STATUS OF WILD ANDEAN BEARS AND POLICIES FOR THEIR MANAGEMENT

BERNARD PEYTON, Museum of Vertebrate Zoology, University of California, Valley Life Sciences Building, Berkeley, CA, 94720, USA, email: ucumari@aol.com
EDGARD YERENA, Proyecto Ambiental Banco Andino, Apartado 68409 Altamira, Caracas 1062, Venezuela, email: eyerena@ccs.internet.ve
DAMIAN IGNACIO RUMIZ, Casilla 5300, Santa Cruz, Bolivia, email: bolfor@mitai.nrs.net.bo
JEFFREY JORGENSON, Departamento de Biología, Facultad de Ciencias Pontificia Universidad Javeriana, Carrera 7 Número 43–82 Edificio 53 Oficina 502, Santafé de Bogotá, DC, Colombia, email: jjorgens@javercol.javeriana.edu.co
JORGE OREJUELA, Avenida 8 Numero 24-118, Cali, Valle, Colombia

Abstract: No reliable estimates exist for populations of Andean bears (*Tremarctos ornatus*). They occupy >260,000 km^2 in 5 Andean countries, and if their densities are comparable to those of North American black bears (*Ursus americanus*), the total population may be >20,000. Unbroken tracts of the Andes stretching more than 200 km and extending over 3000 m of elevation exist for this species in Perú and Bolivia, where over$^2/_3$ of the bear's range occurs. Approximately 18.5% of the range is contained within 58 protected areas. Although the species probably is not on the brink of extinction in the wild, serious threats exist. Hunting may now be as important a factor in bear population decline as habitat destruction. Lack of land ownership and credit combined with increased road access has precipitated the spread of informal economic activities (e.g., shifting agriculture, grazing, mining, narcotic production and trafficking, timber harvest, and hunting for animal parts) in bear strongholds. Drug traffickers have infiltrated 16 parks occupied by bears; this number is triple what it was 15 years ago. International trade in bear gall bladders has been confirmed in Ecuador. The future existence of wild Andean bears depends on linking conservation with benefits that have meaning to local communities. The potential roles of government, communities, and private organizations in managing natural resources for both bears and human prosperity are discussed.

Ursus 10:87–100

Key words: Andean bear, Andes, conservation, policy, South America, status, threats, *Tremarctos ornatus*.

Andean bears are part of a diverse South American landscape that struggles with the same problems shared by developing countries throughout the world. The disparity of resource ownership between rich and poor, which is larger than on other continents (LaFeber 1986), perpetuates a situation where landless farmers have increasing access to bear habitat that they develop to support themselves. Resource policies can be imposed by central authorities (top-down approach) or decided at the community level (bottom-up). We argue the need for both approaches to address threats faced by Andean bears.

Most rural communities do not own land; thus, they lack the authority and will to prevent the destruction of forests. Agencies within Andean governments face similar problems. Ministries that oversee extractive land uses and colonization are typically better funded than agencies dedicated to preserving natural resources. The national parks these agencies established with the help of private organizations are being invaded by industries and colonists, and the agencies have little means to prevent it. However, governments, communities, and private organizations are redefining their roles in ways that may prevent the destruction of Andean watersheds.

We summarize the status and major threats to Andean bear populations and their habitat and place these threats in a broader social, economic, and political context. We discuss what can and should be done by social institutions and government agencies to preserve resources for both people and Andean bears.

We gratefully thank 59 individuals who contributed their knowledge to a draft Andean bear action plan which this paper summarizes. We also thank D. Garshelis, M. Munson-McGee, A. Grajal, C. Canizales, and an anonymous reviewer whose comments greatly improved an earlier draft of this paper.

STATUS OF ANDEAN BEAR POPULATIONS

Andean bears occupy about 260,000 km^2 of forested habitat in Venezuela, Colombia, Ecuador, Perú, and Bolivia (Table 1). This estimate was obtained by drawing boundaries on topographic maps around areas where field expeditions confirmed the presence of bears (Peyton 1980, Brown and Rumiz 1988, Suárez 1989). Roadless areas that were not surveyed for bears were included in these boundaries if they were adjacent to surveyed areas and contained habitat types that bears occupied elsewhere on the same Andean range. Boundaries of unsurveyed areas were drawn from configurations of these habitat types depicted on government vegetation maps. We estimated the size of these areas by superimposing a grid on them (1 cell = 100 km^2) and then summing the parts of the grid within their boundaries. If densities of Andean bears are

Table 1. South American protected areas (categories I–V of Int. Union Conserv. Nat. [1984]) that have Andean bears. Contributors to a draft Andean Bear Action Plan estimated the amount of habitat occupied by bears (bear area). Area statistics are rounded off to the nearest 10 km². Asterisks (*) indicate World Heritage Sites.

Country (no. of parks) Conservation unit[a]	Year established	Park area (km²)	Bear area (km²)
Venezuela (13)			
Sierra Nevada NP	1952	2,760	90
Yacambú NP	1962	150	60
Terepaima NP	1976	190	60
Perijá NP	1978	2,950	80
Tamá NP	1978	1,390	250
Guaramacal NP	1988	210	<10
Dinira NP	1988	420	20
Batallón y La Negra NP	1989	950	180
Chorro El Indio NP	1989	110	<10
Sierra de La Culata NP	1989	2,000	100
El Guache NP	1992	200	20
Tapo Caparo NP	1993	2,700	100
Teta de Niquitao NM	1993	200	30
Parks subtotal		14,230	1,000
Unprotected forests			20,410
Total			21,410
Colombia (20)			
Farallones de Cali NP	1968	1,500	380
Los Katios NP	1973	720	180
Los Nevados NP	1974	380	30
Las Orquídeas NP	1974	320	80
El Cocuy NP	1977	3,060	770
Las Hermosas NP	1977	1,250	380
Nevado de Huila NP	1977	1,580	400
Munchique NP	1977	440	110
Paramillo NP	1977	4,600	1,150
Cordillera Los Picachos NP	1977	4,390	1,100
Pisba NP	1977	450	110
Puracé NP	1977	830	210
Sumapaz NP	1977	1,540	390
Tamá NP	1977	480	120
Chingaza NP	1978	500	130
Macizo de Tatamá NP	1987	520	130
Catatumbo Bari NP	1989	1,580	400
La Macarena NP	1989	6,290	1,580
Tinigua NP	1989	2,080	500
Guanenta–Alto Rio Fonce NS	1993	100	100
Parks subtotal		32,610	8,250
Unprotected forest			21,830
Total			30,080

Table 1. Continued

Country (no. of parks) Conservation unit[a]	Year established	Park area (km²)	Bear area (km²)
Ecuador (10)			
Cotacachi–Cayapas ER	1968	2,040	300
Cayambe–Coca ER	1970	4,030	2,000
Sangay NP *	1975	5,180	2,000
Cajas NP	1979	290	30
Podocarpus NP	1982	1,460	1,100
El Angel ER	1992	300	150
Antisana ER	1993	1,200	600
Sumaco Napo–Galeras NP	1994	2,050	2,050
Llanganates NP	1996	2,200	?
Illinizas ER	1996	1,500	?
Parks subtotal		20,250	8,230
Forest Reserves (5)			3,920
Unprotected forest			16,660
Total			28,810
Perú (6)			
Huascarán NP *	1975	3,400	150
Manú NP *	1980	15,330	2,300
Machu Picchu HS *	1981	330	90
Río Abiseo NP *	1983	2,750	1,920
Yanachaga Chemillén NP	1986	1,220	1,000
Tabaconas–Namballe NS	1988	300	300
Parks subtotal		23,330	5,760
Unprotected forest			76,440
Total			82,200
Bolivia (9)			
Isiboro–Sécure NP, IT	1965	12,000	3,300
Ulla–Ulla NR	1972	2,400	300
Amboró NP, NAIM	1973	6,380	4,100
Pilón–Lajas NP, IT	1977	4,000	1,000
Carrasco NP	1988	6,230	3,000
Tariquía NRFF	1989	2,490	1,700
Eva–Eva BPA, IT	1990	1,350	1,350
Cotapata NP, NAIM	1993	400	400
Alto Madidi NP	1995	18,960	10,000
Parks subtotal		54,210	25,150
Forest reserves (4)			4,970
Unprotected forest			68,070
Total			98,190
Total Andes		144,630	260,690

[a] BPA = Basin Protected Area, ER = Ecological Reserve, HS = Historical Sanctuary, IT = Indigenous Territory, NAIM = Natural Area of Integrated Management, NM = National Monument, NP = National Park, NR = National Reserve, NRA = National Recreation Area, NRFF = National Reserve of Flora and Fauna, NS = National Sanctuary.

like those of North American black bears, most of which are hunted (low = 7/100 km^2, median = 25/100 km^2, Garshelis 1994), the total world population would be 18,000–65,000. Because these estimates are for adult bears, we believe there are >20,000 total bears in the Andes.

