

Ecoregional Strategy for the Conservation of the

Spectacled bear

Tremarctos ornatus

in the Northern Andes



ECOREGIONAL STRATEGY FOR THE CONSERVATION OF THE SPECTACLED BEAR (*Tremarctos ornatus*) IN THE NORTHERN ANDES

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Index

I. Context

The Northern Andes Ecoregional Complex	11
The Spectacled Bear as Focal Species	11
Background Information on the Ecoregional Strategy for the Conservation of the Spectacled Bear in the NAEC	12
Threats to the Conservation of the Spectacled Bear	16
Current Distribution of the Spectacled Bear in the NAEC	19

II. Current situation and status of knowledge about the spectacled bear in the countries of the NAEC

VENEZUELA

Status of the population	29
Threats to the population and interactions with humans	29
Loss of habitat	30
Management	30
Needs for environmental education	30
Current status of research in Venezuela	30

COLOMBIA

Status of the population	31
Threats to the population and interactions with humans	31
Loss of habitat	32
Management	32
Needs for environmental education	33
Current status of research in Colombia	33

ECUADOR

Status of population	34
Threats to the population and interactions with humans	34
Loss of habitat	34
Management	35
Needs for Environmental Education	35
Current status of research in Ecuador	35

PERU

Status of the population	36
Threats to the population and interactions with humans	37

Loss of habitat	37
Management	37
Needs for environmental education	37
Current status of research in Peru	38

III. Ecoregional Strategy for the Conservation of the Spectacled Bear in the Northern Andes

Context	41
General Objective of the Strategy	42
Strategic Principles	42
Vision of the Ecoregional Strategy for the Spectacled Bear	43
Strategic Definition of the Conservation of the Spectacled Bear in the NAEC	43
Defining the Lines of Action	44
Lines of Action	45
Line 1	45
• Landscape conservation and management	45
Line 2	45
• Management policies and tools	45
Line 3	46
• Conservation and management of specimens and ex situ populations	46
Line 4	48
• Research and monitoring	48
Line 5	49
• Education and communication	49

IV. Strategy's logical framework

Goal 1	53
Goal 2	57
Goal 3	59

V. Institutional needs and opportunities for executing the ecoregional strategy

PERU	65
VENEZUELA	65
COLOMBIA	66
ECUADOR	67
BIBLIOGRAPHY	67

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Foreword

Survivor of the Pleistocene glaciations and the only representative of bears in South America, the Andean Bear has been gradually losing large portions of its natural habitat. This has resulted from progressive expansion of human activities into Andean forests and high-altitude grasslands or “páramos”. Habitats slowly eroding away and pressures from hunting and human-bear conflicts, reflect,—in one way or another—the limited public awareness of the importance and value of biodiversity and species conservation.

However, concern and interest in the conservation of the Andean Bear does have its proponents. For the past few decades, individuals and organizations, particularly in Colombia, Ecuador, Peru, and Venezuela, took on the challenge of confronting the threats to the survival of this natural emblem of the tropical Andes. And the numbers of men and women committed to the task of protecting the Andean Bear are gradually increasing. They are working tirelessly in different settings from academia to government agencies and non-government organizations, roaming the mountain bear habitats or promoting education and reproduction programs from inside zoos.

Independent and isolated efforts will not be enough however, to preserve the species. The future survival of the Andean bear depends on the existence of large uninterrupted tracks of natural habitats, which calls for protection and ecological restoration of Andean forests and grasslands, controls on hunting, and the reduction of human-bear conflicts. Research is still needed and rehabilitation and reintroduction of captive animals will contribute to population stability. All of these actions must be founded on policy guidelines, education and public awareness.

The only way to guarantee that adequate conditions are maintained across the full geographic range of the Andean Bear and to address the multiple threats and needs listed above is through the joint efforts of the multiple stakeholders interested in Andean Bears. This fundamental principle of conservation guided the formulation of the global action plan for the conservation of bears enacted by the World Conservation Union (IUCN) in 1999. From this Action Plan, a large number of organizations and individuals have joined efforts to develop the strategy herewith presented.

This document is no more than a navigation chart and a declaration of intent. For this strategy to achieve its true value, it must be adopted and appropriated by the society for which it was elaborated; The challenge of achieving effective protection of the Andean Bear—and of the extraordinary forests and “páramos” that this emblematic animal inhabits—is now even more pressing than 20 years ago. We invite governments, organizations, and civil society in general to join a cause that without doubt characterizes the nature of the environmental threats currently faced in the Northern Andes.

Mary Louise Higgins, Ph. D. ■

COUNTRY REPRESENTATIVE, WWF Colombia



Context

The Northern Andes Ecoregional Complex

The tropical Andes are recognized worldwide not only for their impressive biodiversity but also for being an important center of endemism. The World Wildlife Fund (WWF) included this vast area among the 200 most important ecoregions¹ for the conservation of biodiversity worldwide because it harbors almost half of the diversity of flowering plants, birds, frogs, and butterflies of the entire Neotropics. Despite having an area 14 times smaller than that of the Amazon river basin (490,000 km² vs 6,869,000 km²), the Northern Andes has approximately the same number of species as the Amazon jungles.

The Northern Andes ecoregion complex (NAEC) consists of a series of ecoregions characteristic of tropical Andean highlands and intermontane valleys of western Venezuela, Colombia, Ecuador, and northern Peru. The NAEC covers an approximate area of 49 million hectares that extends throughout 2,000 km from the Sierra Nevada of Santa Marta (Colombia) and the Mérida cordillera (Venezuela) to the Porculla Pass in the Huancabamba Depression in northern Peru.

To conserve this important biodiversity, WWF established the Northern Andes Ecoregional program in 1998. WWF and its partners developed the vision of conservation of biodiversity for this group of 14 ecoregions around four overarching goals: (1) to have at least 10% of all original habitats covered within protected area systems; (2) to ensure the connectivity between large blocks of natural vegetation in landscapes with land uses that are compatible with conservation objectives; (3) to maintain ecological and evolutionary processes along altitudinal gradients; and (4) to maintain viable populations of focal species.

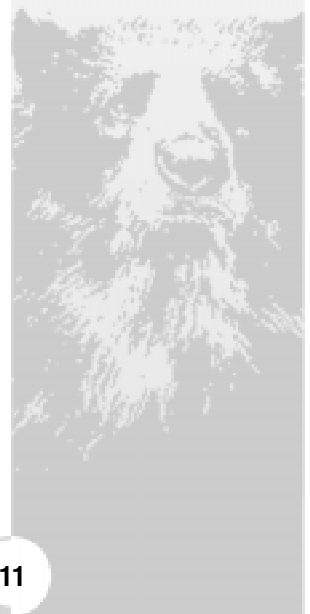
The Spectacled Bear as Focal Species

Including a goal based on a focal species obeyed the need to estimate the size that priority areas should have to maintain viable populations of most wild species. A focal species requires, to survive, a specific combination of habitat, usually in very extensive landscapes (Dinerstein *et al.*, 2000). Those species selected as focal often cover long distances, are area-sensitive and good indicators of the conservation status of their habitats, and have specialized dietary or breeding requirements (Lambeck, 1997). Therefore, if its survival is guaranteed then so would that of many other native species of a region by protecting large, efficiently interconnected areas.

Because the spectacled bear fulfills all these characteristics, it was chosen as primary focal species for the NAEC. The spectacled bear is the only species of its family (Ursidae) present in South America. This animal is distributed throughout the tropical Andes—from the Darién forests along the frontier between Panama and Colombia, including the Venezuelan Andes, down to the frontiers of Bolivia and Argentina (Peyton, 1999). Within this area, the spectacled bear seems to require a

Notas

1. An ecoregion is a relatively large ecological classification unit that contains a distinct assemblage of natural communities sharing a large majority of species, dynamics, and environmental conditions.



mosaic of habitats at different elevations to obtain the food resources on which it depends (Yerena and Torres, 1994). Although this bear is an omnivore, its diet contains a large amount of lipids and fats that the animal obtains from terrestrial bromeliads and Poaceae (Goldstein, pers. comm.) and sugar-rich fruits (Peyton, 1999), which explains to a great extent its extensive potential life areas, its restrictions of habitat, and its altitudinal movements.

Recent estimates of the area necessary for maintaining a viable population of spectacled bears, obtained by extrapolating the requirements of the American black bear, suggest that the domestic area of an adult spectacled bear could range between 3,000 and 4,800 hectares (Paisley, 2000; Peyton, 1999; Yerena, 1994). The high levels of fragmentation, degradation, and loss of forest habitats throughout the Northern Andes could be adversely affecting the species.

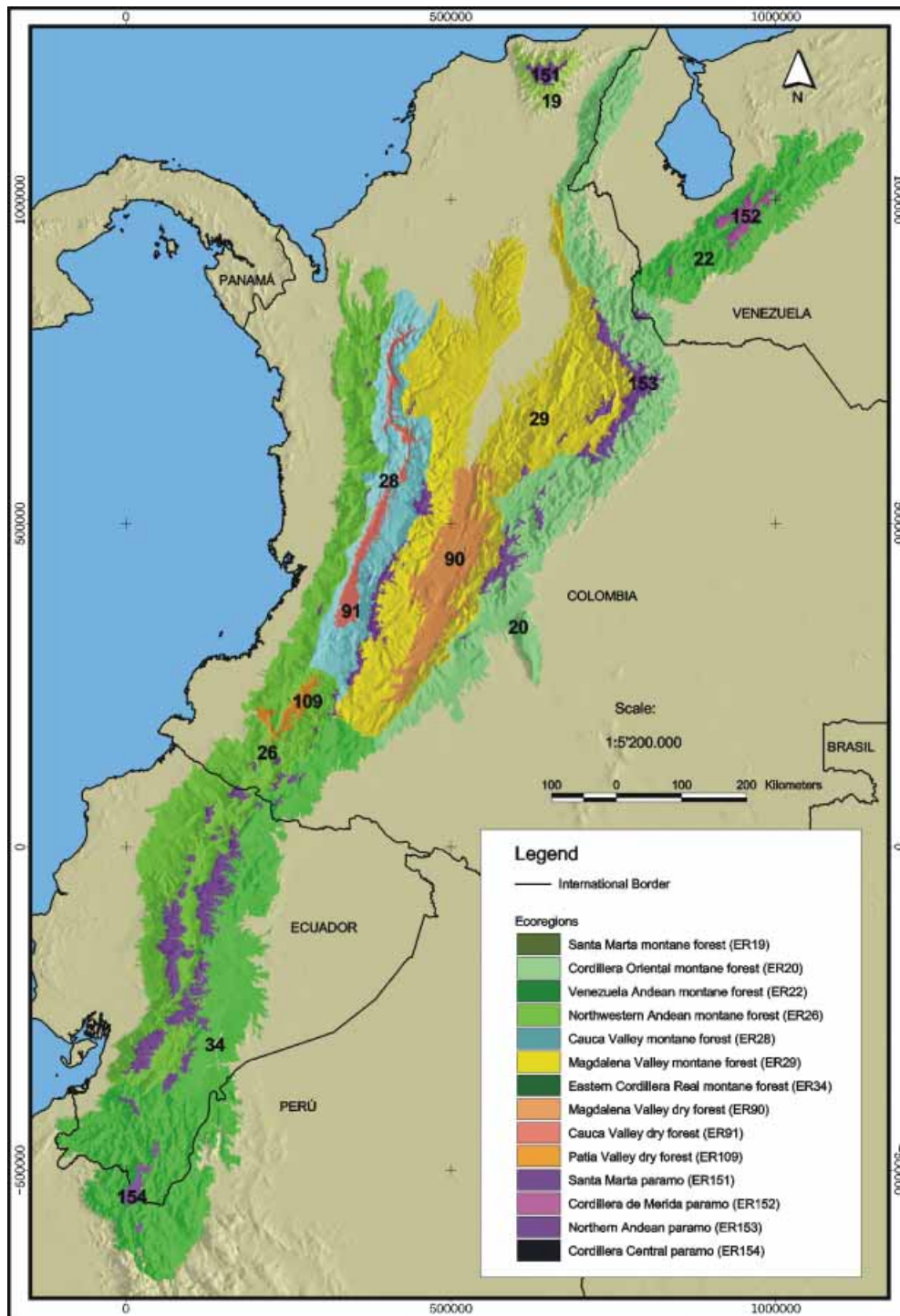
Taking into account the above, the vision of biodiversity for this ecoregional complex considered that a priority area or interconnected series of areas should be, at least, of a size capable of sustaining a viable reproductive nucleus of the spectacled bear. Based on this criterion, the vision identified a series of priority conservation areas. These areas complement the group of national parks, natural reserves, private reserves, and other existing categories of protection, while representing key ecosystems whose ecological integrity affects other habitats, key ecological processes, large-scale ecological phenomena, and focal species that have very specialized habitat requirements.

Background Information on the Ecoregional Strategy for the Conservation of the Spectacled Bear in the NAEC

Although science has known of the existence of the spectacled bear since the 19th century, research on this species and conservation-oriented work only began 23 years ago, with the studies carried out by Bernard Peyton in Peru. Just during the last decade have the interest and concern of a growing number of individuals and organizations in the Andes for this species increased, leading to the development of different lines of work that now flow into a concerted effort to design a strategy for implementing the Action Plan of the IUCN (the World Conservation Union, formerly the International Union for Conservation of Nature and Natural Resources) and for selecting priority actions for the Group of Bear Specialists for South America.

The first initiative to join efforts in favor of the conservation of this species involved the creation of the Spectacled Bear Specialist Group (SBSG) during the VI Conference of the International Association for Bear Research and Management (IBA) in 1983, as a part of the IUCN's group of bear specialists. Most of the members of the SBSG were from Latin American countries and the SBSG, while functioning, issued a newsletter and maintained communication with stakeholders regarding the conservation of the species. The SBSG held work meetings at subsequent IBA conferences and facilitated ideas to develop an action plan that later became part of

Northern Andes Ecoregional Complex Map



Sources

Northern Andes Ecoregional Complex map. WWF 2002.

