rapid biological inventories 05

Bolivia: Pando, Madre de Dios

William S. Alverson, editor

Octubre/October 2003

Instituciones Participantes / Participating Institutions:

The Field Museum

Centro de Investigación y Preservación de la Amazonía, y la Universidad Amazónica de Pando

Herbario Nacional de Bolivia

Herencia

LOS INFORMES DE LOS INVENTARIOS BIOLÓGICOS RÁPIDOS SON PUBLICADOS POR / RAPID BIOLOGICAL INVENTORIES REPORTS ARE PUBLISHED BY

THE FIELD MUSEUM
Environmental and Conservation Programs
1400 South Lake Shore Drive
Chicago, Illinois 60605-2496 USA
T 312.665.7430, F 312.665.7433
www.fieldmuseum.org

Editor: William S. Alverson

Diseño/Design: Costello Communications, Chicago

Traducciones/Translations: Fernando Neri, Tyana Wachter

ISBN 0-914868-55-1

Esta publicación ha sido financiada en parte por la Gordon and Betty Moore Foundation./This publication has been funded in part by the Gordon and Betty Moore Foundation.

Cita sugerida/Suggested citation: Alverson, W.S. (ed.). 2003. Bolivia: Pando, Madre de Dios. Rapid Biological Inventories Report 05. Chicago: The Field Museum.

Fotografía de la carátula/Cover photograph: Oso oro/Silky anteater (*Cyclopes didactylus*), por/by D.K. Moskovits.

Fotografía de la carátula interior/Inner-cover photograph: Pampa abierta cerca de Blanca Flor/Open pampa near Blanca Flor, por/by W.S. Alverson.

Créditos fotográficos/Photo credits: Figures 2B, 2C, 3B, 3D, 3E, 4F, R.B. Foster; Figures 3A, 3C, 4D, 4E, W.S. Alverson; Figures 4A-C, D.F. Stotz; Figures 1, 2A, NASA.

Impreso en papel reciclado/Printed on recycled paper

ENGLISH CONTENTS

(for Color Plates, see pages 15-18)

FIELD TEAM

William S. Alverson (*plants)*
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Daniel Ayaviri (*plants*)
Centro de Investigación y
Preservación de la Amazonía
Universidad Amazónica de Pando
Cobija, Pando, Bolivia

John Cadle (*amphibians and reptiles*)
Department of Herpetology
Chicago Zoological Society
Brookfield, Illinois, USA

Gonzalo Calderón (*mammals)*
Centro de Investigación y
Preservación de la Amazonía
Universidad Amazónica de Pando
Cobija, Pando, Bolivia

Johnny Condori (*birds*)
Centro de Investigación y
Preservación de la Amazonía
Universidad Amazónica de Pando
Cobija, Pando, Bolivia

Alvaro del Campo (*logistics*)
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Robin B. Foster (*plants*)
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Marcelo Guerrero (*amphibians and reptiles*)
Centro de Investigación y
Preservación de la Amazonía
Universidad Amazónica de Pando
Cobija, Pando, Bolivia

Mónica Herbas (*social characterization*)
Herencia
Cobija, Pando, Bolivia

Lois Jammes (*coordinator, pilot)*
Samaipata, Bolivia

Debra K. Moskovits (*coordinator, birds*)
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Julio Rojas (*coordinator, plants*)
Centro de Investigación y
Preservación de la Amazonía
Universidad Amazónica de Pando
Cobija, Pando, Bolivia

Pedro M. Sarmiento O. (*field logistics*)
Yaminagua Tours
Cobija, Pando, Bolivia

Brian O'Shea (*birds*)
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Antonio Sosa (*plants*)
Herencia
Cobija, Pando, Bolivia

Sandra Suárez (*mammals*)
Department of Anthropology
New York University
New York, New York, USA

Janira Urrelo (*plants*)
Herbario Nacional de Bolivia
La Paz, Bolivia

Tyana Wachter *(logistics)*
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Alaka Wali (*social characterization*)
Center for Cultural Understanding and Change
The Field Museum, Chicago, Illinois, USA

COLLABORATORS

Dan Brinkmeier
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Juan Fernando Reyes
Herencia
Cobija, Pando, Bolivia

Douglas F. Stotz
Environmental and Conservation Programs
The Field Museum, Chicago, Illinois, USA

Gualberto Torrico Pardo
Centro de Investigación y
Preservación de la Amazonía
Universidad Amazónica de Pando
Cobija, Pando, Bolivia

Comunidad Blanca Flor
Pando, Bolivia

Comunidad Naranjal
Pando, Bolivia

Comunidad Villa Cotoca
Pando, Bolivia

The Field Museum

The Field Museum is a collections-based research and educational institution devoted to natural and cultural diversity. Combining the fields of Anthropology, Botany, Geology, Zoology, and Conservation Biology, Museum scientists research issues in evolution, environmental biology, and cultural anthropology. Environmental and Conservation Programs (ECP) is the branch of the Museum dedicated to translating science into action that creates and supports lasting conservation. With losses of natural diversity worldwide and accelerating, ECP's mission is to direct the Museum's resources—scientific expertise, worldwide collections, innovative education programs—to the immediate needs of conservation at local, national, and international levels.

