tracts.

This is particularly characteristic of the Portuguesa mountain range, and around Dinira and Tamá NPs. Habitat in the Perijá range is not yet fragmented. Thus this range is the most important block of bear habitat in Venezuela (Yerena and Torres 1994).

Management

Up to November 1996, Venezuela had 43 national parks and 23 natural monuments, that represent around 15% (150,000km²) of the national territory. By 1986 there were five national parks with bears in the Venezuelan Andes (Table 9.7). The number of protected areas dramatically

increased following field studies on bear ecology and conservation by Venezuelans in the 1980s, and due to efforts by Venezuelan members of the IUCN/SSC SBSG. Presently 13 national parks and natural monuments exist within the spectacled bear's range (Table 9.7). The new protected areas were designed to not include significant rural populations. The following factors explain this surprising increment in the number of protected areas: a) politicians' need to be popular; b) pressure exerted by environmentalist organizations at the regional level; c) presence of technicians in government institutions with scientific training in conservation; d) a significant increase of geographical and ecological studies in the Andes undertaken mainly by university students, and e) the importance of watershed preservation in the higher river basins. The fact that rivers with origins in protected areas produce more than eight million m³ of water per year that generate 17% of the hydroelectric potential of Venezuela (Maraven 1993) was a powerful argument to justify the creation and management of all these protected areas. The combined effect of these five factors was especially positive between 1986 and 1992. Since then, government officials consider that too much protected area exists in the Andean region. Consequently these factors are not expected to exert as much influence as they had.

Within the bear's range approximately 14,000km² is protected, an area equivalent to 9.36% of all land in the national parks system. The amount of available bear habitat in protected areas was estimated by subtracting non-wilderness areas from the total park size (Table 9.7). Upon doing so it was apparent to land managers in the mid-1980s that there was not enough suitable habitat within most parks to maintain viable bear populations given the needs of bears for large areas, security cover, and sufficient genetic interchange against inbreeding depression

(Yerena 1992; Yerena and Torres 1994). Consequently several national parks were conjugated or linked to newly created protected areas generating the following large conservation units (Figure 9.6):

- a. Tapo Caparo, Sierra Nevada, La Culata, Guirigay, Páramos del Batallón y La Negra, and Chorro El Indio (total 8,730km²; areas 12, 1, 10, 13, 8, 9 of Table 9.7);
- b. Yacambú, El Guache (total 345km², areas 2 and 11 of Table 9.7).

Also, two national parks share borders with two other national parks of Colombia, generating two key transfrontier conservation units:

- c. Perijá (area 4 of Table 9.7, Venezuela) and Catatumbo Barí (Colombia), totaling 4,530km²; and
- d. Tamá (area 5 of Table 9.7, Venezuela) and Tamá (Colombia), totaling 1,870km².

The creation of a second dispersal corridor has been proposed between Sierra Nevada and Páramos del Batallón, along the uppermost ridge of the mountain range. Another proposed corridor would link Guirigay with Guaramacal, thus expanding the largest conservation unit (a). These corridors would add 1,500km² to regional subsystem of interlinked protected areas that would embrace approximately 10,230km². Similarly some degree of wilderness connection could be maintained between Terepaima and Yacambú, and between these areas and conservation unit (b). Peasant relocation programs have taken place in these latter two parks which have helped park consolidation. Although Sierra Nevada and Tamá NPs contain the largest human populations, these people did not pose a significant threat to wilderness areas. Dinira is the only protected area whose bears may be genetically isolated.

Table 9.7. Protected natural areas in the Venezuelan Andes. All are national parks except the Natural Monument of Teta de Niquitao/Guirigay

Protected area	Size (km ²)	Non-wilderness habitat (km ²)	Elevation (m)	Year
Before 1986				
1. Sierra Nevada	2,765	86	300–5,007	1952
2. Yacambu	145.8	60.2	1,400–2,160	1962
3. Terepaima	186.5	58.7	300–1,675	1976
4. Perijá	2,952.8	80	200–3,500	1978
5. Tamá	1,390	250	320–3,500	1978
After 1986				
6. Guaramacal	214	1.3	1,500–3,100	1988
7. Dinira	420	20	1,400–3,500	1988
8. Páramos del Batallón and La Negra	952	180	1,200–3,900	1989
9. Chorro El Indio	108	7.4	800–2,600	1989
10. Sierra de La Culata	2,004	100	800–4,700	1989
11. El Guache	200	20	800–1,700	1992
12. Tapo Caparo	2,704	100	400–2,800	1993
13. Teta de Niquitao/Guirigay	200	30	2,000–4,000	1993

The Ministry of the Environment oversees the National Institute of Parks (Inparques) which manages national parks and natural monuments, and the Wildlife Service (Profauna) which manages wildlife refuges and reservations and is responsible for wildlife species conservation outside parks and monuments. Up until now there have been no refuges or reserves established in the Andean region. Management of Andean protected areas is performed by Inparques with a minimum of field personnel. Personnel and management programs have so far been sufficient to prevent major loss of wilderness habitat but insufficient to enforce regulations against poaching. Perijá is the conservation unit that has the most critical management situation because of the presence of Colombian guerrillas, illegal crops, conflicts among Creole cattlemen and Indian communities, coal mining, and the advancement of the agricultural frontier. The latter three issues are prevalent in land adjacent to the national park. These conflicts could be alleviated and/or solved if a buffer zone could be established around the park where Indian communities had property rights, and the whole area managed as a biosphere reserve (Yerena, E., La reserva de biosfera de la Sierra de Perijá. IV Seminario Regional para la Conservación del Lago de Maracaibo. San Cristobal, Venezuela, 1994).