DIGITAL ELEVATION MODEL

International boundaries: USGS2000

Projection: UTM 18
Datum WGS 1984

Elaborated by: WWF Colombia, 2003



Notas

2. Bears: Status Survey and Conservation Action Plan. Compiled by C. Servheen, Herrero and B. Peyton and the IUCN/SSC Bear and Polar bear specialist Groups 1998. 306 pp.
3. See figure 2, pág. 41

the world strategy for bear conservation developed by IUCN. The SBSG functioned until 1991 and had more than 100 members.

In 1999, the IUCN published the World Bear Status Survey and Conservation Action Plan². In this document four categories or levels of information were used as a basis for developing the plan. The action plan is a proposal that aims to orient the governments of countries that have bears in their territories on how to implement the steps necessary for their conservation. So far the action plan has been consulted and analysed by environmental authorities and other stakeholders. But, to date, the governments have not implemented the recommendations presented in the plan because of the lack of a contextual framework of national and ecoregional realities.

The categories of interest of the IUCN³ plan are as follows:

- Biological and environmental, covering biology aspects of the species, effects of human population, and ecological issues.
- Sociopolitical, which refers to institutions, the resource management capacity of authorities, and the internal capacity of each government to handle any problems that may arise.
- Legal and economic, which refers to sustainable resource use, the access to capital and education of inhabitants in areas home to the species, and commercial aspects involving bears (traffic, hunting, sale of parts) .
- Assessment, which involves cultural issues and the public's attitude toward the world's bear species.

The document proposes a 7-point strategy, and the designing of actions and strategies is based on a process to define priorities that takes into account the threats for each species and their habitats.

In November 2000, WWF's Northern Andes Ecoregional Program, in collaboration with the Species Action Fund and the Wildlife Conservation Society (WCS), held a workshop "Designing an Ecoregional Strategy for the Conservation of the Spectacled Bear" in Riobamba, Ecuador, to update and prioritize IUCN's Action Plan for the Spectacled Bear and evaluate the feasibility of interconnecting protected areas and other areas inhabited by this bear.

This meeting evidenced the growing interest in research related to the management of wild populations of spectacled bear and animals in captivity, the increase in knowledge about the interactions between the bear and human populations, and the application of modern methodologies such as molecular analyses and geographic information systems in related studies. Thanks to these advances, potential distribution maps of the spectacled bear were updated at the Riobamba meeting, and a first approximation was made to define conservation objectives and actions both at the national and regional levels. Workshop participants also concluded that, although IUCN's Action Plan is a valuable document, it should be updated and

expanded to include other topics and researchers in each country must adapt the plan to their particular situations.

In November 2001, a seminar was held in Chinavita (Boyacá, Colombia) to gather the inputs necessary for preparing the “National Program for the Conservation and Recovery of the Spectacled Bear in Colombia”. This seminar was sponsored by Colombia’s Ministry of the Environment (now the Ministry of Environment, Housing, and Territorial Development, MAVDT), the regional autonomous corporations of Corpochivor, CAR, Corpoguvio, and Corpoboyacá, the Andrés Bello Agreement (CAB, its Spanish acronym), WWF’s Northern Andes Ecoregional Program, and the Wii Foundation for the Research, Conservation, and Protection of the Spectacled Bear. Numerous actors participated in this seminar and substantial advances were made in organizing an interinstitutional effort around this problem. Priority actions to be carried out during the next 3 years were also proposed. The impact of this meeting transcended Colombia’s frontiers, thanks to the attendance of researchers from Venezuela, Ecuador, and Peru.

The workshop/course, “Methodology for collecting field data on the spectacled bear (*Tremarctos ornatus*)”, was held in the state of Mérida, Venezuela, in March 2002. The workshop, sponsored by WWF and WCS-Venezuela with the support of Venezuela’s National Parks Institute (INPARQUES), provided an opportunity for many specialists working on the spectacled bear in their respective countries to exchange experiences in field research techniques. Participants proposed the unification of work methods and sought ways of enhancing the complementarity of the projects carried out in the four countries represented at the event. Furthermore, the desirability of establishing an interinstitutional collaborative agreement to steer future actions in favor of the conservation of the spectacled bear was expressed at the workshop. An informal advisory group was accordingly established whose purpose is to integrate efforts and maintain ongoing consultation with EcoCiencia (Ecuador), WCS-Venezuela, Wii Foundation (Colombia), and WWF regarding the conservation of the spectacled bear in the NAEC.

During the same year, EcoCiencia and The Nature Conservancy (TNC) organized a workshop to study wildlife habitats in Ecuador. The workshop laid the groundwork to analyse the distribution and status of fragmentation of bear populations in the ecoregion and became an important input for designing an action plan for the NAEC. This analysis, based on the interpretation of satellite images of forest cover, poses that the bear populations are divided into 110 population segments that show different degrees of isolation, allowing priority areas for bear conservation to be identified based on the individual country analyses. The inputs for this analysis were produced at the workshops that have been held since 2000.

The 14th Congress of the International Association for Bear Research and Management (IBA) celebrated in Norway in July-August 2002 aimed to discuss the research and management of the eight bear species in the world. Nine oral presentations were given and six posters presented on the spectacled bear. The work of Isaac Goldstein (WCS-Venezuela) and Francisco Cuesta (EcoCiencia from



Ecuador) maintained an ecoregional approach and merged many of the expectations that had arisen as a result of former events. A poster was also presented at this conference that outlined the proposed strategy linked to the vision of conservation of biodiversity for the NAEC headed by WWF. These presentations at this event had an important impact from the viewpoint of gaining ground within the institutions and organizations involved in the conservation of ursids worldwide.

These advances shows that it is possible to coherently link the initiatives related to the conservation of this species and its habitats in the mountains of Venezuela, Colombia, Ecuador, and Peru. The increasing amount of biological data allows problems to be more easily identified and possible solutions proposed, also being reflected in the recent strengthening of the institutional capacity of conservation organizations within the NAEC and providing a unique opportunity to coordinate governmental initiatives for protecting biodiversity in mountain ecosystems.

In November 2002, a workshop to structure the present strategy was held in the city of Villa de Leyva (Boyacá, Colombia), with the participation of 32 representatives from 24 institutions of Venezuela, Colombia, Ecuador and Peru—the geographical area of the NAEC. Participants analyzed and discussed a draft document that presented the general guidelines of the strategy; this document is a result of that discussion. The lines of action were defined in plenary sessions, although these were not prioritized geographically or temporally. Participants of the Villa de Leyva workshop and several experts who did not attend the meeting made additional comments on a new version of the strategy in January and February 2003. The numerous valuable observations were accordingly incorporated and led to the establishment of the priorities presented in this document. The logical decisions of prioritization were based on the fragmentation analysis, the analysis of needs and opportunities, and the programmatic interests of participating entities. The strategy therefore includes the viewpoint of national governmental organizations (ministries of the environment, national parks institutes), international nongovernmental organizations (TNC, Conservation International-CI, IUCN, Traffic, WCS, WWF), mixed organizations (Alexander von Humboldt Institute-IAvH), and NGOs of the different countries that have worked on the conservation of the species and are capable of implementing different aspects of the strategy (EcoCiencia, Ecoandina Foundation and Wii Foundation).

Threats to the Conservation of the Spectacled Bear

The analysis of threats to the conservation of the spectacled bear becomes a basic tool for proposing valid, viable solutions. Figure 1 summarizes the most notable aspects of these threats in the NAEC. Although the conservation of the spectacled bear has its own peculiarities in each country of the NAEC, a common pattern of threat exists throughout the region.

There is evidence that the size and number of wild populations of spectacled bear have decreased, although these indications are not backed by scientific studies. On the other hand, the fragmentation of high mountain ecosystems suggests that the

gene flow between bear populations is minimal, which, if demonstrated, would definitively confirm that this emblematic species of the Northern Andes ecosystems is threatened in the ecoregions forming part of this vast area.

Hunting is one of the major causes of population reduction of this species throughout the NAEC. In the four countries forming part of this ecoregional complex, local inhabitants kill bears for diverse reasons, including subsistence hunting, protection against attacks to livestock and crops (especially maize), fear of the animal due to cultural reasons, and occasionally the illegal traffic of bear parts and live specimens. Although the impact of this threat has not been precisely assessed, it is calculated that around 200 bears are hunted down each year in the region (Adams and Mazariegos, 1994; Orejuela and Jorgenson, 1999).

The expansion of the agricultural frontier is another factor that has recently contributed to the population decrease of the spectacled bear because of the loss and fragmentation of its habitat.

It is urgent to consider how the inadequate crop and livestock management systems affect extant populations of spectacled bear throughout the Northern Andes. Current land uses with different degrees of human intervention include processes such as the felling of forest trees, land preparation, and extraction of timber and firewood for farms in the higher mountainous areas (Rodríguez, 1991). These processes, when added to infrastructure development (highways and roads, oil pipelines, gas pipelines, dams, and high tension lines), the advances in mining, petroleum exploitation, and other industries, have fragmented the distribution range of the spectacled bear into at least 113 patches of wilderness in the mountainous region located between Venezuela and northern Peru (F. Cuesta, pers. comm.).

On the other hand, the introduction of domestic species, favored by the expansion of the agricultural frontier, can adversely affect bear populations. Cattle, goats, and sheep, as well as dogs, cats, and rats, could favor the presence of zoonotic diseases (for example, *Babesia* sp.) that would affect the survival of wild bears entering into contact with these animals, as documented in populations of the mountain tapir (*Tapirus pinchaque*) in Ecuador (O. Montenegro, pers. comm.).

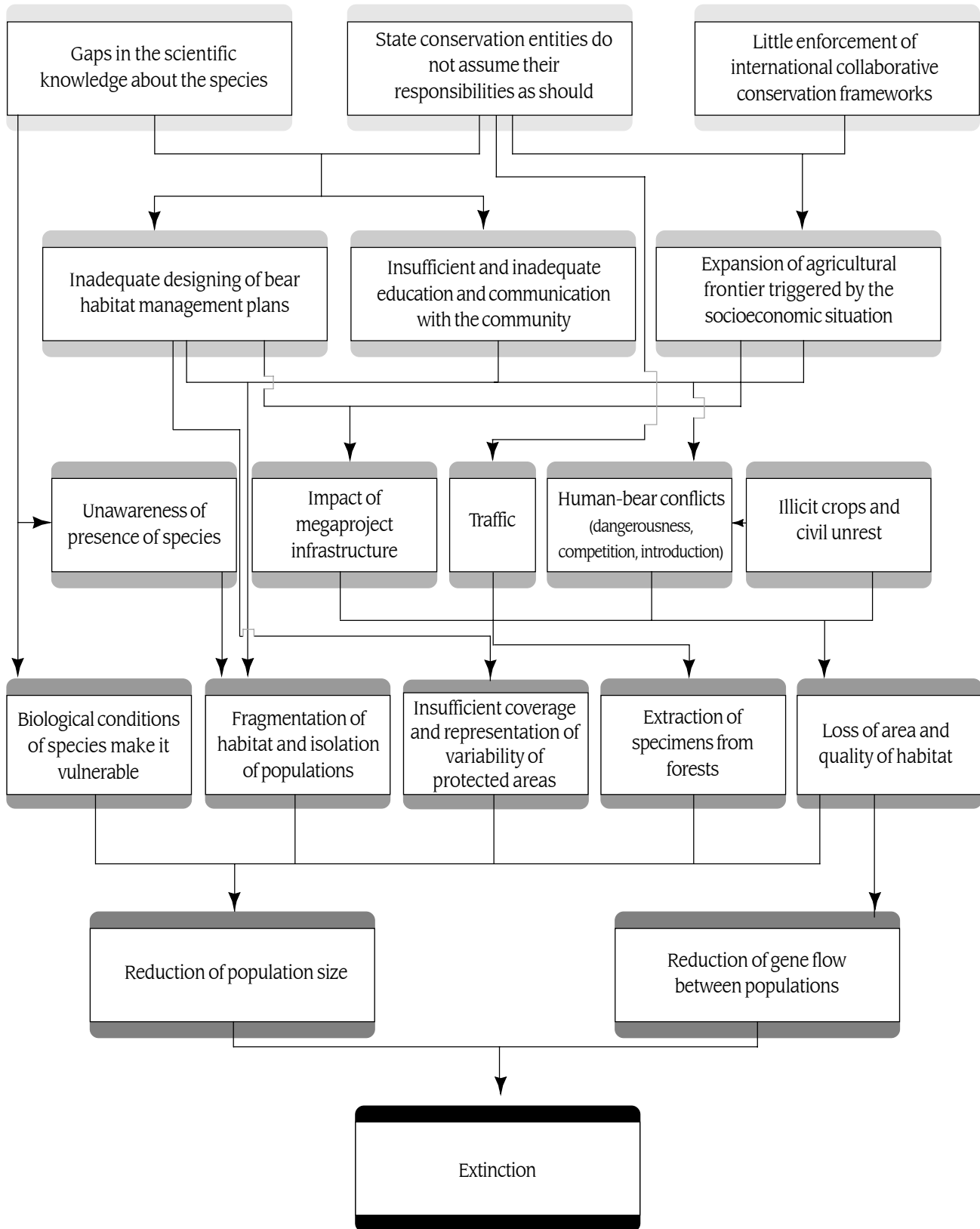
The previous situations can be largely attributed to the inequity in land tenure (WWF, 2002). In the most productive areas of the NAEC, property is concentrated in a few hands, which means that the poorest inhabitants are forced to occupy the limited land available on the fragile hillsides of mountains inhabited by the spectacled bear. The conditions of rural poverty and the worsening of social conflicts in Northern Andean countries have intensified this process, which, in the case of Colombia, has been undoubtedly associated with armed conflict and illegal crops (Rodríguez *et al.*, 2002).