The Field Museum
1400 S. Lake Shore Drive
Chicago, IL 60605-2496
312.922.9410 tel
www.fieldmuseum.org

Universidad Amazónica de Pando – Centro de Investigación y Preservación de la Amazonía

From two original departments at its founding in 1993, Biology and Nursing, the Universidad Amazónica de Pando (UAP) has grown to include Computer Sciences, Agroforestry, Law, Civil Engineering, and Aquaculture. The urgent need for an expert center in Pando to manage the rich natural resources of the region led to UAP's strong emphasis on Biology and to the development of the Center for Research and Preservation of the Amazon (CIPA). The University's maxim—The preservation of Amazonia is essential for the survival of life and for the progress and development of Pando—reflects this focus on conservation. CIPA heads the research for fauna and flora in the region and guides policies and strategies for conservation of natural resources in Amazonia.

Universidad Amazónica de Pando
Centro de Investigación y
Preservación de la Amazonía
Av. Tcnl. Cornejo No. 77
Cobija, Pando, Bolivia
591.3.8422135 tel/fax
cipauap@hotmail.com

Herbario Nacional de Bolivia

The Herbario Nacional de Bolivia in La Paz is Bolivia's national center for botanical research. It is dedicated to the study of floristic composition and the conservation of plant species of Bolivia's different ecosystems. The Herbario was consolidated in 1984 with the establishment of a scientific reference collection observing international standards and a specialized library. The Herbario produces publications that advance the knowledge of Bolivia's floristic richness. Resulting from an agreement between the Universidad Mayor de San Andrés and the Academia de Ciencias de Bolivia, the Herbario also contributes to the training of professional botanists, as well as to the development of the La Paz Botanical Garden in Cota Cota.

Herbario Nacional de Bolivia
Calle 27, Cota Cota
Correo Central Cajón Postal 10077
La Paz, Bolivia
591.2.2792582 tel
lpb@acelerate.com

Herencia

Herencia is an interdisciplinary, non-profit organization that promotes sustainable development through investigation and planning, with the cooperation and participation of residents of Amazonian Bolivia, particularly Pando.

Herencia
Oficina Central
Calle Otto Felipe Braun No. 92
Casilla 230
Cobija, Bolivia
591.3.8422549 tel
pando@herencia.org.bo

ACKNOWLEDGMENTS

We deeply thank every person who helped us to spend a productive time in the Madre de Dios region of central Pando, and to share our preliminary results with interested parties and decision-makers in Cobija and La Paz. We are grateful to all who have given and continue to give of themselves to advance key opportunities for conservation in Bolivia.

Lois (Lucho) Jammes, Pedro M. Sarmiento, Sandra Suárez, and Tyana Wachter formed the energetic team who— with the invaluable help of Jesús (Chu) Amuruz, Alvaro del Campo, Julio Carrasco, and many others in the field, Cobija, and La Paz—wrought order out of chaos and put all details into place. Emma Theresa Cabrera kept us well fed and caffeinated under difficult conditions, and Antonio Sosa helped keep our camp running smoothly. Residents of Blanca Flor, Naranjal, Santa Maria, and Villa Cotoca actively engaged us in a dialog about the aims and results of the rapid inventory process, and provided useful suggestions about specific sites and logistics. In particular, the Mayor of Blanca Flor encouraged our efforts and welcomed us to present our results at a community meeting.

The Universidad Amazónica de Pando (Cobija) and the Secretario Nacional de Investigación, Ciencia, y Tecnología (La Paz) kindly provided us with meeting facilities for our presentations.

Gualberto Torrico P. took the lead in drying and distributing the plant specimens we collected as voucher material during the inventory. Fernando Neri and Tyana Wachter did an admirable job of translating the manuscript into Spanish. Thanks also are due Jennifer Shopland, Tyana Wachter, Robert Langstroth, Julie Calcagno (Smentek), and Isabal Halm for their extremely careful and helpful comments on drafts of the manuscript. As always, James Costello and Tracy Curran were tremendously tolerant of missed deadlines while keeping production of the report on track.

The impact of rapid inventories depends heavily on the applicability of recommendations for conservation action and the possibilities for sound, environmentally compatible economic activities. For their dedication, suggestions, and insightful discussions we thank Luis Pabón (Ministerio de Desarrollo Sostenible y Planificación, Servicio Nacional de Áreas Protegidas), Richard Rice (CABS, Conservation International), Jared Hardner (Hardner & Gullison Associates, LLC), Lorenzo de la Puente (DELAPUENTE Abogados), Mario Baudoin (Ministerio de Desarrollo Sostenible y Planifcación), Ronald Camargo (Universidad Amazónica de Pando—UAP), Adolfo Moreno (WWF Bolivia), José L. Telleria-Geiger (Secretario Nacional de Investigacion, Ciencia, y Tecnología), Juan Carlos Montero (Asociación Boliviano para la Conservación), and Victor Hugo Inchausty (Conservación Internacional, Bolivia). For their continued interest, and steady coordination and collaboration with us in our efforts in Pando, we sincerely thank Sandra Suárez (Fundación José Manuel Pando), Julio Rojas (CIPA, UAP), Juan Fernando Reyes (Herencia), Ronald Calderon (Fundación J. M. Pando), Leila Porter, and Adolfo Moreno and Henry Campero (WWF Bolivia).