STATUS OF PROTECTED AREAS

Approximately 18.5% of the Andean bear's range (48,390 km^2) is legally protected. Most of the protected range is in Bolivia (52%), followed by Ecuador and Colombia (17% each), Perú (12%), and Venezuela (2%). These protected areas include 58 national parks, reserves, or sanctuaries; all but 3 were established since 1968, and 12 were established in the 1990s (Table 1). Eight areas consisting of either a single park or interconnected ones have >1,900 km^2 of bear-occupied habitat (Fig. 1, areas 4–6 and 8–12). This was the median size of 41 parks that were believed to support a stable or increasing population of Andean bears in 1988 (Peyton 1988), and thus represents a possible target size for population viability. Four more areas could have >1,900 km^2 of bear-occupied habitat if bears expand their range within them (Fig. 1, areas 1–3 and 7). Human activities (e.g., grazing, shifting agriculture, and illegal mining) inhibit bears from occupying habitat that could support them in these areas.

Venezuela, Colombia, Ecuador, and Bolivia have enlarged and connected parks during the last 15 years to protect bears and increase the biodiversity within the parks. INPARQUES, the government agency that manages Venezuela's parks and natural resources, is encouraging range expansion by creating new parks that connected most of its conservation units in the Cordillera Merida (Fig. 1, area 1; see Yerena and Torres 1994, Yerena 1998). The result has been the creation of a complex of 5 national parks (e.g., Sierra Nevada, Batallon y la Negra, Chorro el Indio, Potosi, and Tapo Caparo) that includes 5,030 km^2 of potential habitat for Andean bears.

In 1989 the Colombian government added Tinigua and Los Picachos National Parks to the National Park Sierra de la Macarena for a combined area of 12,710 km^2 (Fig. 1, area 4). In 1993 and 1994 the Ecuadorian government added the Antisana Ecological Reserve and the Sumaco Napo–Galeras National Park to the Cayambe–Coca Ecological Reserve in northern Ecuador (combined area = 7,280 km^2, Fig. 1, area 5). The World Heritage Site of Sangay in central Ecuador was almost doubled in size in 1992 from 2,719 to 5,177 km^2 to protect the Paute River drainage, an important watershed for urban residents in the mid-Andean range (Fig. 1, area 6). These recent Ecuadorian park developments also protect woolly tapir (*Tapirus pinchaque*), an endangered animal that lives in approximately 20% of the Andean bear's range (Downer 1996).

Approximately 10,000 km^2 of bear-occupied habitat in northern Bolivia was legally protected when Alto Madidi National Park (Fig. 1, area 10) was established in 1995. The park connects the national parks of Ulla–Ulla and Pilon–Lajas (Ribera 1996). Amboro National Park (established in 1973) and its adjacent management area contain over 4,000 km^2 of occupied bear habitat. When an adjacent area was declared Carrasco National Park in 1988, 12,610 km^2 of Andean bear habitat had protected status in central Bolivia (Eulert 1995; Fig. 1, area 12).

The creation of parks on country borders has been an effective tool in defusing political conflict and promoting cooperative resource management (McNeil 1990). There are 3 Colombian parks that are paired with parks across borders: El Tama and Tama (Venezuela), Catatumbo Bari and Perija (Venezuela), and Los Katios and Darién (Panama). Other corridors could be protected that would link Ecuador's parks with those of its neighbors. The corridor envisioned for Ecuador and Perú would join Podocarpus National Park to Tabaconas–Namballe National Sanctuary in Perú and extend 200 km to the northeast to include the Cordillera del Condor. Another corridor could link the Awa Forest Reserve and El Angel Ecological Reserve in Ecuador with the La Planada Nature Reserve in Colombia. Measures such as these maintain large areas of cloud forest for Andean bears and give the species a more hopeful future.

THREATS TO ANDEAN BEARS AND THEIR HABITAT

Access to Bear Habitat and Land Reform

The dominant threat to Andean bear populations is a growing population of landless peasants that have increased road access to cloud forests (Suárez and Garcia 1986). Currently, 10% of the human population in these 5 Andean nations live in the cloud forest and their numbers are increasing at an annual rate of 1.5% (Young 1992).

Roads enable migrant farmers to establish illegal settlements in bear habitat and are the axes from which agriculture expands and fragments bear populations. The primary axes of fragmentation are the roads in the inter-Andean valleys. Human settlements and degraded land here prevent bears from moving between the 3 Andean