Despite limited knowledge about the biology and ecology of the spectacled bear, it is recognized that several of the characteristics of its life history make it extremely vulnerable to diverse anthropogenic pressures. Its low natural density in many regions, its low reproductive rate, long period of parental dependency, and reduced genetic variability in natural conditions (Ruiz-García, 2002) could be risk factors

continue pag. 19 ►



Figure 1.
Problems associated with the conservation of the spectacled bear



when coupled with the reduction in the natural habitat of the species and the continuous extraction of specimens.

As evidenced in this summary of threats to the conservation of the spectacled bear in the NAEC, there are major gaps of knowledge about the species (for example, population dynamics, habitat uses, and reproduction). These gaps become, in turn, major threats for its conservation. The designing of management plans for the species and its habitats may prove inadequate if the information necessary for ensuring the viability of target populations is not available. Furthermore, efforts aimed at reducing the conflicts between the bear and the farmers may be futile for this same reason.

Identified threats and information gaps repeat themselves at different degrees of complexity throughout the northern distribution of the species, but within a similar sociopolitical framework. This problem has been broadly recognized in the countries involved and, thanks to the growing concern of governmental and nongovernmental institutions and of different sectors of the civil society, a growing number of initiatives exist that aim to close identified information gaps to sustain actions for the conservation of the species.

Because many of these efforts are undertaken in an isolated fashion and their impact is limited, a framework of international cooperation for the conservation of the spectacled bear should be proposed without delay. It is therefore indispensable to develop and implement a concerted strategy that encompasses the distribution area of the species and involves governmental and non governmental institutions and other stakeholders interested in the conservation of the spectacled bear.

Current Distribution of the Spectacled Bear in the NAEC

It is currently estimated that the spectacled bear occupies a potential area of 208,086 km² within the NAEC, in an altitudinal range between 500 and 4,000 meters of elevation and, as a result, encompasses a broad array of ecosystems. For the most part, its distribution is located in the montane forests and páramos. Although the exact size of its current population in the region is unknown, the largest number of spectacled bears are presumably found in Colombia and Peru.

The status of fragmentation of the habitat of the spectacled bear in its northern distribution was assessed by analyzing potential distribution polygons for each country using geographic information systems and then assessing each regarding nine descriptive variables (Cuesta, 2002; Table 1). Distribution polygons of the spectacled bear were defined on the basis of distribution reports generated for each country, taking as minimum altitude the elevation of 500 m from the maps of vegetation cover for each country (Sierra *et al.*, 1999; WWF, 2000). The polygons were delimited according to the coverage of main and secondary roads in each country (EcoCiencia, 2000; WWF, 2000). In areas with road infrastructure, a 2-km area of influence was defined for each patch of potential distribution of the spectacled bear. Finally, the polygons under 100 km² were excluded from the analysis.



Variables were selected based on previous studies that had identified them as relevant to the landscape ecology and distribution of the spectacled bear (e.g., habitat fragmentation) and on previous experiences in developing habitat evaluation models using geographic information systems. All variables used were continuous in nature and calculated for a grid size of 500 m with UTM18 projection and WGS84 datum. A first set of variables evaluated the structure and spatial relationships of habitat patches with the landscape and a second set, the degree of vulnerability of each

Table 1.
Variables selected to assess the habitat of the spectacled bear in its northern distribution

Variable (unit of measurement)	Study area range	Source of data and processing
1. Polygon area (km ²)	113- 208,601.5	Distribution of the spectacled bear: Country reports (WWF, 2000; EcoCiencia, 2001)
2. Polygon shape (border effect)	1 = FRAC = 2	Based on the fractal dimension index (FRAC) of the Fragstat 3.1 program (2000)
3. Index of inside area of polygon	0 = CAI < 100	Based on the core area index (CAI) of Fragstat 3.1 program (2000)
4. Degree of isolation of polygon	PROX = 0	Based on the proximity index (PROX) of the Fragstat 3.1 program (2000)
5. Vegetation cover (plant formations)	4 categories (see text)	Characteristics of the vegetation of Ecuador (Sierra <i>et al.</i> , 2000) and Venezuela and Colombia (WWF, 2000) based on the monitoring and digital classification of satellite images (Landsat TM) and <i>in situ</i> transects.
6. Altitude (m)	6 categories based on Jorgenson & León-Yanez (2001) (see text)	Cartographic base of the Instituto Geográfico Militar. Scale 1:2'000,000 (500 m per pixel)
7. Conservation status (percentage)	3 categories (see text)	Base map of the national system of protected areas for each country (UAESPNN and INCORA for Colombia, SNAP for Ecuador, INPARQUES for Venezuela, INRENA and SURAPA for Peru)
8. Human density (interpolation model)	5 categories (see text)	Demographic data for the third level of classification per country, built with the IDW function of the ArcView 3.2a program: for Venezuela, municipality (1993); for Colombia, municipality (1993); for Ecuador, canton (1996); for Peru (1993), province/district
9. Accessibility (hours of displacement)	4 categories (see text)	Model calculated in number of hours needed to travel from one point of the arc to another (CIAT, 1998) obtained through ArcInfo's cost-distance function

patch before human threats. Because the patches varied in size, all area measurements were converted to percentages for standardization.

Border effect has been used in several landscape ecology studies to evaluate patch shape (Iverson, 1989; Ripple *et al.*, 1991). Patch shape has been found to affect processes between the patches of a given landscape, for example the dispersion of small mammals (Buechner, 1989) and colonization of woody plants (Hardt and Forman, 1989).

The inside area index (IAI) is a relative measurement that evaluates the effect of the outside perimeter (border) on the inside of the patch. In the current study, we defined a 5-km area of influence from the border toward the inside of the distribution polygons of the spectacled bear. Although this is an arbitrary measurement, it was considered fairly accurate because of the topography of the area in which the habitat patches are distributed and because most of the human activities around these natural areas are concentrated in a mean radius of 2 km (Amend and Amend, 1994). The IAI was rounded to 100 when the patch consisted mostly of inside area due to its size, shape, or border.

The evaluation of the degree of isolation using the proximity index (Gustafson and Parker, 1992) considers the size and proximity of all patches whose outside borders are found within a specific search radius. In his study, Hill (2002) defined a 10-km search radius. Although this is an arbitrary value, it is reasonable to presume that it is unlikely that a specimen will effectively reach a patch located at more than 10 km in distance. Isolation is a phenomenon that deals with the spatial and temporal context of habitat patches. This phenomenon is a decisive factor in the dynamics of structured populations and plays a fundamental role in metapopulation theory and in conservation efforts involving endangered species (Levins, 1970; Gilpin and Hanski, 1991; Lamberson *et al.*, 1992). The fragmentation of the distribution of the spectacled bear and the isolation of its populations are the most serious problems identified that will affect the long-term survival of the species (Cuesta and Suárez, 2001; Peyton, 1999; Yereña, 1994).

The evaluation of distribution polygons of the spectacled bear in relation to vegetation cover and altitude was considered important because of the need to conserve functional landscape units that guarantee the access of the species to resources throughout the year (Yereña and Torres, 1994). Observations indicate that the use of the resources present in the different plant formations by the spectacled bear varies seasonally (Peyton, 1980; Suárez, 1985; Goldstein, 1991). Vegetation cover was reclassified into three categories: páramo, forest, and undergrowth. This simplification of habitats of the spectacled bear was made because of the lack of a comprehensive proposal of vegetation units for the NAEC and accordingly incorporated the proposals of plant classification made by each country. The surface area and percentage of each type of vegetation associated with each distribution polygon of the spectacled bear were determined based on the reclassified vegetation scheme.

Six altitudinal belts were used as the measure units to estimate the β diversity of the distribution polygons (Table 2). The surface area and percentage of each altitu-



dinal range associated with the vegetation cover of the polygons were determined. Jorgenson *et al.* (1999) found that 80.8% of the vascular plants of Ecuador are distributed in the vertical elevation range between 1000 and 1500 m and that, as a result of this phenomenon, two significant breaking points in species composition exist in the Ecuadorian Andes: one at 1500 m and the other at 3500 m. Smaller breaking points occur at 500 m, 2500 m, and 4500 m.

The degree of vulnerability of the spectacled bear in the northern part of its distribution was evaluated using 3 variables: status of legal protection, human population density associated with each polygon, and degree of accessibility to each polygon. The status of legal protection was evaluated by determining the surface

Table 2.
Categories of variables used to evaluate the habitat of the spectacled bear in its northern distribution

Variable	Categorías				
Vegetation	Paramo	Cloud forest	Underbrush		
Altitude	< 999 m	1000-1999 m	2000-2999 m	3000-4000 m	> 4000 m
Degree of conservation	National park	Indigenous territory	Overlapping area	Unprotected area	
Population density	0-10 people/km ²	10-50 people/km ²	50-100 people/km ²	100-500 people/km ²	500-7770 people/km ²

area associated to national parks, indigenous territories, overlapping areas of the former two, and unprotected areas. The population density was estimated based on third-level census data from each country: at the municipal level for Venezuela (1990) and Colombia (1993), at the cantón level for Ecuador (1990), and at the provincial level for Peru (1993). An interpolation model was built based on this information and values were obtained for each exit grid by assigning weights as a function of statistical observation and the distance between each observation (Larrea *et al.*, 2002). The values obtained were grouped into 5 categories to estimate the surface area of each polygon in association with each density range.

Finally, an accessibility model developed by the International Center for Tropical Agriculture (CIAT, 1998) was used to evaluate the potential opportunities for human contact and interaction with natural resources. These opportunities for interaction were analyzed by defining the most accessible way of displacement from one site to another within each distribution polygon. The criteria for the displacement model were based on land topography and the presence of roads (levels 1 to 3), navigable rivers, and human population centers). Based on this model, four categories were defined and used to determine the degree of accessibility of each distribution polygon of the spectacled bear in the NAEC.

The spectacled bear is distributed in 110 habitat patches that vary in size from 113 km² to 36,174 km² ($x = 1809.3$ km²; $sd = 2958$ km², see pag. 25) and cover an area of 208,086 km² of which just 47,749 km² (25%) enjoy some degree of protection. Colombia has the largest area of potential presence of the spectacled bear, covering 55% (112,482.4 km²) of the northern distribution of the species. However, only 17.1% of this area is protected. Of the entire northern distribution of the species, Venezuela is the country that proportionately has the largest surface area of habitat under legal protection, 46%. Based on the values of the different variables, the distribution polygons of the species were grouped using the non-hierarchical K-means cluster analysis of the SPSS statistical program (SPSS Inc., 1998), with a maximum of 30 interactions and a convergence criterion of 0.01.

Five groups were accordingly defined (Table 3, see next page)⁴. The first group contains 29 patches characterized as being the largest of the northern distribution ($= 3528.3$ km² + 2430.2 km² sd). The degree of internal fragmentation of these patches is, in general, low ($= 42.19\% + 13.85\%$ sd) as well as their degree of isolation ($= 6821.2 + 9407.7$ sd). On the other hand, 28% (32,560 km²) of the surface is protected (national park) and 36% corresponds to areas inaccessible to human use (> 60 h displacement). However, 66% of the surface is associated with areas with a population density of 10-50 people/km².

The second group contains only two patches of distribution associated with Colombia, characterized by an overlapping of protected areas with indigenous territories (15.9% or 629.1 km²) and a degree of internal fragmentation resulting from the border effect on the inside of the distribution polygons ($= 16.27\% + 21.94\%$ sd). On the other hand, most of these polygons are located in areas with a population density between 10-50 people/km² ($= 0.98$) and more than 50% of their surface ($= 0.59$) is in areas of very limited accessibility (> 60 hours displacement).

The third group consists of eight medium-sized patches ($= 1754$ km² + 1134 km² sds), of which 36% is linked to cloud forests located between 1000-2000 m in elevation (Figure 3); 80% (11,326.6 km²) lacks protection and 82% of the surface is associated with areas of human population densities between 10-50 people/km² and 13% with areas of 50-100 people/km². In addition, the polygons of this group are exposed to human influences such as population centers or access routes; 31.7% of the area is associated with accessible areas (7-24 hours displacement) and 36% to moderately accessible areas (25-60 hours displacement).

The fourth group is composed of 70 fragments characterized as being the smallest in size of the northern distribution ($= 535.6$ km² + 427.1 km² sd) and facing the highest degree of risk. Its degree of fragmentation is the highest of all the groups ($= 8.7\% + 11.2\%$ sd) as well as its degree of isolation ($= 1271 + 1704$ sd). Only 10% (3954 km²) of the area is protected despite being highly exposed to human pressure. Of its surface, 70% (26,210 km²) is associated with areas of human density from 10 to 50 people/km² and 30% with areas accessible between 7-24 hours displacement.