Eighteen (12: 6) spectacled bears have been kept in six zoos during the last 30 years (Pernalet 1991; Torres 1992). Captive breeding efforts had not been reported until very recently, due mainly to the lack of females and poor breeding facilities. Now only two institutions have captive spectacled bears: Gustavo Rivera Zoo (Punto Fijo) and Miguel Romero Antoni Zoo (Barquisimeto City). Gustavo Rivera has a breeding program in cooperation with Lincoln Park Zoo of Chicago. Miguel Romero has just begun another breeding program with an imported female from Lima's Las Leyendas Zoo. They also have imported a captive-born spectacled bear from Leipzig (Germany), and recently got a confiscated circus bear. An ambitious breeding and re-stocking program has been proposed as a joint effort by these zoos, Inparques, and Fundacondor, a private NGO, (see Specific Projects below). These zoos are competent in captivity management, but research is sporadic and somehow restricted to veterinary needs.

Public education needs

The spectacled bear has become a symbol of conservation in just the last eight years. Previously few people know of its existence in Venezuela. Now it has become a flagship species, even named with some frequency by politicians. This has been achieved with modest but effective efforts of government organizations like Inparques, Los Andes University, Venezuelan oil companies, State of Mérida,

and NGOs such as ProVita, Fudena, Banco Andino, Fundacondor, Boy Scouts Association, Polar Brewery, Brigada Conservacionista Tremarctos Ornatus, CREE, FAPAS, and others. Support has been received from international organizations such as the Lincoln Park Zoological Society, New York Zoological Society and Jersey Wildlife Preservation Trust. The environmental education programs that resulted from this support included the use of posters, pamphlets, graffiti, T-shirts, handicrafts, participation in radio and TV programs, forums, and conferences. This has generated a snowball effect that has encouraged many companies, unions, conservationists, sport event promoters, etc., to diffuse the spectacled bear image and name. Spectacled bears have been featured in special television and radio programs, commercials, and press deliveries. Although the effect of these media have not been quantitatively monitored and evaluated, it is obvious that this kind of promotion should continue due to its positive impact on public opinion of bears and all wildlife.

Specific conservation recommendations

1. Reduce poaching

Vast improvements are needed in the abilities of law enforcement officers in the field to combat poaching, both to reinforce mechanisms and field operational capacities. This should be carried out by specially trained and equipped personnel with aptitude to work in remote and difficult areas. It should also be accomplished with the cooperation of regional and community institutions. Protected area management programs should give high priority to anti-poaching activities. Such activities should be accompanied by extension programs that promote sustained use of alternative resources such as ecotourism, captive breeding of game species, honey farming, handicrafts, etc. Local inhabitants should derive real and tangible profits from sustainable natural resource use, and from a conservationist attitude toward wildlife. Policies should diminish bear/people conflicts, especially those associated with extensive cattle grazing on páramo land. More intensive and higher tech grazing techniques might reduce extensive cattle presence on páramos, and thus the competition between cattle and wild herbivores. Compensation programs should be considered for confirmed livestock kills caused by bears or felines.

2. Address habitat needs for the maintenance of viable bear populations

Habitat availability for bears should be met within a legal frame of protected areas. It is necessary to use other management categories different from national parks such as wildlife refuges and reservations. The search for the maintenance of habitat continuity should continue,

implementing management of dispersal corridors and redesigning some boundaries of already existing conservation units. It is important to coordinate with Colombian authorities and institutions to apply these same measures in transfrontier wilderness areas. Also it is important to achieve adequate planning and integral management of already established protected areas. In peripheral areas of parks, sustainable resource use programs should be implemented to prevent habitat fragmentation and create buffer zones. Forest use policies outside protected areas should be revised to stop the advancing agriculture frontier, and promote more intensive and profitable land use.

3. Increase scientific research

Presently lacking is detailed knowledge of the bear's geographical distribution and all other aspects of its biology, and how this knowledge can be applied to conservation training and support for new professionals and students from different technical and scientific disciplines is needed. Also lacking are tools to analyze information such as a permanent monitoring system that includes sighting locations and data processing. Cooperation with researchers and students of the other Andean countries is another need. An experimental reintroduction or restocking program could be a vehicle to increase understanding of bear behavior, reproductive biology, population genetics, and ecology. Such a program, although polemic, should be discussed thoroughly.

4. Increase public awareness

Venezuelans of all social backgrounds should appreciate and support initiatives for the conservation of this species,

with full awareness of all tangible benefits that are derived from it: conservation of cloud forests, biodiversity, and watershed products such as drinking water and hydroelectric energy; alternative industries such as tourism, and regional planning and development. All available resources for massive and selective diffusion, with special emphasis on radio mass media, should be used. The educational forum should be both formal and informal and especially be directed toward peasants who live inside and around bear habitat. These programs should reinforce the achievement of the first two objectives of this action plan. The achievement of the conservation of this species is important for the Andean identity of Venezuelans and their country. Such identity requires a shared objective of ecological integration with the neighboring Andean countries, one that could be very fruitful in terms of technical and scientific cooperation.

5. Develop capacities for integral captive population management

This objective has a double purpose: to integrate *in situ* and *ex situ* conservation strategies, and contribute to the achievement of the educational objective. A National Plan of Captive Management must first be established, endorsed, and accepted by all zoos. In connection with efforts of maintaining wild populations, a captive breeding stock should be established, and techniques developed to replenish diminished wild populations with captive-raised animals. This is a medium to long-range plan. Zoos should play a more active role in promoting awareness about this species; particularly in their local regions. Coordination should be strengthened between Venezuelan and international *ex situ* management institutions.