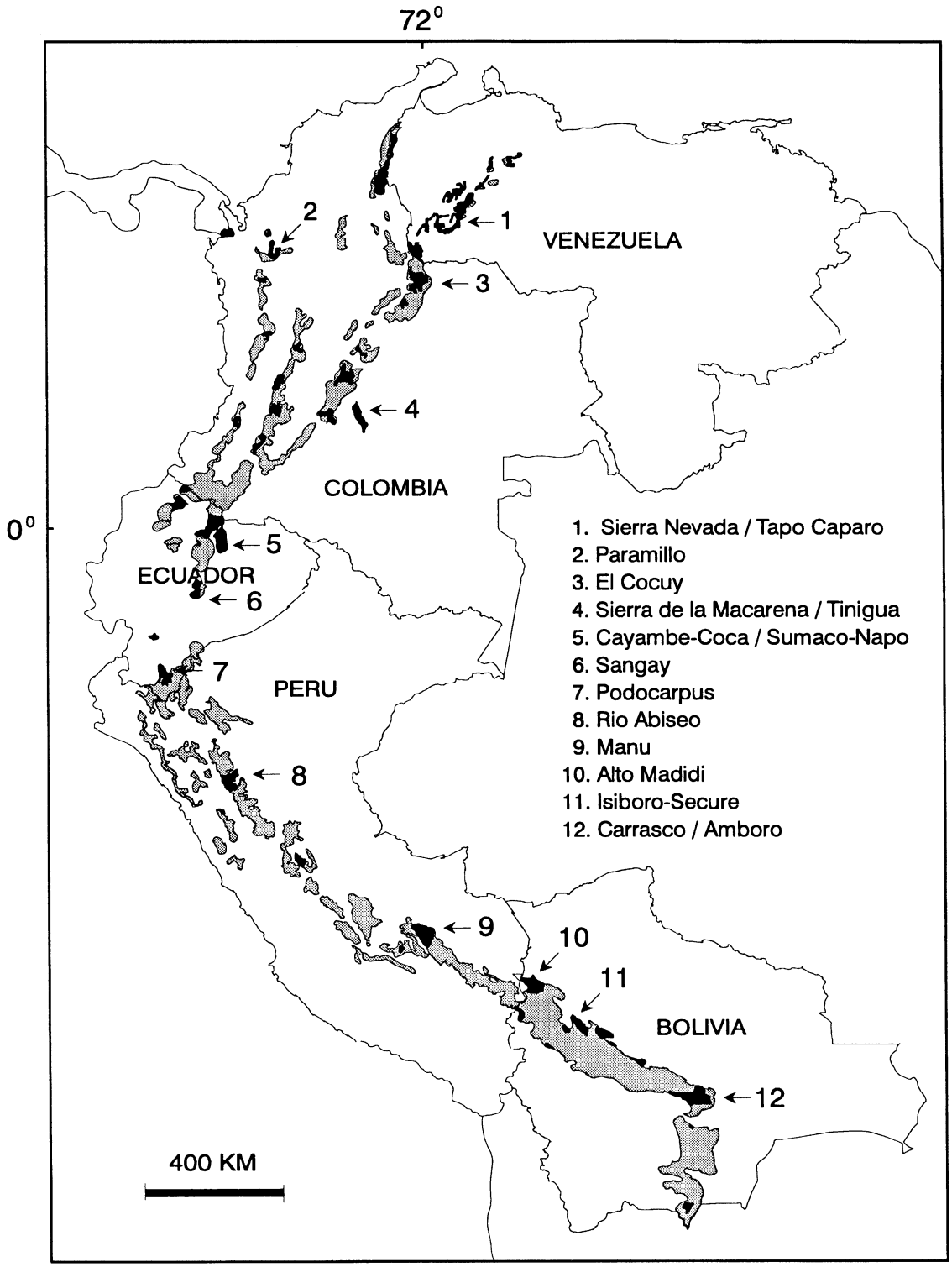

Fig. 1. Range of the Andean bear in South America's protected (black shaded) and unprotected (gray shaded) parts of the Andes, 1995. Numbers denote parks or reserves that contain >1,900 km² of habitat occupied by or available for Andean bears.

ranges, especially in Colombia and Perú where the 3 ranges are most distinct. Andean bears have been displaced by people in almost all valleys <1800 m elevation with the exception of roadless areas on the eastern slope of the Oriental Andes.

The second axes of fragmentation is along roads that cross the Andes. Typically, these roads pass through mountain saddles; scats and feeding sign suggest that bears use these saddles to cross sides of a mountain range (Peyton, unpubl. data). As human settlements proliferate along these roads, bear populations become increasingly isolated in a process that can occur rapidly. In the Yungas region of Bolivia, Liberman (1991) found effects on large mammals such as Andean bears that extended 2 km from roads during the initial stages of road construction.

The conditions that forced farmers to move into bear habitat were lack of land ownership and failure of land reform measures to redistribute land to them (Peyton 1994). By the 1950s, 2–5% of the human population in the Andean nations owned 60–80% of the arable land (Eckstein 1983, Gradwohl and Greenberg 1988). This inequitable land distribution and the increased peasant population forced families to abandon fields that were too small to support them. In Perú 23% of the population (2 million people) were migrant in 1962. Most of these farmers went to urban centers seeking education and entrance to the industrial class of society. These emigrations combined with high urban birth rates (e.g., 4.5–5% annually in the 1960s; LaFeber 1986) explain why 51–91% (Bolivia–Venezuela) of the human population is now urban in the 5 countries with bears (World Resour. Inst. 1992). South American countries have the most urban populations of all developing parts of the world (Gonzalez 1991). This places tremendous pressure on governments to provide employment and on bear habitat to provide resources.

Peasants left overpopulated urban centers on their own once access to more promising employment was provided. Governments threatened with social unrest from unemployed urban peasants built roads over the Andes to the Amazon basin. Colonization programs were initiated at the ministerial level to encourage migration over the Andes for other reasons. Oligarchies could retain power and not be forced to distribute their land. The state could populate its remote regions to defend borders and to provide labor to produce food and export products (e.g., oil and timber). The latter was considered collateral by the developed countries for their bilateral aid that helped build the roads. During 20 years of road building in Perú (1960–80), hunters and farmers estimated that Perú's bear population declined by a third (Peyton 1981). The Bolivian road system increased by 70% following the 1952 Agricultural Revolution. In Colombia 73,000 km^2 have been cleared in government-sponsored colonization programs, an area equivalent to 28% of the Andean bear's present range.

Deforestation and Informal Agriculture

An estimate of the rate of deforestation in the entire Andean mountain range does not exist, but it is severe. In Ecuador the forests between the Andean ranges is almost gone, and only 4% remains on the western Andean slope (Dodson and Gentry 1991). Henderson et al. (1991) estimated that <10% of the Andean forest remains in Colombia. Most deforestation of Andean bear habitat is the result of slash and burn agriculture. Typically, a farmer clears 1–3 ha of cloud forest, burns it in the dry season, and plants corn, beans, and squash. When soil nutrients are exhausted after 3–4 years, the farmer cuts a new field, usually up-slope from the old one, and plants the old field in rhizomatous grass for cattle. In this fashion the forest edge recedes approximately 100 m every crop rotation. Most of the cloud forest habitat for Andean bears below 1800 m elevation has been replaced by agriculture.

Cattle grazing also damages habitat for Andean bears. Peasants use cattle as a hedge against lean times caused by events such as crop failures; cattle can be traded for other goods. One of the ways the aristocracy maintains tight control of the peasant communities on their land is by employing cattle rustlers to steal peasant livestock. Practices such as these encourage peasants to thrust their cattle deeper into bear habitat where they are harder to find. Favored grazing sites are on grasslands above the forest and in the mosaic of abandoned cornfields at the lower forest edge. Cattle knock over trees and trample soil. After a decade cattle can reduce an intact cloud forest to bare pasture with deep eroded gullies.

Unfortunately the best areas for crops and grazing coincide with the best food-producing habitat for Andean bears. These are the grasslands above cloud forests (generally above 3,000 m, depending on latitude) that provide bears with berries (Ericaceae spp.), terrestrial bromeliads (*Puya* spp.), and frailejon (*Espeletia* spp.), and the cloud forests below 2500 m where Andean bears eat tree fruit, palm leaf petioles, and epiphytic bromeliads (Tate 1931, Peyton 1980, Goldstein 1988, Suárez 1989). Andean bear populations are increasingly restricted to the area between these agricultural bands; this area is characterized by steep slopes (50°–70°) covered with bamboo (*Chusquea* spp.), which Andean bears do not eat.

Hunting

Illegal hunting appears to be more widespread than it was 15 years ago, partly because increased fragmentation of bear habitat and its conversion to human habitation has exposed more bears to hunters. Hunting is considered to be the greatest problem for bears in Venezuela (Yerena 1998). Venezuela has the most urban population of all South American nations (World Resour. Inst. 1992) and has lost a greater percentage of its cloud forests than any of the other 4 Andean nations with bears.

Farmers who for centuries revered the Andean bear (Randall 1982) increasingly regard the animal as a pest and threat to their livelihood. They enlist the help of hunters (e.g, military, civil police, the aristocracy, and foreign sport hunters) who find the bear easy to shoot in the cornfields. Formerly, hunters had limited success in finding Andean bears in the cloud forest, even with the use of dogs to tree them (Peyton 1980). Now, bears are attracted to cornfields at the forest edge. Farmers from the eastern slope of the Oriental Andes in northern Ecuador, Perú, and southern Bolivia say that annually 1–3 bears are killed/valley in their cornfields (Peyton, unpubl. data). Although all 5 Andean countries have laws that prohibit hunting Andean bears, the laws are not enforced due to lack of trained personnel and funds to operate an enforcement program (Marconi and Donoso 1992, Young 1992), reluctance of governments to place armed forestry police in areas controlled by terrorists and drug lords, suspicion that armed members of the forestry police might become terrorists (Perú), and illegal hunting done by those who are charged to prevent it.

Commercial Agriculture, Trade Barriers, and Drugs

Commercial agriculture, world trade issues (e.g., sanctions and price competition), and subsidies on domestic food production now adversely affect an estimated 20% of the Andean bear's range, and their impacts are increasing. The following example from Colombia illustrates how government policies designed to improve agricultural output tend to fail and increase the illicit economy.