The fifth group is represented by a single polygon with very specific characteristics (Figure 3). This is the largest fragment of habitat of the northern distribution of the

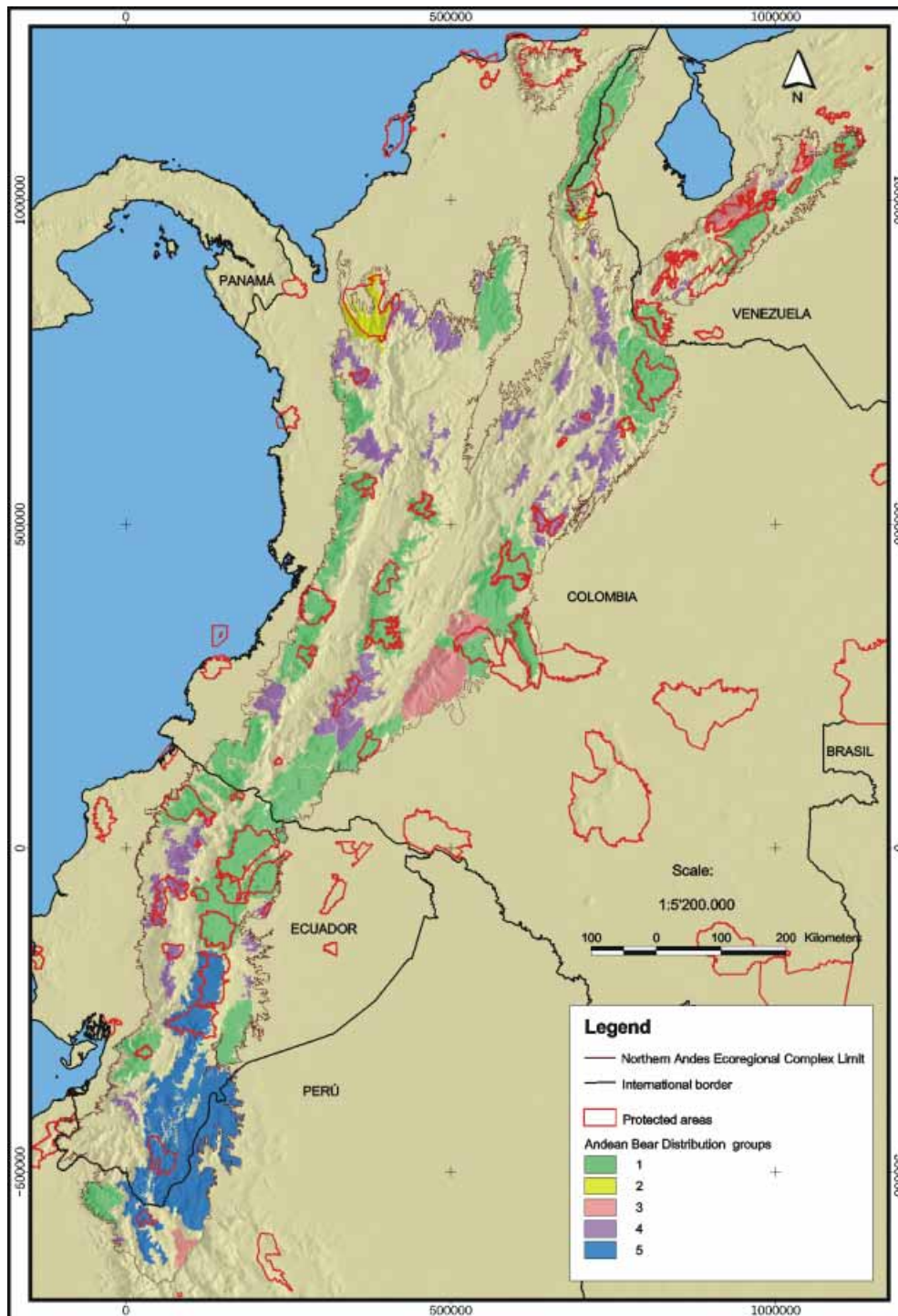


spectacled bear (36,192 km²). Its inside area index (IAI) corresponds to 48%, most of which is located in the lower elevation ranges of the distribution of the species in

Table 3.
Diagnostic characteristics of each group of distribution patches, whether real or potential, of the spectacled bear in the Northern Andes Ecoregional Complex

Group	Characteristics
1	Are the largest patches of the northern distribution ($\bar{x} = 431,310$ ha).
	Associated to cloud forests between 1000 to 2000 masl; 29.2% of patches are located in this type of habitat
	Patches of this group have the highest percentage of inside area of all polygons of the northern distribution ($\bar{x} = 42.2\%$)
	The level of protection is high; 31.3% (36,530.8 km ²) of the area is under some type of protection.
	Associated to areas with a population density between 10-50 people/km ² ; 76.39% (88,962.22 km ²) of these patches show low population densities.
	Limited accessibility to patches (25-60 hours); 37% (43,437 km ²) of these patches located far from human population centers.
2	Associated to areas undergoing land tenure conflicts (overlapping of indigenous territories and protected area; 16.17% (639.33 km ²) presenting this type of conflict.
	Areas located below 999 masl; 42.23% (1669.25 km ²) below this altitude.
3	Low levels of protection; only 19% of the area is protected.
	Accessible areas (7-24 hours displacement); 32% of the surface located near human population centers.
4	Areas of high population density (50-100 people/km ²); 13% (18,700 ha) associated with human population centers.
	Smallest patches and isolated from the distribution ($\bar{x} = 50,625$ ha).
	Associated with highly accessible areas (1-6 hours displacement); 13% (480,000 ha) associated with human population centers.
5	Patches of this group have the lowest percentage of inside area of all polygons of the northern distribution ($\bar{x} = 7.89\%$).
	The only patch of 3,600,000 hectares.
	Only 17% is protected.
	Habitat exclusive to the distribution-the Amazon cordilleras.
	Highly vulnerable (petroleum and mining)

Distribution map of the spectacled bear in the Northern Andes Ecoregional Complex



Sources

NAEC Boundary.
WWF, 2002.

International boundaries:
USGS 2000.
INPARQUES, Venezuela.
UAESPNN, Colombia.
Unidad de Parques, Ecuador.
INRENA, Peru.

Bear distribution:
EcoCiencia, 2002
WWF, 2002.

Unified by:
WWF 2002.

Projection:
UTM 2N 18
Datum WGS 1984.

Elaborated by:
WWF Colombia, 2003.



the NAEC (500 m). Despite the fact that most of the polygon (34%) is associated with inaccessible areas (> 60 hours displacement) and a population density between 10 to 50 people/km² (84% of its surface), it presents a high degree of vulnerability because of its size and irregular shape (FRAC = 1.19) and the fact that only 22% of the polygon is protected.

To design the current strategy, both the opportunities for and limitations to the implementation of conservation actions for the groups defined by this cluster analysis were defined and brought together in two broad categories. Groups 1 and 5 (Table 3) were placed in the category of “large patches”, whereas groups 2, 3, and 4 were placed in the category of “small patches”. Therefore, the categorization of actions for each country should be based on the previous analysis, taking into account the presence of large and small patches in their respective territories.





Current situation and status of knowledge about the spectacled bear in the countries of the CEAN

VENEZUELA

The analysis of satellite images of the ecoregion indicates that the bear population of Venezuela is fragmented in at least 12 segments that occupy ca. 2,000 km², in areas above 500 m in elevation, being almost completely restricted to a strip above 2,500 m. Main population nuclei are located in the Perijá mountain range and the Sierra Nevada of Mérida.

An important proportion of the spectacled bear distribution area in Venezuela is included within the protected areas system (national parks and natural monuments). This is undoubtedly due to the fact that, since the mid-1980s, the declaration of protected areas in the Venezuelan Andes has been based on the presence and distribution of this species (Yerena, 1992). However, as pointed out by the IUCN Action Plan, in Venezuela the most vulnerable populations of the spectacled bear are those found in the Portuguesa mountain range, and the ones present in the protected areas themselves (Yerena, 1999). This vulnerability can be attributed to the reduced size of these areas as well as to the high degree of anthropic intervention in adjacent areas.

Status of the population

There is no accurate estimate of the size of the spectacled bear population in Venezuela. Although the IUCN Action Plan gives an estimate of less than 1000 individuals, calculated on the basis of an American black bear population for a similar area, recent genetic analyses (Ruiz García *et al.*, 2002) indicate that the number of animals can be significantly higher (around 1,200).

However, both estimates can be far from reality. The first one is based on the assumption that two species inhabiting very different latitudes and habitats and, using different resources have similar area requirements. Although both animals belong to the same family and have a similar size, it is quite feasible that their needs for space are different and, as a result, their population densities are also different. Furthermore, the estimates of Ruiz-García *et al.* (2002) are based on the sampling of a single block of wild segments corresponding to the Mérida cordillera, which disregards the probability of local differences in other important blocks such as those of the Perijá mountain range and the Tamá area for which no information is available.

Threats to the population and interactions with humans

The IUCN Action Plan points out that illegal hunting is the main threat for bear populations in Venezuela. However, in recent years illegal hunting in the areas where the Sierra Nevada and Serranía de la Culata national parks are located has decreased, mainly because most of the inhabitants of certain population centers located within these parks have emigrated or many traditional bear hunters have grown old or died.

However, this could possibly not be the case for the Perijá mountain range, where Bracho (pers. comm.) recently indicated a high level of bear hunting due to trade of



animal parts in the black market. In addition, the predation of livestock by the bear has triggered indiscriminate bear hunting in areas exposed to this problem.

Loss of habitat

The IUCN ranks this threat as second in importance and there is evidence that it constitutes an important reason for reduced spectacled bear populations in Venezuela. In addition to the destruction of habitat, other factors that are major concerns in the country are the deterioration of habitat due to excessive use of the páramos and the loss of connectivity between different wild areas—which is particularly important in the Portuguesa mountain range, as well as in all other wild areas where the cultivation of vegetables, potato, and garlic are extending to higher-altitude areas.

Management

The management of the spectacled bear in Venezuela has specifically focused on the conservation of wild areas inhabited by bears through the creation of national parks. At present most of the distribution of the spectacled bear in the country has been protected, particularly by increasing the connectivity between large wilderness areas. Although several interconnecting corridors are currently unprotected, studies are being conducted and arrangements being made to achieve the highest number possible of connections.

Needs for environmental education

The spectacled bear has become a symbol of conservation in Venezuela thanks to the continuous efforts of many NGOs—local, national, and international. Public awareness of the current status of bear populations and the threats they face has increased, and as a result local communities have become capable of effective collaboration with individuals and institutions involved in the management and conservation of this species.

Current status of research in Venezuela

Work is currently being conducted on the design and establishment of interconnecting corridors among bear populations of the Portuguesa mountain range (Yerena *et al.*, 2001) as well as research on livestock predation (Goldstein, 1997; Goldstein *et al.*, 2002), dietary requirements and genetics of bear populations/individuals in the Sierra Nevada and Serranía de la Culata national parks, located in the state of Mérida (Goldstein, personal communication). On the other hand, there have been important developments in the area of environmental education thanks to the efforts carried out for some 10 years especially in the Mérida region (Torres, 2002). Research on bears in captivity has been related to the proposal of management protocols and care of cubs in zoos with specimens of this species (Bracho, 2001).



COLOMBIA

As put forth by IUCN (Orejuela and Jorgenson, 1999), in Colombia the spectacled bear is distributed throughout the three branches of the Andes, an area that occupies 26% of the national territory. The ecological characteristics of the spectacled bear, for example its great displacement potential, versatility, and omnivory, allow this species to occupy different altitudinal ranges in the cordilleras and, as a result, different habitats, placing it in conflict with the historical and social patterns of transformation in the Andes.

The bear occupies 23 of the 50 areas protected by the country's National System of Protected Areas, many of which were constituted, as was the case in Venezuela, based on the presence of this species (INDERENA, 1987). The most important areas of distribution of the bear are located mainly on the external flanks of the Eastern and Western cordilleras, while those of the Central cordillera are highly fragmented.

Estimates of the number of bears in Colombia, based on the genetic analysis of effective numbers (Ruiz García *et al.*, 2002), indicate that the population may be close to 8,000 individuals. However, this information could be biased due to the low number of wild specimens. The IUCN Action Plan states that there are some 5,000 bears in Colombia, based on information extrapolated from black bear populations; however, the same considerations given for Venezuela hold true for Colombia.

Status of the population

For centuries the communities of the Colombian Andes have transformed the habitat of the spectacled bear, a phenomenon that has increased notably over the last 100 years. The country's main human settlements are located along the stretches of Andean forests, causing serious fragmentation as is the case of the central part of the Eastern Cordillera where there is no longer a connection between the blocks of habitat as a result of the linear infrastructure built (roads, gas pipelines, oil pipelines, etc.), water reservoirs, and the expansion of the agricultural frontier. The potential bear population of Colombia is currently divided into 75 segments, located in the higher parts of the cordilleras.

The spectacled bear seems to have disappeared from La Macarena mountain range because of the isolation these forests have suffered due to colonization to establish illegal crops, in addition to the pressure exerted by armed groups, the building of roads, and the colonization by farmers displaced from rural areas of other parts of the country. In the Darién mountain range, in the bordering area with Panama, hunters have recently reported the presence of the spectacled bear. Reports also exist of the presence of this species in the Baudó mountains, but no recent information exists that confirms their existence.

Threats to the population and interactions with humans

According to the IUCN Action Plan, the main threats for the survival of the spectacled bear in Colombia are the destruction and transformation of its habitat



and the hunting triggered by the damages caused to maize crops and the depredation of domestic animals, mainly cattle, in the páramo areas. These problems seem to have increased in recent years with the deforestation of Andean forests to establish illegal crops.

Loss of habitat

According to IUCN (1999), it is not fortuitous that in Colombia the largest bear populations are found in the Western cordillera because, historically, its colonization started relatively late, beginning approximately 60 years ago, whereas the towns located in the central part of the Eastern cordillera, between the Cundiboyacense massif and the piedmont of the Eastern Plains, have supported human impact for approximately 300 years. Of the three branches of the Andes, the Central cordillera suffered the greatest impact of colonization from mid-19th century through more ca. 1930, when the so-called Antioqueña colonization finished, basically transforming this area into cattle ranches and coffee plantations.

At present, colonization processes, in addition to activities related to drug trafficking and the armed conflict, occur throughout the cordilleras. Although their impact has not been duly assessed, these processes have undoubtedly altered what remains of spectacled bear's habitat. Furthermore, it is precisely in the Andean cordilleras and intermediate valleys where most of the country's agricultural and livestock production activities are concentrated, enhanced by the better-quality soils, favorable climate, and better communication channels (IUCN, 1999).

The highly fragile Andean and high Andean forest ecosystems are most affected by the expanded cultivation of illegal crops such as opium poppy. The Andean forests occupy approximately 91,342 km² according to data provided by IDEAM (2000) and account for 8% of the national territory. This low percentage is related to the high pressure to which they have been submitted. It has been estimated that 2.5 hectares of Andean forest must be destroyed to establish 1 hectare of poppy.

The adaptation of land for agriculture not only causes the loss of diversity of local flora and associated genetic resources, but also triggers fragmentation, displacement, loss of fauna, and alteration of trophic chains. Erosion is another consequence, seriously affecting communities downstream because of the high-risk processes generated such as sedimentation of rivers, dams, massive soil removal and landslides.