In 1971 a consortium of international agricultural research centers developed a new rice variety in Colombia that could increase yield by as much as 40% (Hansen 1986). However, government policies did not provide owners of small farms (1–5 ha) access to credit, technology, and equipment to take advantage of the new rice. Colombia's government favored the industrial agriculturalist by extending them low interest loans and training. In the late 1960s and early 1970s, 88% of the financial credit in the agricultural sector went to the 0.7% of farms that were >500 ha (Hansen 1986). The interest rates on loans to small farms were higher. Additionally, farmers with small land holdings could not obtain the fertilizers and pesticides that the new rice variety required. Consequently many farmers with small plots of land left their fields, which were acquired by ranchers and farmers with large land holdings (Hansen 1986). Migrants entered the cloud forest illegally. During 1955–70, the number of rice farms diminished from 97,000 to 39,000. In the upland sector nearest the national parks with the most bear habitat in Colombia (e.g., Chingaza, Sumapáz, Tinigue, Los Picachos, and La Macarena), the number of small (<5 ha) to medium-sized farms (5–50 ha) declined by 55% and 59% respectively during this period (Scobie and Posada 1977). The consolidation of rice holdings in the Meta region was representative of the pattern of colonization seen throughout Central and South America: pioneers arrived and cleared the land that was absorbed into large ranches (*latifundia*), while small farms (*minifundia*) proliferated on unstable highland soils.

Many displaced farmers now grow narcotics near or within national parks with Andean bears. Coca (*Erythroxylum coca*) and heroin poppy (*Papaver somniferum*) production is 2–5 times more lucrative to these farmers than subsistence crops (Lee 1989). Consequently more land is being converted to agriculture than would be converted for subsistence use. An estimated 425–510 km^2 of forest is cleared each year in Colombia for the production of heroin (Cavelier and Etter 1995). In 1987 an estimated 7,000 km^2 of coca fields occupied the Chapare region of Cochabamba (Bolivia) where there once were bears. The 2 oldest national parks in Perú with bears, Cutervo and Tingo Maria (established in 1961 and 1965, respectively) have been destroyed by the expansion of coca production from the Huallaga Valley where half the world's supply of cocaine originates (Garcia 1991). Coca field eradication from the Huallaga Valley has precipitated the spread of coca production to bear habitat in the Protected Forest of Matias–San Carlos and the Cordillera de Sira, (A. Brack-Egg, Ecodesc, Oxapampa, Perú, pers. commun., 1994). Presently 16 parks, most of them in Colombia, have been infiltrated by narcotic traffickers. This represents a threefold increase since 1970.

Finally, trade policies of foreign governments have increased the presence of social unrest and drugs in areas occupied by bears (Peyton 1994). After Colombian coffee growers moved farmers off their land in the Santander Provinces during the early 1900s, foreign nations imposed

trade barriers and stiff tariffs that still prevent Colombia from exporting processed coffee. The industrial coffee growers who could not penetrate world markets changed their production to drugs. They and their descendants control the drug trade in places like Medellin and Cali. The danger of the drug trade has prevented field research and meetings about bear conservation from occurring in most of the central and eastern Andean ranges of Colombia. For the same reasons little is known about bears in the Cordillera Perija (Venezuela–Colombia), several areas in Perú (e.g., the coastal Andes north of Chota, the upper Apurimac River Valley in the Central Andes, and the Province of La Convención in the southern Oriental Andes), and the northern half of the Andean bear range in Bolivia.

Soil Erosion and Mining

The combined effects of land stripped for crops and overgrazing on steep Andean slopes eroded soil. Most of the top soil in cloud forests in the eastern Andes is lost immediately after the forest is cleared (Liberman 1991). The total effect of many such small clearings is enormous. For example the sediment load of the Beni River in Bolivia indicated a mechanical erosion of 3,000 tons/km^2/year, or 27 times the rate of topsoil erosion in the Amazon Basin (Goodland and Irwin 1975). The Cauca watershed lost 4,000 tons of topsoil/km^2 during a 10-month period, mostly due to farming on 1–3-ha plots on erosion-prone bear habitat (Hansen 1986). In 1983 the culmination of a decade of deforestation in the highlands above Amboro National Park resulted in floods that destroyed 2/3 of the arable land that sustained the inhabitants of Santa Cruz, Bolivia (Clarke 1983).

Increased sediment loads in rivers from erosion has encouraged miners to enter bear habitat in pursuit of gold (Cifuentes et al. 1989). Miners penetrate farther into bear strongholds than subsistence farmers. Their land clearing threatens forests of many parks in the Andes including Perija in Venezuela, most of the parks in the Central Andes in Colombia, Podocarpus in Ecuador, Yanachaga–Chemillén and Manú in Perú, and all the parks with bears in Bolivia.

Trade in Bear Parts and Legal Protection

Illegal trade in Andean bear gall bladders by Korean businessmen was confirmed in Cayambe–Coca and Cotacachi–Cayapas (Ecuador; M. Castillo, Fundacion Natura, Quito, pers. commun., 1993). Domestic trade in bear parts has a long history in the Andes (Baumann 1963), but evidence of demand from Asian markets is recent. Farmers were offered $115/bear gall bladder, which is many times the monthly wage. The spread of the narcotic industry mentioned earlier and its associated violence could provide an impenetrable protective cover for full-scale trafficking in Andean bears and their parts.

Forestry laws in each of the 5 Andean nations prohibit the hunting of Andean bears and trade of their parts. During 1992–93, Perú enacted laws that allowed the government to collect a fee for the transfer of endangered wildlife bred in captivity (Andean bears included) to other captive breeding centers, creating a loophole in the prohibition. Transfer of Andean bears under these provisions cost $1,000 (D. Aguilar and M. Leo, Asociación Peruana para la Conservación de la Naturaleza, Lima, Perú, pers. commun., 1993). The laws do not provide for adequate background checks on either the source of the wildlife (captive bred or wild caught), the integrity of the recipient's claim as a captive breeder, or the fate of bears. The laws thus provide a legal cover for the sale of bears for parts. Similar laws of 1990 now compromise Andean bears in Bolivia.

CONSERVATION POLICY

What should be done to maintain Andean bears in the wild? We present a threefold message. First, design projects that address the problems of lack of resource ownership, unemployment, and lack of political empowerment. Second, ensure that projects are commensurate with their location and the capacity of the people who undertake them. Third, intend for those who are most adversely affected by conservation action to benefit from projects. Implementing projects is not so much about achieving biological targets, but a social activity. With that in mind, we will examine the role governments, communities, and private non-government organizations play and how to improve them.

Role of Government

Strengths and weaknesses.—The government's responsibility is to ensure that resource use at local levels does not compromise the national interest. The main attraction of administering projects from the top-down is efficiency. Directives can take place overnight and buy time for bottom-up (locally initiated) measures to have an effect. Of the 5 countries with Andean bears, Venezuelan land managers have been the most successful at employing a top-down approach to protecting watersheds and Andean bears. With the use of state-of-the-art technology (e.g., satellite imagery, geographic information system mapping, and computer models that included biological concepts of population viability),

INPARQUES technicians were able to estimate how much forest cover they had in Venezuela and how many Andean bears each forest fragment contained (Yerena and Torres 1994). They determined that forests were vulnerable to fragmentation and too small to maintain viable bear populations if surrounded by human settlements. Their analyses prompted officials to triple Venezuela's national park system, now at 15% of the national land area (Colombia has 17% and Ecuador has >17% of its land area designated as parks). When the new park of Tapo Caparo has its boundaries finalized and Guaracamal National Park is connected to other parks in the Cordillera Merida (e.g., Sierra Nevada, La Culata, Guirigay and Paramos del Batallon y la Negra, and Chorro El Indio) the joint park area will be approximately 10,230 km^2 (Yerena and Torres 1994).

Perú's bears would benefit from Venezuela's approach by creating protected bridges between conservation units. Although Perú has >30% of the total range of the Andean bear in South America, only 7% of that range is included within park boundaries. In contrast Bolivia has 3.6 times as much of this bear range under protected status. Only 5% of the montane forest above 1,500 m on the eastern slope of the Cordillera Oriental is included within the boundaries of Perú's 3 largest parks with bears (Young 1992), and these parks are separated from each other by >250 km of unprotected forest. Six potential park candidates exist in Perú and Bolivia where 2/3 of the Andean bear's range is found. These corridors have roadless cloud forest extending for >3,000 m of elevation; these areas, stretching for >200 km along the Oriental Andes (facing Brazil), have habitat and elevational conditions that are likely adequate to sustain bears (Peyton 1988).

The main weakness of top-down policies is the inability of governments to enforce them locally (Bodmer 1994). Top-down implementation is capital intensive and relies on strong institutions. Although Venezuela is currently undergoing a banking crisis, its financial ability to implement top-down approaches to conservation is better than that of the other 4 Andean countries with bears. A consolidation and decentralization of resource management agencies occurred in Perú in the late 1980s and is now occurring in Colombia (since December 1993), severely straining these countries' abilities to implement policies. For example, there is only 1 park guard/5,700 km^2 of Andean bear habitat in Perú (Young 1992), and no vehicles for transportation. With few guards, forestry laws that protect bears and their habitat tend to be ignored. The situation is similar in Bolivia where only 3 of 36 parks had guards in 1991 (Marconi and Donoso 1992).

Solutions.—Lack of people and capital resources have prompted Andean nations to initiate management-sharing programs, which have benefited both wildlife and indigenous people. Collectively, these programs involve the decentralization of authority. One of these is privatization, where governments relinquish the authority to manage natural resources to private groups. This approach has been developed to the greatest extent in Colombia, but is increasingly popular throughout the Andes. Power-sharing mechanisms exist in Colombia to manage parks and unprotected forests. For example, regional corporations and utility companies manage approximately 25,000 km^2 of bear habitat outside national parks. They are well-funded and capable of protecting habitat from development. Another example of decentralization is the creation of park buffer zones that support indigenous groups. Extractive or biosphere reserves that also preserve indigenous culture exist for many ethnic groups who share land with bears: Paez, Inga, Ingano, Sibundoy, and Kamsa, in Colombia; the Awa and Cofane on the border of Colombia and Ecuador, Quechua of Ecuador to Bolivia, the Amuesha in Perú, and Aymara in Bolivia. More of these kinds of programs will exist in the future as the budgets of resource management agencies get tighter.

A condition for vertical control of policies is their coordination horizontally across ministries and departments. Policy contradictions at the ministerial level harm compliance with policies at lower levels. For example Ecuador's concession of 6,000 km^2 for petroleum exploration within days of declaring part of the same area a national park (Sumaco Napo–Galeras) reinforced distrust of government policies in the region's communities (Wray and Alvarado 1996).

Finally, to provide communities with incentives to move toward sustainable resource use, governments must ensure that local people achieve legal ownership of land and have a principle role in decision-making (Hill and Press 1994). Lack of enforcement and the vague terms of ownership that characterize much of the bear habitat in the Andes have left communities with little authority to prevent its destruction (Brown and Wyckoff-Baird 1992). In some cases governments encourage the destruction of forests. Government recognition of land ownership in communities adjacent to 2 Ecuadorean parks with bears (Sumaco Napo–Galeras National Park and Cayambe–Coca Ecological Reserve) was conditional on the inhabitants converting 50–60% of the forest into cattle pasture, an inefficient way to use land (Wray and Alvarado 1996).

Role of Communities

Strengths and weaknesses.—Communities provide 3 things most projects require: knowledge, labor, and administrative capabilities beyond the capacity of outsiders. Local people have more experience with bears and their habitat than most project planners, particularly in remote tropical areas where little is known about bears. Planners are often ignorant of the ways communities make decisions and allocate resources, yet such knowledge is essential for project success. For example contributions of labor in return for state taxes and tangible goods has existed since pre-Colombian times in the Andes and is known by a variety of names (mita, minga). Use of mitas could greatly improve the implementation of projects that require local labor. To capture local labor, planners should base project tasks on current skill levels (Peyton 1994) and not let dependence on outside specialists undercut local administrative institutions (Lewis and Carter 1993).

Many communities do not have institutions that can simultaneously provide local needs, control the behavior of their own members, and interact with outside groups (Brandon 1996). Where these exist, the central government should empower them with the authority to stop, and not just monitor, resource degradation (Poffenberger 1994). When possible, project managers should use existing institutions rather than creating new ones. Communities that cooperate on irrigation projects, markets, and shared cropfields generally have capable leadership to undertake projects.

Solutions.—Successful projects at the community level balance costs with benefits. Costs include foregoing income generated by harvesting forest products and killing bears, providing labor to projects instead of to more secure means of livelihood, reduced agricultural output, and crop depredation. Project planners should try to minimize these costs. For example, if the project goal is to increase a bear population, funds should be secured to employ communal crop guards to scare bears out of cornfields.

Benefits must be realistic. People tend not to leave bears and their habitat alone if the benefit does not compensate their lost opportunities. Private conservation organizations in the Andes that promote environmental education by itself, without including more meaningful benefits, fail to compensate poor farmers. For example, 18 Andean bears were killed in the Capaz River drainage (State of Mérida, Venezuela) despite education programs during the same period (1988–96) that taught local residents about the need to protect Andean bears (Garcia, 1996). Local inhabitants generally do not think their future livelihood will be compromised when bears are extirpated and the forest is replaced with pasture. They tend to discount future returns on resources when they need to harvest resources to feed themselves (Ostrum 1990), and they rarely value biodiversity intrinsically. Instead, they often experience biodiversity in a negative sense, such as an increased variety of pests that attack their food crops.

A better way to create a cooperative incentive for improving bear populations is to link the adoption of costs to the provision of benefits that have the most meaning to people. In descending order the benefits with the most value to Andean farmers are land tenure, access to capital (credit and employment), political empowerment, technical assistance, and training opportunities. However, these are interrelated. Without tenure local farmers cannot borrow money because banks do not recognize untitled land as collateral for loans. Without loans farmers can not invest in the means that make their agriculture more permanent (e.g., irrigation, fertilizers, pesticides, etc.). Without political empowerment, communities have little incentive to invest in permanent agriculture because the central government or other outsiders could take their investment away. Land tenure, access to capital, and political empowerment are not sufficient to secure bear habitat, but are essential parts of a package of benefits that can be linked to slowing down deforestation. The existence of these benefits does not guarantee success, but their absence is often why community-based conservation efforts fail (Wells and Brandon 1992).

Finally, technical assistance and training are often required to enable local participants to use resources in a sustainable way that minimally harms bears. The Amuesha who live in and around Yanachaga Chemillén National Park (Perú) were taught to harvest trees in bear habitat using a strip clear-cut method. The method allows the soil to retain nutrients, and forest regeneration occurs rapidly from existing seed stocks (Hartshorn 1989). Unsold timber is made into charcoal which is used to bake pottery for sale. Other revenue generating activities that can be less damaging to bear habitat than grazing and shifting agriculture include tourism, alternative agriculture (palm oil and fronds for festivals, orchids, and medicinal plants), and education.

The Toroche-Proto project to provide irrigation water to farms on the border of Podocarpus National Park in southern Ecuador is an example of how technical assistance and training could be combined to benefit Andean bears inside the park. Food production in fields bordering the park declined, forcing inhabitants to cut new fields out of the forest above. The continued existence of bears in Podocarpus may depend on increasing crop yields on existing land. A new irrigation canal built with technical

assistance from the park's border may double the yield on surrounding farms (Knapp 1991). The link between improved agricultural output and sustained forestry could be improved by authorizing project leaders to create a cooperatively owned fund from the sale of excess production and using part of the fund to employ and train local people as park guards. Similar funds and systems for managing them have been successfully established in Costa Rica (Donovan 1994) and Surinam (Thomsen and Brautigam 1991), where a portion of the interest is income to local farmers and the rest is reinvested to ensure the sustainability of local resource use. Training in basic skills, such as record keeping, will be required to enable residents to manage this fund.