Management

The bear management needs put forth in the IUCN Action Plan for Colombia have not changed substantially. Pertinent actions have basically aimed at proposing conservation alternatives in areas included in the National Parks System, but to date have left out those regions of jurisdiction of the regional autonomous corporations where the bear not only occupies protected areas, but enters into conflict with local inhabitants because of the attacks to penned cattle near forest areas. At these sites the communities frequently complain that the government does not carry out effective

conservation actions, because these are reduced to legal protection systems and there is no way of compensating the impact of the bear on the local economy. This situation exacts the development of alternatives that facilitate an approximation to the species, with the perspective of “improving” man-bear relationships. This should include mechanisms such as the purchase of lands to establish regional areas of protection, compensation schemes for damages caused by bears, and/or conservation incentives.

At several sites where the levels of interaction with the species are high, the need to remove problematic animals and relocate them in other forest areas or ex situ collections has been expressed. This proposal, however, has been highly questioned and there are no sustained proposals that support or disqualify it completely. The Ministry of the Environment recently began to coordinate a consensus-building process among the authorities of the Environmental National System to propose and prepare an Action Plan for Colombia. A first draft is already available and will be submitted to those entities responsible for natural resource management in rural areas for discussion.

Needs for environmental education

Although the 1999 plan described a number of actions in environmental education that had been carried out until then, these showed little coherence among themselves, evidencing the lack of a unified proposal in this regard. Contradictions have arisen between environmental authorities and communities when the former do not have the technical expertise to solve conflictive situations and have stated, for example, that the spectacled bear does not attack livestock.

At present, many national NGOs have continued with informative campaigns and the regional autonomous corporations and other conservation entities are carrying out campaigns aimed at increasing public awareness about the conservation needs of the spectacled bear granting it ample space in conservationist discussions.

Current status of research in Colombia

In November 2001, the Ministry of the Environment, the regional autonomous corporations of Corpochivor, CAR, Corpoquavio, and Corpoboyacá, the Andrés Bello agreement (CAB), WWF, and the Wii Foundation for Research, Conservation, and Protection of the Spectacled Bear sponsored a seminar to bring together the technical and conceptual elements necessary for designing the “National Program for the Conservation and Recovery of the Spectacled Bear in Colombia”. The seminar gathered numerous actors, allowing the priority actions for the initial three years of the program to be defined.

The expert knowledge about the spectacled bear in the country is the result of specific studies carried out on the distribution of the species. These studies have also identified, in general terms, the challenges for its conservation (Rodríguez *et al.*, 2002). Quick surveys have been carried out on the status of the bear populations in six national parks as well as on the management of bears in captivity on at least



three private reserves. Other studies have focused on genetic aspects (Ruiz-García, 2002), dietary habits (Bolaños, 2001), and management of bears in captivity and human-bear interactions (Goldstein *et al.*, 2002).

The location of population nuclei on the internal flanks of the cordilleras is still pending as well as the location of dispersion corridors for the species and their current status. A general reconnaissance of the distribution and status of the spectacled bear is indispensable.

ECUADOR

The bear population in Ecuador shows fragmentation values similar to those of Colombia and lower than those of Venezuela. A total of 24 nuclei inhabited by the spectacled bear have been identified in this country, occupying a combined extension of 5,788,426 hectares. As Suárez (1999) pointed out in the IUCN Action Plan, human activities have been concentrated in the inter-Andean valleys, separating the bear populations of the western and eastern cordilleras.

Status of population

The main bear populations in Ecuador are located in those areas shared with Colombia and Peru, although large habitat patches are also found on the western flank of the eastern cordillera. The presence of spectacled bears in the Condor mountain range has been recently reported. This area was the issue of conflict with Peru and just recently studies are being conducted to determine its wealth of biodiversity.

Threats to the population and interactions with humans

The principal threats for the survival of the spectacled bear in Ecuador, just as in Venezuela and Colombia and mentioned in the IUCN Action Plan, are the loss of habitat due to the expanding agricultural frontier and to hunting, mainly in response to bear attacks to maize crops. Although bears also attack livestock, in Ecuador the intensity of attacks is not as high as in Colombia or Venezuela.

The IUCN Action Plan states that between 70 and 120 bears die each year in Ecuador, without counting cubs. Although this figure could be overestimated and no data is available on the level of extraction of specimens from natural populations, the pressure exerted by hunting is undoubtedly a major threat for the survival of the spectacled bear in the country.

Loss of habitat

Oil exploitation in Ecuador has facilitated the opening of penetration roads into the Amazon region, fragmenting large extensions of continuous forest that constitute the spectacled bear's habitat. As in other Andean countries, one of the first phases of colonization of forest areas involves the planting of maize. Bears venture into the

small farms where they find an easy-to-obtain food because of crop management practices, causing a defensive reaction in farmers who then hunt them down. The conversion rate of forest into maize fields has increased in southern and eastern Ecuador where the largest bear populations are found. A situation similar to that of Venezuela and Colombia also occurs: the opening of pasture areas for extensive livestock grazing affects the páramo areas and increases the interaction of bears with humans.

Management

Bear management actions in Ecuador focus on protected areas where the species is present, but just as in Colombia and Venezuela, the strengthening of these actions in unprotected areas where human-bear conflicts occur faces many drawbacks.

Recently two important efforts were made to reintroduce confiscated bears that had been rehabilitated into the biological reserves of Maquipucuna and Cotacachi-Cayapas. Although these trials proved unsuccessful, both yielded important information on the problems involved in the reintroduction of specimens to the environment after having been handled by humans, demonstrating the need to develop adequate monitoring strategies for animals submitted to this procedure.

The participation of local communities in this type of project has been fundamental to their success and constitutes the starting point for developing proposals of translocation or reintroduction of rehabilitated specimens.

Needs for environmental education

The proposals to reintroduce bears in Ecuador highlight the need for coherent overarching proposals of environmental education. It is important to have the support of the communities affected by the research proposals to conserve the spectacled bear. Similarly, local communities should be involved in research projects related to bear habitats, as was the case of the project carried out by EcoCiencia on the Cayambe-Coca Ecological Reserve and the Sangay National Park. Community support may prove to be one of the most important factors to ensure successful conservation of the spectacled bear in Latin America.

All the information gathered in participatory research processes carried out with the spectacled bear should be compiled to establish specific and common elements that allow the linking of coherent and applicable processes in other conservation scenarios of the species.

Current status of research in Ecuador

Current studies on the spectacled bear in Ecuador involve three important fronts: research on environmental requirements (Cuesta *et al.*, 2000), proposals of reintroduction (Castellanos, 2000), and management and research of bear populations maintained in captivity which have yielded important data on the biological and veterinary characteristics of the species (Aryan *et al.*, 2001)



In all cases, major advances have been made regarding the IUCN Action Plan. Research proposals have been prepared to study bear dietary habits (Troya, 2002) and conduct genetic analyses of wild populations (Viteri, 2002), and important information has been compiled on the problems involved in the reintroduction of the species. Advances have been made in the techniques of how to manage bears in captivity and important comparative parameters have been obtained regarding haematological values for bears, both in captivity and in the wild.

The proposal of monitoring using telemetry and the techniques for capturing wild bears highlight current shortcomings and stress the need to establish protocols and techniques harmonized with research objectives. Two juvenile females are being monitored by conventional telemetry and pertinent data have proved important for presenting new conservation proposals such as the establishment of corridors of dispersion or connectivity between bear habitat patches (Castellanos, pers. comm.). These data should be combined with the information previously compiled in the monitoring of six reintroduced specimens.

PERU

In Peru, the spectacled bear is distributed throughout the small portion of the NAEC in the country, and extends southward into neighboring Bolivia and northern Argentina. Bear populations in the ecoregional complex correspond to four segments that occupy 1,737,552 hectares to the north of the Huancabamba depression. Population estimates are not available for bears in this region and relatively little is known about the species (Peyton, 1999). The IUCN Action Plan estimates that the total bear population in Peru could be close to 6,000 individuals, although this figure should be considered with caution based on the comments previously made for other NAEC countries.

Genetic studies that could yield a population estimate for Peru are not available, especially for the target populations of this document. Peru is, however, a country with large areas occupied by bears where human pressure is not as strong as in Colombia, Venezuela, and Ecuador.

Bear populations of northern Peru are shared with Ecuador and bear habitats in the Amazon region are presumably in good shape, although recent reports indicate that the pressure being exerted by hunters has been high (Figueroa, pers. comm.). The increase of human settlements in these regions, together with the impact of the roads being built to open the region to oil exploitation and the development of hydroelectric megaprojects, will ultimately result in the fragmentation of existing bear habitats.

Status of the population

The status of bear populations corresponding to this segment of the Peruvian mountain range is unknown. Population assessments are currently being carried out in the department of Piura. Up-to-date data are not available and the only

information available is that contributed by Peyton for the IUCN Action Plan, which simply mentions the existence of the spectacled bear in the national parks of the region.

Threats to the population and interactions with humans

Due to the lack of knowledge regarding bear populations, it is difficult to define the real threats to these populations in the region. However, it is known that bears are extracted from the forest to market their parts, which are used in traditional medicine practices. Farmers also hunt down bears in response to attacks to maize fields. Records of attacks to livestock are not available.

Loss of habitat

Same as above—there is no recent information on loss of habitat for Peru’s Northern Andes. However, the opening of new fronts of colonization to the country’s Amazon region and the expansion of the agricultural frontier are causing the fragmentation of spectacled bear’s habitat in the region.

Management

Peru has a conservation program for the spectacled bear, which is coordinated by the National Institute of Renewable Resources (INRENA, its Spanish acronym) together with private and state institutions. As part of the program, the populations of the spectacled bear are being studied to establish biological corridors.

A spectacled bear management program is also being implemented in the ‘Chaparrí’ Private Conservation Area (ACP, its Spanish acronym), aimed at the conservation of the populations and habitats of the species. Rural communities endorse these conservation efforts, and corridors will be established between the ‘Chaparrí’ ACP, the Laquipampa Reservation, and the Pomac Historical Sanctuary to connect these areas and the NAEC. A model management scheme will be implemented and in situ conservation actions will be complemented with the management of spectacled bears.

Other key components to ensure the success of this initiative are the strengthening of local participation in wildlife management, education, and public awareness.

Needs for environmental education

Several interesting proposals of environmental education have been carried out in Peru. However, these efforts have been isolated and have attempted to cover the greatest number possible of bear-occupied sites, but have lacked the necessary institutional support to have national coverage (Figuerola, 2001; Stuchi, 2001). The coordination between private initiatives and INRENA must be improved to ensure the development of a conservation program for the spectacled bear that includes environmental education as one of its lines of work.



It is also important to join efforts with the 'Chaparrí' ecological reserve (Peyton, pers. comm.) to strengthen the work with communities and official entities that could help develop this line of work.

Current status of research in Peru

The status of knowledge about bear populations in the Peruvian part of the Northern Andes is incipient. In the 1970s and 1980s some research was carried out in Peru on the spectacled bear, but recently the advances have been few. A short time ago field research was reinitiated in protected areas, which in Peru only cover 7% of the area accessible to the spectacled bear (IUCN, 1999), as well as in the forests in the province of Ayabaca, department of Piura, located within the NAEC.

Several visits made to protected areas of the Huancabamba region, including areas close to the national parks located in the region, indicated that the spectacled bear could be occupying parts of the Amazon jungle (Figuroa, pers. comm.), of which no records exist to date. This information, however, must be verified to confer new guidelines for the designing of a conservation policy for the species.

In Peru, genetic studies on the species are not being conducted and, as a result, information similar to that available for Venezuela, Colombia, and Ecuador is not available. Just recently has the development of molecular techniques for application to the laboratory research conducted on the spectacled bear been posed. This research could be supported by international collaborative efforts, with the understanding that the shipping of samples to other countries for analysis would be subject to the Common Regimen on Access to Genetic Resources and to national legislation. In the cases of scientific research, access is facilitated through collaborative framework agreements.