Some skills could be learned by participating in research and monitoring projects of Andean bear populations. With training, Andean peasants could learn to record data on habitat use from bear sign, take measurements of habitat variables such as food abundance, and gather information on human use of bear habitat and local attitudes towards bears. Project managers would need to develop methods to ensure the accuracy of these data. As skill levels increased, local residents could participate in more sophisticated aspects of projects such as mapping bear and human uses of landscapes. A product of such participation could include a better understanding of the community's present and estimated future use of resources. Armed with this information, communities would become more able to respond to their resource needs and to outsider demands. The incentive communities have to achieve this goal is to receive recognition from the central government of their authority to regulate local resource use.

Role of Nongovernmental Organizations

Strengths and weaknesses.—Nongovernment organizations (NGOs) are catalysts and facilitators of projects. Projects often originate from NGOs because they are not inhibited from brainstorming solutions by rigid bureaucracies, and they often know more about the biological and social systems than central authorities. Their knowledge helps planners to use existing cultural traditions when designing projects, and thus enables project goals to be understood by community members.

NGO ability to mobilize human and capital resources enables them to respond rapidly to a situation. For example Arco Iris was able to stop miners from entering Podocarpus National Park in 1994, a year after its founding. The marketing and capital management skills NGOs have enable them to analyze resource-use options for their sustainability (May 1992).

NGOs can be perceived to be politically independent. This enables them to monitor and evaluate projects and serve as intermediaries between central and peripheral authorities. NGO knowledge of rights and responsibilities help governments and communities sort out land tenure and other property issues.

NGOs are strongly influenced by their donors' political interests which may not be what wild bear populations need. For example in 1995 the World Society for the Protection of Animals reintroduced 3 orphaned Andean bears into the Maquipucuna Nature Reserve in northern Ecuador. Although reintroductions may be useful vehicles to call attention to species needs, this case was guided by what was perceived to be good for the individual bears, not the wild population. No studies were made prior to the release on the reserve's capability to provide for the needs of wild or captive bears. There was no clear justification to augment the local bear population. NGOs need to support field research. In the absence of field knowledge, management is guided more by human values than the needs of bears.

Lastly NGO's such as the International Association for Bear Research and Management have technical expertise and knowledge to help South Americans focus their land management on the needs of Andean bears. Lacking are knowledge of distribution and degree of population fragmentation, population size, habitat requirements, and the effect of humans on bears and their habitat. Most of the technical ability to achieve this understanding is in North America and Europe where there is a strong emphasis on using scientific research to manage bear populations and human behavior. In contrast, Andean NGOs emphasize the social aspects of management (e.g., dialogue, achieving consensus, promoting self-determination, etc.) more than their northern counterparts. They are wary about allowing foreign experts to supplant the leadership and institutions of the host country. This has inhibited a north–south dialogue that would benefit both parties.

Solutions.—NGOs can help understaffed government agencies achieve their objectives. For example, Fundacion Natura and Ecociencia in Ecuador help the government manage 3 parks with bears (e.g., Podocarpus, Cotacachi–Cayapas, and Cayambe–Coca). The Wildlife Conservation Society helped the Bolivian Forestry Department in 1996 to design timber harvest techniques that maintain long-term productivity of tropical forests and wildlife populations such as Andean bears. Andean governments should not become so dependent on NGOs' abilities to explore solutions and rapidly apply resources that they abandon their decision-making functions to them. Gov-

ernment agencies should continuously monitor NGO actions to ensure that these actions do not conflict with national policies.

Although NGOs are well suited to provide start-up capital and technical help to community-based projects, the effect of these resources is slight if the local institutions of authority are weak. If they are weak, a priority NGO action should be to strengthen their ability to control the behavior of community members, and to articulate the community's concerns to outside groups. Steps Andean NGOs can take in this regard are to deal separately with leadership and technical issues (Wray and Alvarado 1996). NGOs should be careful not to usurp local leadership or foster dependency relations with their donations (Murphree 1994). Foreign NGOs need to de-emphasize regulation in favor of assistance to local NGOs, governments, and communities (Stearman 1996). By doing so NGOs build stewardship for bears where it counts the most and improve the skills of rural residents to adapt and manage their own development (Wright 1994).

DISCUSSION

Future existence of wild bears in the Andes depends on limiting human effects on bears and bear habitat. The era of designating parks for bears in areas of low human habitation is rapidly closing. In its place is a rising human population that threatens to consume the resources both in and outside parks. Currently, Andean governments are struggling to accommodate their swelling labor force, and increased capital investment is required to create jobs in resource management as well as manufacturing sectors (Glade 1991). The consequence of unemployment is the huge rise of the informal economy, including drug trafficking and illegal mining in protected bear areas (estimated at 39% of Perú's gross domestic product, De Soto 1989). This raises several questions. What is the purpose of Andean bear conservation? How much resources should we allocate to save them in light of the needs of Andean people?

While the conservation community is searching for answers to these issues, we point out that wild bear conservation in South America can help slow environmental degradation, perhaps enough to enable effective solutions to evolve. While debate continues about whether problems of bears and sustained human use of their habitat can best be solved by a centralized authority or at the community level (Wells and Brandon 1992), some roles and procedural strategies are becoming clearer.

The existence of a home for wild Andean bears will depend on coordination of action, particularly at the government level. Governments must accept the responsibility of what happens to resources and not release that responsibility to lower organizational levels of society or to outsiders. The question is: how best can governments preserve watersheds that Andean civilizations depend on, and simultaneously conserve bears?

The short-term answer may include tough top-down measures where governments retain ownership and control. Part of Venezuela's policy to ensure the integrity of national parks in the Cordillera Merida against agricultural expansion was to relocate communities. However, the risks of not sharing ownership and management of natural resources with rural inhabitants include losing control over their use and having to secure them militarily. Resource managers in Venezuela and elsewhere know that people with the least access to resources often ignore authorities and take matters into their own hands. In the 1940s investors of Venezuela's oil wealth acquired large coffee plantations and cattle ranches around Lake Maracaibo. They pushed farmers with small land holdings off their land. The displaced farmers moved up the slopes of the Vertiente del Llano into Andean bear habitat, destroying 2/3 of the original cloud forest in the 1950s (Veillon 1977), a loss (12,890 km^2) equal to 60% of the remaining Andean bear distribution in Venezuela. They became violent and engaged in guerrilla activities and drug trafficking. The drug trafficking and illegal immigration that came from the Colombian side of the border added to the government's difficulties to manage resources in the Perija region. By the mid 1980s, INPARQUES called on Venezuela's military to control natural resource use in Perija National Park (IUCN 1986, Fuerzas Armadas de Cooperaciòn 1987, Yerena 1998). Similar social conditions precipitated the Colombian government to use its military in 1994 to defend the dam in Chingaza National Park when terrorists threatened to blow it up. Chingaza's watershed supplies water and electricity to approximately 6 million residents of Santafé de Bogota, the capital city. These examples emphasize that resource issues become national security issues unless policies enable a more equitable distribution of income and opportunity to those on the bottom rung of the socioeconomic ladder. In the Andes these measures are revision of policies that limit land, credit, technology, markets, education, and skills to poor people; the empowerment of local institutions to play a major role in implementing these changes. These are the long-term social solutions to maintain bears.

There is no guarantee that local participation will save wild bears; however, it is essential given the apparent trends in the status of Andean bear habitat (Brown and

Wyckoff-Baird 1992). The insecurity poor people feel about obtaining basic needs (e.g., food, clean water, shelter, clothing, health services, etc.) make it difficult for them to make bear conservation a priority. We believe the best approach is to take care of human needs where the most bears live and explore ways to link development with bear conservation. The degree to which the benefits of conservation are captured by those who experience most of the costs will determine how strong a link can be made. Communities with strong institutions that are in and around the largest protected areas (Fig. 1) should be given priority for projects (see Glick and Wright 1992 for criteria for choosing sites and planning benefits).

There is also no guarantee that donors who supported NGO efforts to keep people out of biodiverse areas will now support some rural development. Foreign NGOs (e.g., World Wildlife Fund, The Nature Conservancy, Wildlife Conservation Society, Conservation International) and national NGOs (e.g., Fondo Andino para la Conservación de los Animales Salvajes and Fundacondor in Venezuela, Fundación para la Educación Superior and Fundación Natura in Colombia, Ecociencia and Fundación Natura in Ecuador, Pro Naturaleza in Perú, and Fundación Amigos de Naturaleza and the Bolivian Conservation Data Center in Bolivia) increasingly promote the concept that more biodiversity will remain if they encourage some local development. To appeal to donors, NGOs use Andean bears to symbolize biodiversity. An estimated 76% of South America's mammalian species occur in the 3.2% of the continent's area on the eastern slope of the Oriental Andes (Mares 1992), where most of the Andean bear's range exists. The northern Andes have a greater floral diversity (30,000–40,000 spp.) than what is estimated for the Amazon Basin, and far greater than that of Europe and North America (Gentry 1982, 1991; Henderson et al. 1991). The cloud forest above 1,500 m in Perú where bears live contains an estimated 15% of vertebrates and vascular plants and 32% of Perú's endemic species in only 5% of its 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).

The next decade will be characterized by the building of more efficient and cooperative institutions to address the problems mentioned in this paper. Currently these issues are being discussed in regional meetings throughout the Andean range. To the extent that these dialogues result in capable partnerships to implement action, the Andean bear faces a brighter future.

LITERATURE CITED

BAUMANN, H. 1963. Gold and gods of Perú. Pantheon Books, New York, N.Y. 218pp.

BODMER, R.E. 1994. Managing wildlife with local communities in the Peruvian Amazon: the case of the Reserva Comunal Tamshiyacu–Tahuayo. Pages 113–134 *in* D. Western, R.M. Wright, and S.C. Strum, eds. Natural connections, perspectives in community-based conservation. Island Press, Washington, D.C.

BRANDON, K. 1996. Traditional peoples, nontraditional times: social change and the implications for biodiversity conservation. Pages 219–236 *in* K.H. Redford and J.A. Mansour, eds. Traditional peoples and biodiversity conservation in large tropical landscapes. American Verde Publ., The Nature Conservancy, Arlington, Va.

BROWN, A., AND D.I. RUMIZ. 1988. Habitat and distribution of the spectacled bear (*Tremarctos ornatus*) in the southern limit of its range. Pages 93–103 *in* M. Rosenthal, ed. Proc. First Int. Symp. on the Spectacled Bear. Lincoln Park Zool. Gardens, Chicago, Ill.

BROWN, F., AND B. WYCKOFF-BAIRD. 1992. Designing integrated conservation and development projects. Biodiversity Support Program of the World Wildl. Fund, The Nat. Conservancy, and the World Resour. Inst., Washington, D.C. 62pp.

CAVELIER, J., AND A. ETTER. 1995. Deforestation of montane forests in Colombia as a result of illegal plantations of opium (*Papaver somniferum*). Pages 541–550 *in* S.P. Churchill, H. Balslev, E. Forero, and J.L. Luteyn, eds. Biodiversity and conservation of neotropical montane forests. New York Botanical Garden, Bronx, N.Y.

CIFUENTES, M., A. PONCE, F. ALBAN, P. MENA, G. MOSQUERA, J. RODRIGUEZ, D. SILVA, L. SUÁREZ, A. TOBAR, AND J. TORRES. 1989. Estrategia para la sistema nacional de areas protegidas, II fase. Ministerio de Agricultura y Ganaderia y Fundacion Natura, Quito, Ecuador. 196pp. (In Spanish.)

CLARKE, R.O.S. 1983. Final report. British Tropical Agric. Mission, Santa Cruz, Bolivia. 83pp.

DE SOTO, H. 1989. The other path. Harper and Row, Publ., Inc., New York, N.Y. 271pp.

DODSON, C., AND A.H. GENTRY. 1991. Biological extinction in western Ecuador. Annals of the Missouri Bot. Garden 78:273–295.

DONOVAN, R. 1994. BOSCOSA: forest conservation and management through local institutions (Costa Rica). Pages 215–233 *in* D. Western, R.M. Wright, and S.C. Strum, eds. Natural connections, perspectives in community-based conservation. Island Press, Washington, D.C.

DOWNER, C. 1996. The mountain tapir, an endangered "flagship" species of the high Andes. Oryx 30:45–58.

ECKSTEIN, S. 1983. Revolution and redistribution in Latin America. Pages 347–386 *in* C. McClintock and A.F. Lowenthal, eds. The Peruvian experiment reconsidered.

Princeton Univ. Press, Princeton, N.J.

EULERT, C.F. 1995. Evaluación del estado actual del jucumari (*Tremarctos ornatus* Cuvier) en el Parque Nacional Amboro, Santa Cruz, Bolivia. Licenciatura Thesis, Univ. Autónoma Gabriel Rene Moreno, Santa Cruz, Bolivia. 89pp. (In Spanish.)

FUERZAS ARMADAS DE COOPERACIÒN. 1987. Los parques nacionales hacia el tercer milenio–aspectos estratégicos de la guardería ambiental (ponencia institucional), Caracas, 22–27 February. Instituto Nacional de Parques, United Nations Educ., Sci., and Cult. Org. Man and the Biosphere, Int. Union Conserv. Nat. Nat. Resour., Ministerio del Ambiente y de los Recursos Naturales Renovables. Caracas, Venezuela. 51pp. (In Spanish.)

GARCIA, J.Z. 1991. Perú and Bolivia. Pages 448–470 *in* J.K. Black, ed. Latin America: its problems and its promise. Westview Press, Boulder, Colo.

GARCIA, M.M. 1996. Refuerzo Español para Cuidar al Oso Frontino. Frontera, 14 Aug:1B (In Spanish.)

GARSHELIS, D.L. 1994. Density-dependent population regulation of black bears. Pages 3–14 *in* M. Taylor, ed. Density-dependent population regulation in black, brown, and polar bears. Int. Conf. Bear Res. and Manage. Monogr. Series No. 3.

GENTRY, A.H. 1982. Neotropical floristic diversity: phytogeographical connections between Central and South America, Pleistocene climatic fluctuations, or an accident of the Andean orogeny? Annals of the Missouri Bot. Garden 69:557–593.

———. 1991. Tropical forest biodiversity: distributional patterns and their conservation significance. Oikos 62:1–10.

GLADE, W.P. 1991. Economic aspects of Latin America. Pages 141–156 *in* J.K. Black, ed. Latin America: its problems and its promise. Westview Press, Boulder, Colo.

GLICK, D., AND M. WRIGHT. 1992. The wildlands and human needs program: putting rural development to work for conservation. Pages 259–275 *in* K.H. Redford and C. Padoch, eds. Conservation of neotropical forests. Colombia Univ. Press, New York, N.Y.

GOLDSTEIN, I. 1988. Distribution and food habits of the spectacled bear in Venezuela. Pages 2–16 *in* M. Rosenthal, ed. Proc. First Int. Symp. on the Spectacled Bear. Lincoln Park Zool. Gardens, Chicago, Ill.

GONZALEZ, A. 1991. Physical landscape and settlement patterns. Pages 19–38 *in* J.K. Black, ed. Latin America: its problems and its promise. Westview Press, Boulder, Colo.

GOODLAND, R.J., AND H.S. IRWIN. 1975. Amazon jungle: green hell to red desert? An ecological discussion of the environmental impact of the highway construction program in the Amazon Basin. Landscape Planning 1(2–3)123–245.

GRADWOHL, J., AND R. GREENBERG. 1988. Saving tropical forests. Island Press, Washington, D.C. 214pp.

HANSEN, E. DE G.R. 1986. Let them eat rice. Pages 100–151 *in* A. Maguire and J.W. Brown, eds. Bordering on trouble, resources and politics in Latin America. Adler and Adler, Publ. Inc., Bethesda, Md.

HARTSHORN, G.S. 1989. Application of gap theory to tropical forest management: natural regeneration on strip clear-cuts in the Peruvian Amazon. Ecology 70:567–569.

HENDERSON, A.S., S.P. CHURCHILL, AND J. LUTEYN. 1991. Neotropical plant diversity. Nature 351:21–22.