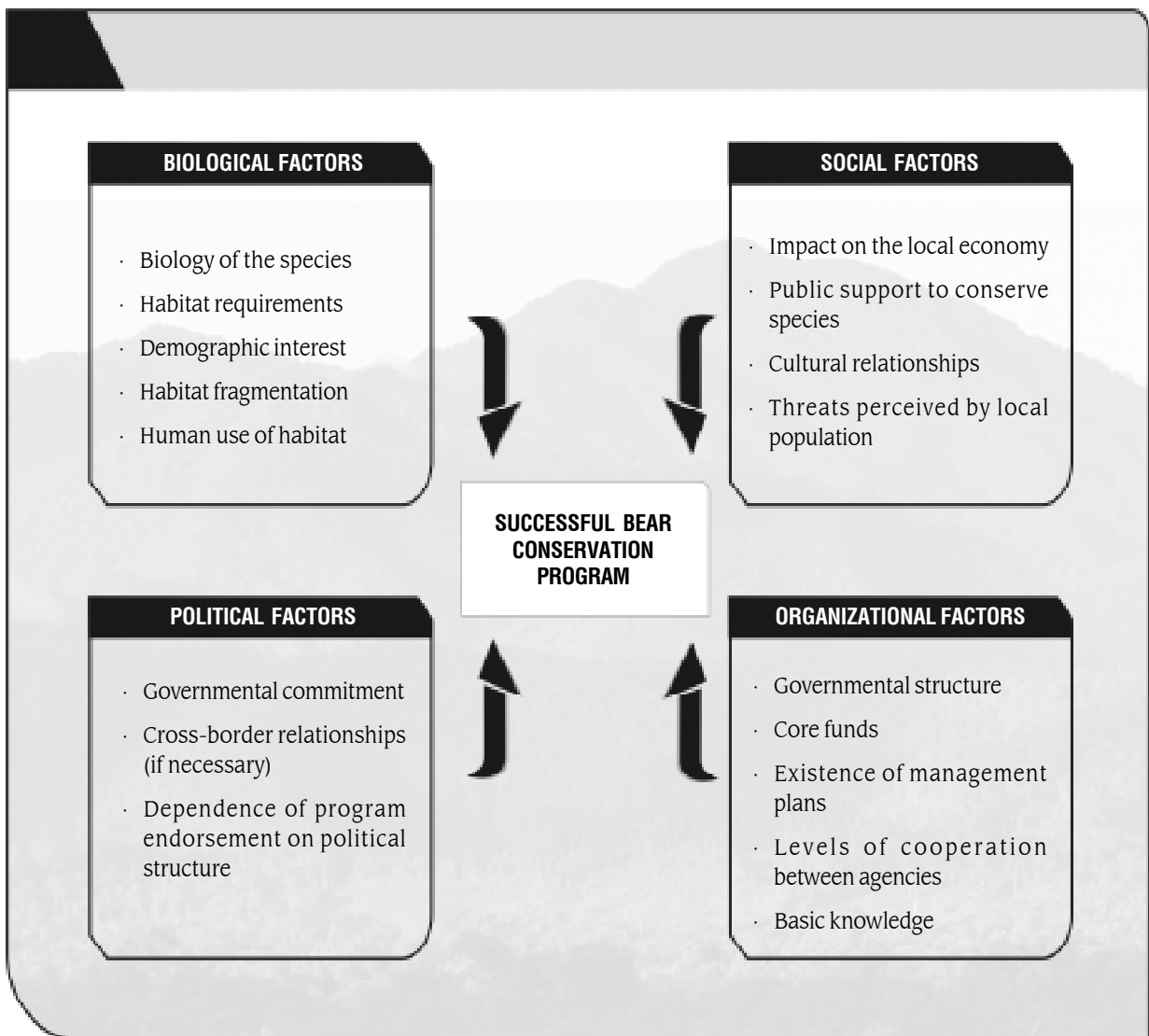


Ecoregional Strategy for the Conservation of the Spectacled Bear in the Northern Andes

Context

The action plan for the conservation of the world's bear species, prepared by IUCN (Servheen *et al.*, 1999), considers that it is essential to study the four principals factors (Figure 2). Although these factors have the same level of importance, elements should be modified depending on the situation of each country or region where the plan is to be implemented. Taking into account this recommendation and considering the environmental, social, political, and economic complexity of the NAEC, the development of the conservation strategy for the spectacled bear should begin with an analysis of national priorities for each of these factors. In addition, social and political factors should be analyzed within the local, national, and international context to effectively respond to contemporary

Figure 2.
Key factors for developing a bear
conservation plan, according to the IUCN



sociopolitical peculiarities of the Northern Andes. In particular, the feasibility of carrying out actions in cross-border areas should be evaluated, allowing interinstitutional cooperation between neighboring countries.

Likewise, the organizational structure of the different countries should be taken into account, which in all cases will involve diverse actors with decision-making capacity. Each country should prepare and implement, as soon as possible, its own action plan that should harmonize with what was proposed by IUCN in 1999 as well as with the Northern Andes Ecoregional Strategy, within the framework of international biodiversity agreements, among others.

General objective of the Strategy

The Ecoregional Strategy for the Conservation of the Spectacled Bear aims to establish general guidelines at the local, national, and international levels, as well as execution mechanisms and priority actions for the next 15 years, that will guarantee the protection of the spectacled bear in the NAEC, increase the knowledge and improve public awareness about the species.

To achieve this objective, the actors involved in this strategy will promote and facilitate actions geared toward guaranteeing the protection, management, and recovery of the species and the long-term maintenance of viable populations. Actions will be designed and executed taking into account that the spectacled bear is a vulnerable species at the ecoregional level, listed in Appendix I of the CITES, and following several principles set forth in the Cartagena Agreement, the Convention on Biological Diversity, the IUCN Action Plan, and the environmental legislations of different countries.

Strategic principles

This strategy takes into account the situation of the different countries and the precedent that a regional biodiversity strategy exists, signed by the countries of the Andean community, in which endangered species (including the spectacled bear) are considered of common interest. The proposed strategy is based on the following principles:

1. The importance given to ecosystems, their integrity, and the relationship with the spectacled bear by human communities.
2. The active participation of local communities in the conservation, understanding, and protection of the species through different organizational mechanisms. The lines of action formulated should take into consideration the knowledge, appropriation, and consolidation of rights of all inhabitants and, particularly, the territorial rights of ethnic groups.
3. The sustainable use of ecosystems inhabited by the spectacled bear implies the maintenance of the integrality and rational use of its resources, which, in turn, ensures a stable quantity and quality of ecosystem goods and services

so that the present and future generations can use them to improve the well-being of local communities.

4. The habitats and ecosystems necessary for ensuring healthy, viable bear populations should be preserved. The ecosystems used by communities should be managed without causing damage to the species and the environmental services from which different human activities derive. These ecosystems should be protected from indiscriminate destruction to prevent not only the disappearance of the spectacled bear but also the degradation and loss of soils and the deterioration of water regulation processes, with the subsequent loss in water volume and the possible occurrence of natural disasters.
5. The reduction of the gene flow and of populations of spectacled bears caused by hunting and by habitat fragmentation and loss should be counteracted by actions directed toward its primary causes.
6. The generation of knowledge about the ecology and biology of the spectacled bear and about the social, economic, and cultural variables that affect this species should be strengthened using all possible resources, including international cooperation mechanisms.

Vision of the Ecoregional Strategy for the Spectacled Bear

The populations of spectacled bear and their habitats in South America will be healthy and the long-term survival of the species will be ensured by 2017. The different actors will have developed strategies, understanding, and sustainable management practices associated with the species and its habitat, improving the relationship of society with nature and facilitating a fair and equitable access to the environmental services and goods derived from the conservation of the bear and its habitats.

Strategic definition of the conservation of the spectacled bear in the NAEC

The conservation strategy for the spectacled bear in the NAEC addresses four overarching goals: (1) the reduction of the rate of loss of habitat to guarantee a minimum percentage of interior area; (2) the increase of the connectivity between populations and blocks of habitat; (3) the reduction of the mortality of bears induced by human conflicts; and (4) the articulation of ex situ conservation programs with populations of wild bears.

The achievement of these ambitious goals depends on the execution of numerous actions identified at the different meetings held to prepare this strategy and approved by consensus at the Decision-makers' Workshop held in Villa de Leyva in November 2002. These actions can be grouped into five categories that correspond to the lines of action of the strategy.



Defining the lines of action

The five lines of action proposed herein are the result of an analysis of the outcome of the meetings held to address this issue and were approved, by consensus, by the participants of the Villa de Leyva workshop.

The activities proposed for each line of action are prioritized for the short, medium, and long term. No timeframe is established because this will vary depending on the country and on administrative dynamics, and not necessarily on the biological importance of the species or on the activities planned.

The execution of these lines of action and their components will exact different types of collaborative agreements depending on former work conducted on the conservation of the spectacled bear, the institutional goals of participating organizations, and the role played by the different actors in their respective areas. Although most research activities can be designed by scientists and technicians in each country in accordance with national priorities, greater coordination and exchange among the different research organizations are desirable. Likewise, activities related to policies and management tools, as well as ex situ conservation, should be carried out by skilled staff capable of handling the comprehensive problems involved in the conservation of species.

For example, in the case of bear hunting by farmers to protect their means of subsistence, proposals related to sustainable livestock or crop management that address the dynamics of each country are needed. Also, to reduce the effects of population fragmentation, habitat management proposals must address binational development in some cases. All these actions require that policy-making instruments be designed by responsible state entities in association with NGOs and grassroots organizations, and that monitoring mechanisms be strengthened to allow an ongoing evaluation of results.

If the actions carried out to ensure the conservation of the spectacled bear in the ecoregion are to be effective, these should have a component that involves different actors and ensures citizen participation. Efficient communication mechanisms should be developed at all levels of participation, as well as environmental education and research processes at different fronts. The strategic lines of environmental education and research and monitoring, in addition to involving their own activities, should be cross-referenced to the advances of the other three lines of the Ecoregional Strategy.

Lines of action

Line 1 Landscape conservation and management

Objective

To reduce the loss and degradation of habitats, while maintaining the appropriate size and quality of current areas or blocks of Andean forests and paramos, ensuring viable populations of the spectacled bear in the long term.

Considerations

The existence of national protected areas as well as protected areas of the civil society makes it possible to maintain existing blocks of bear habitat and contribute to other official conservation processes and organizations, such as Colombia's National Environmental System (SINA, its Spanish acronym), Venezuela's Ministry of the Environment and Natural Resources (MARN, its Spanish acronym), Ecuador's Ministry of the Environment (MAE, its Spanish acronym), and Peru's National Institute of Natural Resources (INRENA, its Spanish acronym). These governmental entities can formulate policies that strengthen and enforce efforts directed towards the conservation of the spectacled bear, as well as lobby the defense of ecosystems inhabited by the species in the international scenario. Other citizen organizations, such as Green Councils, the Network of Reserves of the Civil Society, and Private Protected Rural Areas, as is the case of the 'Chaparrí' ecological reserve in Peru, involve rural communities directly in the management of wilderness spaces inhabited by bears.

Large patches of potential bear habitat still exist. Therefore, new protected areas can be established in all four countries, as well as binationally between Colombia-Ecuador, Colombia-Venezuela, and Ecuador-Peru. These patches are associated with other wilderness areas below 500 m in elevation and could eventually contribute to the connectivity between patches at that altitude. Several ongoing programs and projects in the NAEC could include the spectacled bear in their agendas. The dry forest initiative in Peru, the design and implementation of a conservation corridor on the Cotacachi Cayapas-Awa-El Angel Reserve in northwestern Ecuador, and the activities funded by the GEF-Andes project well illustrate this potential.

Line 2 Management policies and tools

Objective

To promote the standardization of the protection and sustainable management of habitats and natural resources in ecosystems inhabited by the spectacled bear.



Considerations

Despite the broad standardization of protection and management practices, adjustments and updates are necessary to adequately respond to the dynamics of anthropogenic intervention. In some cases, the standards existing in different countries related to high mountain and páramo ecosystems, particularly those involving endangered species, have been recently issued and therefore are little known and have possibly not been enforced or are facing difficulties in their application. As a result, it is urgent to examine such standardization throughout the distribution area of the spectacled bear, especially in the case of forest reserves, protection of páramos, land management, and establishment of civil society nature reserves.

This strategic line should also facilitate the generation of spaces of interinstitutional and sectorial articulation so global territorial processes that harmonize with environmental management processes can be jointly proposed and planned. By initiating these processes at the territorial and farm levels, where the communities themselves are the promoters, conservation objectives are appropriated by the communities. Local, regional, and national environmental authorities should also promote territorial zoning to protect remaining wilderness areas and/or expand protected areas, as well as the establishment of biological corridors between existing protected areas.

The design of new national and supranational strategies that respond to the biological and ecological needs of the spectacled bear will strengthen public awareness about the need to conserve the species and its habitats. In addition, prevailing conditions favor the signing of strategic alliances between governmental and nongovernmental institutions to prepare research proposals and conservation plans for the species, as was the case of Venezuela's National Biodiversity Strategy and the initial consensus-building process for Colombia's Management and Conservation Plan for the Spectacled Bear. Both illustrate collaborative work between governmental entities responsible for policy-making and NGOs with the technical capacity to execute these policies.

Line 3 Conservation and management of specimens and *ex situ* populations

Objective

To ensure the viability of populations in captivity and genetically improve wild bear populations in small, highly fragmented, and altered habitats with animals born in captivity.

Considerations

This document defines *ex situ* conservation as the series of actions oriented toward the conservation of a given animal species, when these are carried out with

animals or groups of animals outside their natural habitat. Because the priority for the conservation of the spectacled bear should be the restitution and protection of its natural habitats, *ex situ* conservation is a tool to protect highly endangered individuals because of the conditions of their original habitat.

In 1991, the IUCN made a call to combine *in situ* and *ex situ* conservation to maintain sources of genes and species, and invited zoos worldwide to enforce a conservation strategy that adequately maintained animal populations *ex situ*⁵. This organization has reiteratively emphasized the importance of the role played by *ex situ* facilities in the reintroduction, restoration, and rehabilitation of habitats and in the reestablishment of species naturally extinct in the wild.

The Convention on Biological Diversity, published in 1992, establishes in its Article 9 that, with a view to complement *in situ* measures, each contracting party shall: (a) adopt measures for *ex situ* conservation; (b) establish and maintain facilities for *ex situ* conservation of and research on plants, animals, and microorganisms; (c) adopt measures for the recovery and rehabilitation of threatened species and for their reintroduction; (d) regulate and manage collection of biological resources from natural habitats for *ex situ* conservation purposes; and (e) cooperate in providing financial and other support for *ex situ* conservation.

Although in the case of the spectacled bear it is still unnecessary to establish conservation programs based on individuals kept in captivity, the understanding and management of bear populations in zoos should indeed be strengthened so new animals can be obtained when it is considered pertinent to carry out programs of resettlement, reintroduction, or strengthening of relict populations in areas of ancestral distribution of the species.

Although zoos are considered as centers of *ex situ* conservation par excellence, herein we also include rehabilitation and release centers. A rehabilitation center is a veterinary hospital where animals are received for individual clinical assessment and treatment of diseases and physiological disorders or behavioral problems. Release centers are places where the animals are placed to help them adapt to the natural environment before they are returned to their habitat of origin. The main difference between these two types of centers and zoos is that in the latter animals are shown to the public for educational and research purposes. Rehabilitation and release centers may form part of zoos because many own facilities that fulfill the functions of the first two. Breeding facilities are not included in this document because these mainly operate for commercial purposes and have never proposed an *ex situ* conservation strategy for the spectacled bear.