HILL, M.A., AND A.J. PRESS. 1994. Kakadu National Park: an Australian experience in comanagement. Pages 135–157 *in* D. Western, R.M. Wright, and S.C. Strum, eds. Natural connections, perspectives in community-based conservation. Island Press, Washington, D.C.

INTERNATIONAL UNION CONSERVATION NATURE. 1984. Categories and criteria for protected areas. Pages 47–53 *in* J.A. McNeely and K.R. Miller, eds. National parks, conservation, and development. The role of protected areas in sustaining society. Smithsonian Inst. Press, Washington D.C.

———. 1986. Perspectivas económicas de los parques nacionales venezolanos. 27a Sesión de trabajo de la Comisión de Parques Nacionales y Areas Protegidas (CNPPA), Bariloche, Argentina. 16pp. (In Spanish.)

KNAPP, G. 1991. Andean ecology: adaptive dynamics in Ecuador. Dellplain Latin Am. Stud., No. 27, Westview Press, Boulder, Colo. 220pp.

LAFEBER, W. 1986. The alliances in retrospect. Pages 338–388 *in* A. Maguire and J.W. Brown, eds. Bordering on trouble, resources and politics in Latin America. Adler and Adler, Publ. Inc., Bethesda, Md.

LEE, R.W. 1989. The white labyrinth: cocaine trafficking and political power in the Andean countries. Transaction Publ., New Brunswick, N.J. 263pp.

LEO, M.L. 1993. The importance of tropical montane cloud forest for preserving vertebrate endemism in Perú: the Río Abiseo National Park as a case study. Pages 198–211 *in* L.S. Hamilton, J.O. Juvik, and F.N. Scatena, eds. Tropical montane cloud forests. Springer–Verlag, New York, N.Y.

LEWIS, D., AND N. CARTER, EDITORS. 1993. Voices from Africa: local perspectives on conservation. World Wildl. Fund, Washington, D.C. 216pp.

LIBERMAN, M. 1991. Evaluación del impacto ambiental de la carretera Cotapata–Santa Barbara. Centro de Estudios Ecológicos y Desarrollo Integral (CEEDI), La Paz, Bolivia. 340pp. (In Spanish.)

MARCONI, M., AND S. DONOSO. 1992. Bolivia, habitantes en las áreas protegidas. Pages 53–79 *in* S. Amend and T. Amend, eds. Espacios sin habitantes? Parques nacionales de América del Sur. Int. Union Conserv. Nat. and Editorial Nueva Sociedad, Caracas, Venezuela. (In Spanish.)

MARES, M.A. 1992. Neotropical mammals and the myth of Amazonian diversity. Science 255:976–979.

MAY, P.H. 1992. Common property resources in the neotropics:

theory, management progress, and an action agenda. Pages 359–378 *in* K.H. Redford and C. Padoch, eds. Conservation of neotropical forests. Colombia Univ. Press, New York, N.Y.

McNeil, R.J. 1990. International parks for peace. Pages 23–38 *in* J. Thorsell, ed. Parks on the borderline: experience in transfrontier conservation. Protected Area Programme Series No. 1., Int. Union Conserv. Nat., Gland, Switzerland.

Murphree, M.W. 1994. The role of institutions in community-based conservation. Pages 403–427 *in* D. Western, R.M. Wright, and S.C. Strum, eds. Natural connections, perspectives in community-based conservation. Island Press, Washington, D.C.

Ostrum, E. 1990. Governing the commons: the evolution of institutions for collective action. Cambridge Univ. Press, Cambridge, Mass. 280pp.

Peyton, B. 1980. Ecology, distribution, and food habits of spectacled bears (*Tremarctos ornatus*) in Perú. J. Mammal. 61:639–652.

———. 1981. Spectacled bears in Perú. Oryx 16:48–56.

———. 1988. The ecology of conservation: a case for an ecosystem approach. Pages 75–92 *in* M. Rosenthal, ed. Proc. First Int. Symp. on the Spectacled Bear. Lincoln Park Zool. Gardens, Chicago, Ill.

———. 1994. Conservation in the developing world: ideas on how to proceed. Int. Conf. Bear Res. and Manage. 9(1):115–127.

Poffenberger, M. 1994. The resurgence of community forest management in eastern India. Pages 53–79 *in* D. Western, R.M. Wright, and S.C. Strum, eds. Natural connections, perspectives in community-based conservation. Island Press, Washington, D.C.

Randall, R. 1982. Qoyllur Rit'i, an Incan fiesta of the pliedes: reflections on time and space in the Andean world. Bull. Inst. Francais d'Etudes Andines 11:37–81.

Ribera, M.O. 1996. Guia para la categorizacion de vertebrados amenazados. Centro de Datos para la Conservacion, La Paz, Bolivia. 105pp. (In Spanish.)

Scobie, G., and R. Posada. 1977. The impact of high yielding rice varieties in Latin America with special emphasis on Colombia. Cent. Int. de Agric. Tropical, Cali, Colombia. 10pp.

Stearman, A.M. 1996. On common ground: The Nature Conservancy and traditional peoples: the Rio Chagres, Panama Workshop. Pages 237–250 *in* K.H. Redford and J.A. Mansour, eds. Traditional peoples and biodiversity conservation in large tropical landscapes. American Verde Publ., The Nature Conservancy, Arlington, Va.

Suárez, L. 1989. Seasonal distribution and food habits of the spectacled bear, *Tremarctos ornatus*, in the highlands of Ecuador. Stud. Neotropical Fauna and Environ. 23:133–136.

———, and M. Garcia. 1986. Extinción de animales en el Ecuador. Fundación Natura, Quito, Ecuador. 153pp.

Tate, G.H.H. 1931. Random observations on habits of South American mammals. J. Mammal. 12:248–256.

Thomsen, J.B., and A. Brautigam. 1991. Sustainable use of neotropical parrots. Pages 359–379 *in* J.G. Robinson and K.H. Redford, eds. Neotropical wildlife conservation. Univ. Chicago Press, Chicago, Ill.

Veillon, J.P. 1977. Las deforestaciones en los Llanos Occidentales de Venezuela, desde 1950 a 1975. Pages 97–110 *in* L. Hamilton, ed. Conservacion de los bosques humedos de Venezuela. Ministerio del Ambiente y de los Recursos Naturales Renovables, Caracas, Venezuela. (In Spanish.)

Wells, M., and K. Brandon with L. Hannah. 1992. People and parks: linking protected area management with local communities. World Bank, World Wildl. Fund, and U.S. Agency for Int. Dev., Washington, D.C. 99pp.

World Resources Institute. 1992. World resources 1992–1993. Report by the World Resour. Inst. in collaboration with the United Nations Environ. Program and the United Nations Dev. Program. Oxford Univ. Press, New York, N.Y. 385pp.

Wray, N., and J. Alvarado. 1996. Sumaco National Park, Ecuador: change and continuity in the indigenous economy and the challenges of biodiversity conservation. Pages 93–113 *in* K.H. Redford and J.A. Mansour, eds. Traditional peoples and biodiversity conservation in large tropical landscapes. American Verde Publ., The Nature Conservancy, Arlington, Va.

Wright, R.M. 1994. Recommendations. Pages 524–535 *in* D. Western, R.M. Wright, and S.C. Strum, eds. Natural connections, perspectives in community-based conservation. Island Press, Washington, D.C.

Yerena, E. 1998. The protected areas for Andean bear (*Tremarctos ornatus*) in South America. Ursus 10:101–106.

———, and D. Torres. 1994. Spectacled bear (*Tremarctos ornatus*) conservation and dispersal corridors in Venezuela. Int. Conf. Bear Res. and Manage. 9(1):169–172.

Young, K.R. 1992. Biogeography of the montane forest zone of the eastern slope of Perú. Pages 119–140 *in* K.R. Young and N. Valencia, eds. Biogeografia, ecologia y conservacion del bosque montano en el Perú. Memorias del Museo de Historia Natural No. 21. Lima, Perú.