Ex situ conservation serves to support *in situ* conservation plans by offering animals born in captivity as a source of genetic renewal in very small populations and by providing shelter to individuals taken from wild environments that were severely threatened by fragmentation, destruction, hunting, or any other situation. Animals entering into conflict with humans can be captured, clinically and genetically assessed, and then either released in safer, nearby areas or integrated into breeding programs in captivity (breeding stock) and their cubs released in safer areas. Likewise,

Notas

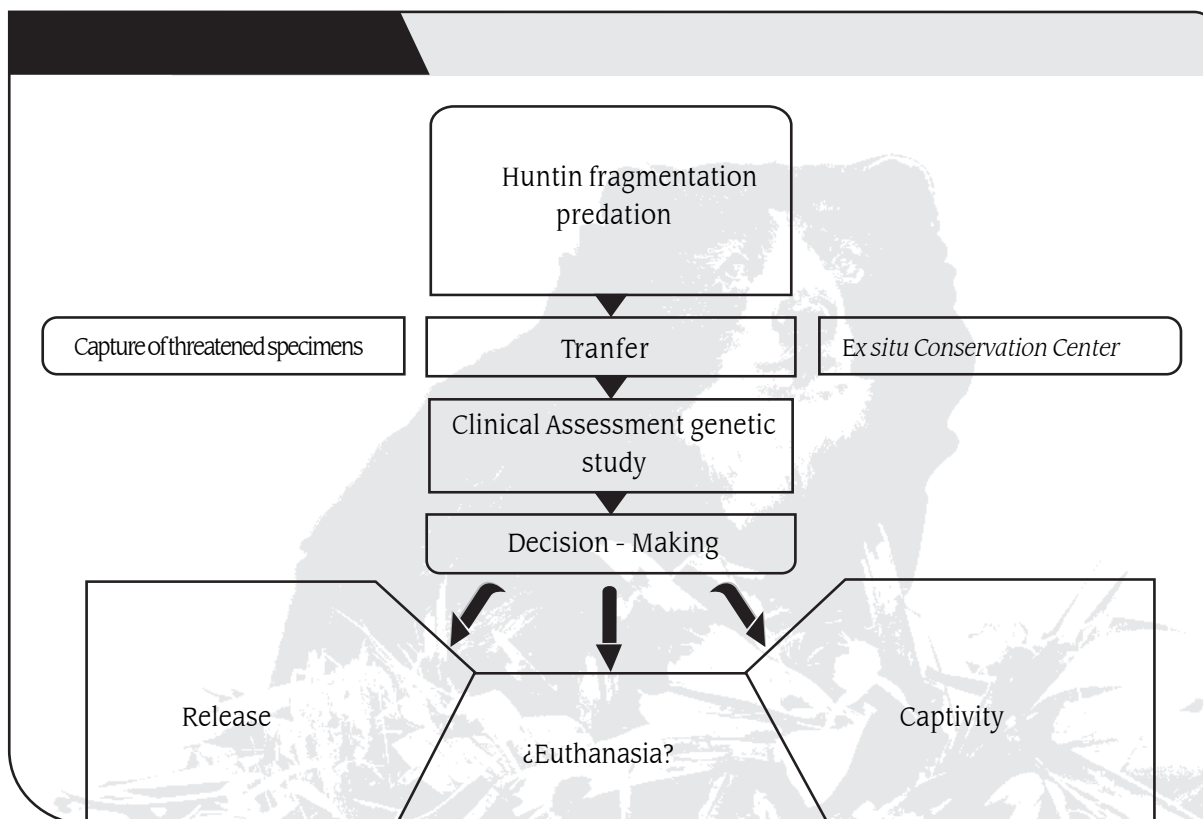
5. IUDZG & CBSG – IUCN / SSC, 1993, UICN, 1991.



very reduced populations that fall victim of natural catastrophes can be captured and placed in captivity on a good reserve and then used to reinforce degraded populations. Figure 3 summarizes the actions involved in the line of ex situ conservation that contribute to the conservation of the spectacled bear in the NAEC.

Figura 3.

Actions involved in the line of ex situ conservation



Line 4 Research and monitoring

Objective

To increase the information pertinent to the conservation of the spectacled bear and develop schemes to monitor the execution of specific actions of the strategy.

Considerations

Despite the increasing number of researchers studying the biology of the spectacled bear, there is still not enough knowledge available to guarantee the conservation of the species in the NAEC. Fundamental aspects, such as the real size of the populations of spectacled bear in what remains of their habitats throughout

the NAEC and the minimum requirements of area to maintain a viable population—which are determined on the basis of primary information—have not been established so far.

Therefore it is fundamental to strengthen the research on the biology of the spectacled bear, linked to the conservation measures proposed for the NAEC. Taking into account the increasing scientific competence in the four countries of this ecoregional complex, a medium-to-long term financial plan would allow new technologies, for example remote sensors, satellite telemetry, and molecular tools, to be used in research; monitoring plans could also be tailored to specific information needs about the species.

Research is facilitated by the proximity and relative accessibility of target wilderness areas, another indicator of the vast deterioration of bear habitats. This offers an opportunity to involve student organizations in research to provide support in scientific and academic issues, thus strengthening the research capacities in different disciplines regarding the spectacled bear.

Also, the proximity of human settlements to blocks of natural vegetation occupied by bears evidences the need to involve local actors in the development of production systems compatible with the conservation of the species. The growing interest of local communities to participate in decision-making processes regarding territorial ordinance and management opens an opportunity for research within the framework of this strategy. The establishment of participatory research models that incorporate local communities into all bear-related research projects is crucial for the effective implementation of the conservation strategy of the species at the ecoregional level.

Furthermore, the bear specimens maintained in ex situ collections have a practically unexplored research potential that could shed light on certain unknown issues, such as different physiological aspects of the species and its minimum nutritional requirements. Many of the animals captive in Latin America are of wild origin, which could make the work of biologists studying in situ populations of the species more comparable and measurable.

All these conditions favor research and offer the possibility of establishing appropriate monitoring programs to evaluate the strategy in the future. Once key information gaps are filled about the acceptable interior area size of a bear habitat patch, viable minimum populations, and levels of connectivity necessary for the maintenance of both individual and gene flow, trustworthy achievement indicators will be available for the goals proposed in this strategy.

Line 5 **Education and communication**

Objective

To establish environmental education programs oriented toward offering new opportunities of participation and to increase the awareness of different actors in



the conservation of the spectacled bear, promoting conceptual capacity building for appropriate decision-making regarding land zoning and management, especially in those areas considered important as potential and/or real habitats of the species.

Considerations

For the different activities planned within this strategy to have the anticipated success, it is indispensable that they be conceived, from the beginning, as a work of communication and continuing education where the sharing of experiences, knowledge, and learnings between all actors and the general public guide the conservation of the spectacled bear and its habitats.

The understanding of the importance and value to conserve and manage high mountain ecosystems and the habitats occupied by the spectacled bear in a sustainable manner is only possible if the different actors are aware of the comprehensive relationship existing between the presence of the species and the benefits derived in terms of environmental services and goods used for its well-being and that of the future generations.

For this reason, it is necessary to prepare spaces and develop participatory tools that guarantee community intervention in the preparation of plans and in the development of activities related to the protection, conservation, management, and study of the spectacled bear and associated ecosystems. The development of this line should recover traditional practices and knowledge on the environment, so that these are linked to the guidelines of community environmental education and formal education implemented by the entities responsible for natural resource management, also seeking to involve children and young people in the assessment of the Andean ecosystems.

To ensure effective education and communication processes, these should be permanent and accompany all research, management, and policy-making processes so key actors are aware of the importance of the initiatives carried out.



IV

Strategy's logical framework

GOAL 1

To reduce the rate of habitat loss to guarantee a minimum percentage of inside area

- Problems encountered:

Expansion of the agricultural frontier, loss of quality of habitat, impact of development of large infrastructure projects.

- Expected impact:

Reduced expansion of agricultural frontier, reduction of habitat loss and degradation, fewer environmental problems as a result of development of infrastructure projects, increased protection of areas inhabited by bears and better representation of pertinent ecosystems, areas identified for expansion of protection and restoration units.

Landscape conservation and management				
Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Promotion and strengthening of effective management practices in protected areas important for the spectacled bear.	Establishment of new protected areas and expansion of existing areas in sectors considered of high value for bears.	Implementation of habitat restoration projects in areas inhabited by bears.	1	<ul style="list-style-type: none"> • % reduction of the rate of habitat loss per country in the ecoregion. • % area expanded in existing protected areas.
Identification and implementation of sustainable agricultural production projects aimed to reduce habitat loss, fragmentation and disturbance of spectacled bear habitats, using a participatory approach that involves indigenous and farmer communities		Promotion and strengthening of land zoning plans using the spectacled bear as an important element of the landscape.	3 and 4	<ul style="list-style-type: none"> • Number and size of protected areas established. • Number of projects established and coverage (area) restored.
Assessment of the impact of infrastructure projects on the species and its habitats.	Enforcement of restoration measures or mitigation of the negative impact of infrastructure projects.	Incorporation of feasibility studies of new projects into land zoning plans.	5	<ul style="list-style-type: none"> • Number of projects carried out on sustainable agricultural practices per country. • Number of infrastructure-related projects that incorporate restoration/mitigation actions.

Policies and management tools

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Designin policies and legal and economic instruments that promote the conservation of the spectacled bear and its habitat, using a participatory approach.	Formulation of policies on economic incentives for communities maintaining remaining areas of habitat that are currently unprotected		Depends on the area	<ul style="list-style-type: none"> • Number of land zoning plans concerted that consider the spectacled bear as an important species.
Promotion of the establishment of protected areas in all their management modalities.	Formulation of policies on the assessment of environmental services and execution of management mechanisms.		1, 3 and 5	<ul style="list-style-type: none"> • Number and extension of new protected areas.
Strengthening of the technical, operational, and managerial capabilities of institutions responsible for managing areas inhabited by the spectacled bear.			All	<ul style="list-style-type: none"> • Increase in the number of successful actions carried out by the institutions. • Reduction in the number of conflicts between bears and humans. • Reduction of the rate of loss and fragmentation of bear habitats.
Participatory design and execution of management plans concerted with the communities located in areas adjacent to protected areas.			1, 2 and 3	<ul style="list-style-type: none"> • Number of management plans prepared.
Strengthening of the organizational and institutional capacity of local communities associated with priority areas for the conservation of the species.	Inclusion of conservation criteria in the development plans of sectional agencies in the priority areas defined per country.		Pending definition, depends on institutional priorities	<ul style="list-style-type: none"> • Increase in the number of institutional processes executed. • Increase in the actions oriented toward the conservation and management of populations of the spectacled bear and its habitats. • Greater resource management capacity in grassroots organizations working in areas considered priority for the spectacled bear. • Number of development plans that consider the spectacled bear as focal species.
Improvement of programs to substitute illegal crops, especially in the Andean area.			3	<ul style="list-style-type: none"> • % substitution of illegal crops in the Andean area. • Reduction in the area planted to illegal crops in the NAEC.

Policies and management tools (continue)

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Strengthening of control mechanisms regarding the granting of environmental licenses.			1 and 3	<ul style="list-style-type: none"> Number of environmental licenses that take into consideration the reduction of the negative impact on wild bear populations.

Ex situ conservation and management of specimens and populations

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Studies on diet quality and animal physiology.	Studies on habitat quality, based on nutritional studies.		1 and 5	<ul style="list-style-type: none"> Protocol of minimum requirements for successful rehabilitation of bears in captivity.

Research and monitoring

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Definition of priority areas (classes 1 and 4) where long-term research and monitoring programs of wild bear populations should be established.	Evaluation of habitat areas of the spectacled bear that are susceptible to be included within a protection regime.		1, 3 and 5	<ul style="list-style-type: none"> Number of areas identified that have research and monitoring projects in place.
Determination of the rate of loss of area and habitat quality in protected areas and other priority habitat blocks.	Time series analysis of changes in vegetation cover and land use, and development of predictive scenarios.		1 and 3	<ul style="list-style-type: none"> Rate of variation of the size of habitat areas and of habitat quality estimated
Determination of home range size and habitat use patterns for the spectacled bear (dispersal patterns and seasonal habitat use of radio-tagged animals).	Evaluation of the use of agricultural production systems by the spectacled bear and incidence of conflicts with human activities.		1, 3 and 5	<ul style="list-style-type: none"> Minimum area requirements for a viable bear population determined. Size and type of production systems used by individual bears identified. Critical thresholds of occurrence of conflicts between wild bears and humans determined.

Research and monitoring (continue)

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Determination of the distribution and population size in priority areas.	Time series analysis of bear population size and threats in priority areas.	Assessments of the impact of habitat fragmentation on bear population size and on gene flow	1, 3 and 5	<ul style="list-style-type: none"> • Population trends in established priority areas are known. • Critical fragmentation thresholds determined. • Number of areas evaluated to be included in a protection regime.

Education and communication

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Design and execution of coordinated environmental education and conservation strategies for urban development projects.	Development of technology extension programs for sustainable resource management.		4, 3 and 1	<ul style="list-style-type: none"> • Number of projects designed and executed.
Design and implementation of educational projects in aspects of sustainable natural resource management and territorial planning, compatible with conservation objectives.			4, 2 and 3	<ul style="list-style-type: none"> • Number of extension programs working with sustainable technologies
Participation of local organizations and communities located in areas inhabited by the spectacled bear in the execution of the strategy.			4, 2 and 3	<ul style="list-style-type: none"> • Number of local organizations participating in the strategy.
Inclusion of a subject on bear conservation and management in the curriculum of schools located in areas inhabited by the species.			4, 3 and 1	<ul style="list-style-type: none"> • Number of educational institutions that include programs and projects related to the conservation and management of the spectacled bear in their curricula.
Dissemination of information on the importance of conserving bear habitats through the different existing communication media.			1, 3 and 5	<ul style="list-style-type: none"> • Number of communication campaigns carried out. • aware of the problems of conservation of the spectacled bear.

GOAL 2

To increase the connectivity between spectacled bear populations and habitat blocks

- Problems encountered:

Habitat fragmentation, isolation of populations.

- Expected impact:

Connection of the habitat blocks inhabited by the species.

Landscape conservation and management

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Analysis of the feasibility of including potential bear habitats when biological corridors are being defined.			4 and 3	<ul style="list-style-type: none"> • Number of bear habitat fragments that are connected. • Number of bear populations connected.
Definition of priority areas strategic for the restoration of ecosystems and the recovery of corridors.	Establishment of dispersal corridors between priority spectacled bear populations.	Development and application of habitat restoration models and techniques to increase the connectivity between fragmented and isolated patches.	4	<ul style="list-style-type: none"> • Area of restored habitat.

Policies and management tools

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Coordination of land zoning plans from the perspective of establishing and protecting dispersion corridors.	Establishment and strengthening of inter-institutional agreements for the creation of bi-national protected areas.		4 and 3	<ul style="list-style-type: none"> • Number of land zoning plans that include dispersal corridors. • Number of proposals involving the expansion of protected areas for interconnection.
Strengthening of the operational and managerial capacities of governmental and non-governmental institutions in the conservation and management of fragmented ecosystems.	Designing of the expansion of protected areas from the viewpoint of the connectivity between patches.		4	<ul style="list-style-type: none"> • Increase in the number of inter-institutional agreements in place.

Policies and management tools (continue)

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Development of mechanisms to maintain dispersal corridors that have previously been agreed upon with the			4 and 3	<ul style="list-style-type: none"> • Bi-national agreements being enforced within the framework of the Andean community and the regional biodiversity strategy. Number of mechanisms agreed upon with the community regarding the maintenance of dispersal corridors.

Ex situ conservation and management of specimens and populations

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Development and implementation of a breeding program for captive animals to increase genetic variability.	Development and implementation of proposals to exchange zoo specimens.	Implementation of genetic improvement programs in weakened populations.	Will originally come from 4 to be introduced into the closest patches 5, 3, 2, and 1	<ul style="list-style-type: none"> • Number of bears born under the inter-zoo breeding scheme. • Number of exchange proposals executed. • Number of proposals of genetic improvement implemented

Research and Monitoring

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Determination of the distribution and size of bear populations, sex ratios, and gene variability in priority areas.	Genetic characterization of the different populations, with special attention to more fragmented areas.	Time series analyses of natural vegetation cover.	1	<ul style="list-style-type: none"> • Number of projects on population ecology. • Number of management alternatives for dispersion corridors. • Number of projects involving time series analysis of vegetation cover. • Number of studies on the population genetics of the species. • Number of projects carried out to determine the viability of interconnecting fragments
Studies on the population dynamics in continuous and fragmented patches.		Analysis of gene flow and colonization processes using molecular techniques.	1 and 3	
Viability analyses of possible biological corridors including demographic and socioeconomic variables.			3 and 4	

Education and communication

Actions			Where	Action Indicator
Shortterm	Medium term	Long term	Blocks	
Design and implement a communication strategy related to the connectivity of blocks of natural vegetation.			3, 1 and 4	<ul style="list-style-type: none"> • Number of communication campaigns carried out. • Number of individuals/ organizations aware of the problem of conservation of the spectacled bear.
Training and capacity building of staff of governmental organizations and NGOs in the design, creation, and maintenance of corridors connecting habitat blocks.			3, 1 and 4	<ul style="list-style-type: none"> • Staff of governmental organizations and NGOs trained in the design, creation, and maintenance of corridors interconnecting habitat blocks.

GOAL 3

To reduce the loss of animals by death or extraction from wild populations because of conflicts with humans

• Problems encountered:

Extraction of specimens from wilderness areas.

• Expected impact:

Reduced extraction of animals from the habitats they occupy.

Landscape conservation and management

Actions			Where	Action Indicator
Shortterm	Medium term	Long term	Blocks	
Technical assistance to develop mechanisms aimed to prevent negative interactions with humans.	Concerted development, with local communities, of sustainable production alternatives that minimize the incidence of negative interactions between bears and humans.		3 and 1	<ul style="list-style-type: none"> • Reduction in the number of bears killed/confiscated per country. • Reduction in the number of incidents of human/bear conflicts. • Reduction of economic losses caused by wild bears in rural landscapes.
Relocation of problematic bears, especially from small fragments and marginal areas of continental segments.			4, 3, 1 and 5	<ul style="list-style-type: none"> • Number of bears successfully relocated.

Policies and management tools

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Technical assistance to government organizations, NGOs, and grassroots organizations to develop policy tools for managing human/bear conflicts.			Depends on the area	<ul style="list-style-type: none"> • Number of policy instruments developed • Number of institutions involved in the development of instruments • Rate of success of bear-human conflict resolution
Strengthening mechanisms to control the illegal extraction of bear specimens and the commercialization of bears (or bear parts).			4, 3 and 1	<ul style="list-style-type: none"> • Number of control mechanisms evaluated and adjusted • Number of control mechanisms applied to specific situations

Ex situ conservation of specimens and populations

Actions			Where	Action Indicator
Short term	Medium term	Long term	Blocks	
Development of relocation protocols of problematic bears from the areas of conflict to resettlement sites.	Incorporation of problematic bears into captive breeding programs.		4, 3 and 1	<ul style="list-style-type: none"> • Protocols developed and applied • Number of participating institutions • Number of individual bears rehabilitated and relocated • Number of bear cubs included in reintroduction programs • Monitoring system for reintroduced bears developed and implemented

Research and monitoring				
Actions			Where	
Short term	Medium term	Long term	Blocks	Action Indicator
Evaluation of the frequency and magnitude of human-bear interactions in different landscapes and land use patterns.	Genetic characterization of confiscated specimens and of problematic bears captured.		3, 2 and 1	<ul style="list-style-type: none"> • Base line developed • Monitoring system for bear-human conflicts developed and implemented • Genetic characterization of problem bears complete

Education and communication				
Actions			Where	
Short term	Medium term	Long term	Blocks	Action Indicator
Design and implementation of educational programs oriented towards the reduction of the frequency and magnitude of human/bear conflicts			3, 1 and 2	<ul style="list-style-type: none"> • Number of educational programs developed and implemented • Number of stakeholders involved in the educational programs • Educational tools designed and published
Design and implementation of communication campaigns aimed at preventing hunting and bear trade.			1, 2 and 3	<ul style="list-style-type: none"> • Number of communication campaigns designed and implemented • Number of beneficiaries of communication campaigns • Number of communications tools adopted by local education/communications programs



V

Institutional needs and opportunities for executing the ecoregional strategy

Participants in the Villa de Leyva workshop agreed to carry out activities oriented to implement the ecoregional strategy at their institutions.

PERU

INRENA envisages the possibility of implementing “The Regional Strategy for the Conservation of the Spectacled Bear” within the pertinent National Conservation Program, giving priority to the southern area of the NAEC. The entity is supported with public funding. The strategy would be implemented through alliances with national and international conservationist entities, as is the case of WWF-Peru.

This organization is conducting a biological survey at the Tabaconas Namballe National Sanctuary, where a spectacled bear population exists, together with the Museum of Natural History of the Universidad de San Marcos in Lima and with INRENA's Directorate of Protected Areas.

The Chaparrí Ecological Reserve is working with the community to increase the protected area habitat for the spectacled bear in dry forest zones to establish biological corridors.

VENEZUELA

The national Ministry of the Environment, through the National Biological Biodiversity Office and the General Directorate of Fauna, is currently working on two projects related to the conservation of the spectacled bear. The first one is carried out in collaboration with Conservation International (CI) of Venezuela and PAT (Tropical Andes Project), and involves the execution of a GEF Project for the Venezuelan Andes regarding the conservation of agroproductive landscapes. The second project involves the assessment of protected areas, and is linked with the work carried out by the Foundation for the Defense of Nature (FUDENA, its Spanish acronym) in the Portuguesa mountain range.

The Ministry aims to prioritize and facilitate the permits it grants to study the spectacled bear and, depending on the funding available, open lines of research on the species, even though the Ministry is not the direct executor.

The Ministry's National Biological Biodiversity Office has a team with expertise in national inventories and perhaps this team could also monitor the spectacled bear in the Andean region. Finally, the Office's Director General also presides over the Foundation of Venezuela's Parks, Zoos and Aquariums, and could promote, with the support of specialists, research that would better organize the conservation projects related to the spectacled bear in Venezuelan zoos.

The National Parks Institute (INPARQUES) tries to include the protection and conservation of the spectacled bear when preparing ordinance plans and regulations of use of several national parks located in the Sierra Nevada and in the Portuguesa



mountain range. In addition, it tries to involve neighboring communities in the different actions of this strategy through the local public planning councils.

Conservation International -Venezuela will continue to support the GEF project to establish corridors in the Andes of Mérida and, together with FUDENA, will strengthen the activities carried out in the corridors located in the Portuguesa mountain range and in the Caldera branch. It will also work on the concept of “biosphere reserves” for these areas.

COLOMBIA

The Office of Forests and Ecosystems informed that Colombia’s Ministry of the Environment, Housing, and Territorial Development (MAVDT) will continue to support the regional autonomous corporations in the execution and development of the Action Plan for the Conservation and Protection of the Spectacled Bear in Colombia, prepared in 2001 (Minambiente, 2002), by establishing interinstitutional agreements that provide information on this species nationwide and by coordinating actions presented in the ecoregional strategy.

Colombia’s Special Administrative Unit of National Natural Parks (UAESPNN), mentioned that is necessary to organize the work in the Tamá binational corridor between Venezuela and Colombia and to link the GEF Massif Program with Ecuador’s Paramo Project.

The Wildlife Conservation Society (WCS) intends to consolidate activities throughout the entire Northern Andes subregion and that collaborative alliances could be established with other entities to conduct research on the spectacled bear, identifying those areas that need support and capacity building in ongoing projects.

The Threatened Species Program of the Alexander von Humboldt Institute (IAvH, its Spanish acronym), has a fellowship program for the conservation of threatened species that could support thesis work related to the biology and conservation of the spectacled bear in Colombia.

Conservation International - Colombia has begun to develop, with local partners throughout the Andean region, the Threatened Species Initiative—a small grants program dedicated to priority species ranked in the CR and IN categories at the global level and in other categories at the national level. This initiative is already in place in Colombia and should be completely functional throughout NAEC by June 2003. In Colombia, Unit works together with the IAvH and plans to offer 100 study grants per year to students, professionals, and community members endorsed by a recognized professional. At the regional level, the Unit is beginning activities in established conservation corridors (Chocó Manabí, between Colombia and Ecuador), Condor Cutucú (between Ecuador and Peru), Vilcabamba Amboró (Peru and Bolivia), and soon in the Northern Andes corridor (Colombia and Venezuela). Topics of interest include the perception of threat by local communities and, in the case of Colombia, contact has been made with the Environmental Action Fund to establish, on a pilot scale, a special line of compensation for the communities, aiming to avoid

the unnecessary slaughter of individuals while they are captured and transferred to breeding centers. For its successful implementation, this option will undoubtedly require tremendous creativity from the entire group of specialists and experts.

ECUADOR

The Division of Protected Areas of the Ministry of the Environment informed that the Ministry is interested in incorporating the conservation strategy for the spectacled bear into Ecuador's current institutional structure, from the highest levels of authority to technicians and mainly field staff. The Ministry will continue to work in the Condor mountain range with EcoCiencia, among other currently supported bear-related programs. The Ministry will be more participatory and active in the conservation of the spectacled bear but, to do so, the Northern Andes Ecoregional Strategy must be adopted by Ecuador's new government.

The Paramo Project highlighted the importance of the workshop that brought together different organizations that recognize that the spectacled bear is disappearing because of habitat loss and fragmentation and hunting and are willing to face the complex challenge of designing and implementing a strategy to overcome these problems.

The causes of habitat fragmentation, deterioration, and destruction and the hunting of the spectacled bear are closely related with poverty, the nonsatisfaction of basic needs for the rural population, the social disintegration that causes serious armed conflicts, and several laws and policies that are not duly enforced because of the tremendous lack of communication and the existence of biased policies.

To implement this strategy it is necessary to lobby not only before NGOs, farmers, and state conservation agencies but also before the ministries of Public Works, Development, and Economy and other stakeholders, and strive to achieve not only the conservation of the spectacled bear but also the solution of these social problems.

The Paramo Project will soon merge with EcoCiencia's Biodiversity Project, where it will work with Ecuador's Ministry of the Environment and other ministries, as well as rural and national organizations such as TNC and the Natura Foundation, regarding the management of the high Andean ecosystems that form part of the spectacled bear's habitat. On the other hand, the GEF Paramo Project, a recently formulated strategy, could contribute to this process by forming different groups of stakeholders that involve government organizations, NGOs, social groups, etc. This would give the problem international importance and gain the support of IUCN, WWF, and CI. It could lead to the development of more specific actions at the binational level, increasing regional integration. The ecoregional strategy for the conservation of the spectacled bear should be considered within this framework.

Representatives from EcoCiencia emphasized the need for implementing actions over the next four years, and will promote, together with the Ministry of the Environment, the preparation of the action plan for the conservation of the spectacled bear in Ecuador, involving all interested institutions, especially those



working in research and environmental education. From the perspective of IUCN-IBA, they highlighted that it was necessary to prioritize the actions from Venezuela down to Bolivia and link them to the ecoregional strategy.

The Natura Foundation, stated the necessity to promote this type of events and agreed to share the strategy document with other actors in Ecuador, inviting collaborative research and conservationist organizations and academic institutions to participate in its execution. The Foundation will enforce the strategy's objective more explicitly than it has to date.

The Nature Conservancy (Ecuador) pointed out that the organization is interested in assuming the priorities put forth in the strategy as its own at both the ecoregional and local levels, and willing to help disseminate the strategy within the TNC, especially in the other countries of the Andean Division, and share it with other institutions that could support this initiative.

The above institutions agree that, together with the MAE', the development of the action plan for the conservation of bears in Ecuador should be promoted.

WCS-Ecuador is interested in continuing its collaboration with research and monitoring programs to further strengthen the line of landscape conservation and management.



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