John W. McCarter, Jr. continues to be an unfailing source of support and encouragement for our programs. Funding for this rapid inventory came from the Gordon and Betty Moore Foundation and The Field Museum.

The goal of rapid biological and social inventories is to catalyze effective action for conservation in threatened regions of high biological diversity and uniqueness.

Approach

During rapid biological inventories, scientific teams focus primarily on groups of organisms that indicate habitat type and condition and that can be surveyed quickly and accurately. These inventories do not attempt to produce an exhaustive list of species or higher taxa. Rather, the rapid surveys (1) identify the important biological communities in the site or region of interest, and (2) determine whether these communities are of outstanding quality and significance in a regional or global context.

During social asset inventories, scientists and local communities collaborate to identify patterns of social organization and opportunities for capacity building. The teams use participant observation and semi-structured interviews quickly to evaluate the assets of these communities that can serve as points of engagement for long-term participation in conservation.

In-country scientists are central to the field teams. The experience of local experts is crucial for understanding areas with little or no history of scientific exploration. After the inventories, protection of natural communities and engagement of social networks rely on initiatives from host-country scientists and conservationists.

Once these rapid inventories have been completed (typically within a month), the teams relay the survey information to local and international decision-makers who set priorities and guide conservation action in the host country.

REPORT AT A GLANCE	
Dates of fieldwork	7—12 July 2002 (biological), 25—27 July 2002 (social/cultural)
Region	The Área de Inmovilización Madre de Dios, in south-central Pando between the Madre de Dios and Beni Rivers (Figures 1, 2A). This Área de Inmovilización (a designation given to sites that need further studies before categorization for land use) covers a mixture of open savannas (*pampas abiertas*), low forests on pampa soils (*pampas arboladas*), and tall western-Amazonian forests on well-drained soils.
Sites surveyed	Six sites, including (1) well-drained, tall upland Amazonian forests immediately west of the Área de Inmovilización (*Cotoca Camp*), (2) open pampas (*Pampa Blanca Flor* and *Pampas Abiertas Naranjal Este*), and (3) complex and varied older pampa habitats with a mixture of grassy, shrubby, and low arboreal vegetation (*Pampa Arbolada Naranjal Noroeste*, as well as the previously mentioned sites). See Figure 2.
Organisms surveyed	Vascular plants, reptiles and amphibians, birds, and large mammals.
Highlights of results	The inventory team identified significant opportunities for conservation of relatively intact pampa habitats, which are very rare in Pando. The adjacent, western-Amazonian forest habitats, logged about 40 years ago, are structurally intact but appear to suffer from intense hunting that has modified the bird and mammal communities present. The following is a brief summary of the rapid biological inventory team's results during its six days in the field: **Plants:** The team registered a moderate species richness of 523 species of plants and estimated about 800 for the region. Natural reproduction of Brazil-nut trees is conspicuous and significant, as is the occurrence of pampas this far north in Bolivia. Several plant species were at the limits of their range or were new records for Pando. **Large Mammals:** The team registered 23 species of large mammals out of 46 estimated for the region. Population densities appeared very low for many game species (agoutis, pacas, peccaries, howler and spider monkeys, tapirs). Only 5 out of a possible 10 primate species were recorded, and even small primates that are normally common elsewhere in Pando were very rare. In contrast, small cats (*Leopardus*) and nocturnal rodents and opossums appeared to be common. The hunting pressure in the region is very high. **Birds:** The team recorded 241 species in the Madre de Dios study sites, of which 210 were from the forest around and south of Cotoca, and 81 were from pampa habitats and associated forest islands and edges. The forest avifauna seemed incomplete for southwest Amazonia.

REPORT AT A GLANCE	
	Amphibians and Reptiles: We registered 38 species (19 reptiles and 19 amphibians), out of an estimated 140 to 160 species for the region (80 of reptiles and 60 to 80 of amphibians). All of the species we recorded are common in southwestern Amazonia, and all, except for one lizard, were from forest habitats.
Human communities	Modern immigration to the region began in the early 1930s when large estates devoted to rubber and Brazil-nut gathering (*barracas*) were established. With the collapse of the rubber boom (1950s-1980s), workers took ownership of the lands and petitioned for formal legal status for the towns or villages. We worked with three communities in and around the Área de Inmovilización Madre de Dios: Blanca Flor (with about 450 inhabitants), Naranjal (with 197), and Villa Cotoca (with 91). Population density in the region is relatively low, but growing. The regional economy is still principally dependent on Brazil-nut harvesting. Other economic activities include livestock herding, small-scale commercialization of rice, and the sale of wild game for food and medicine.
Main threats	Very intense hunting pressure on mammal and bird populations is the primary threat. We observed many successful hunters in the forest carrying primates, peccaries, birds (including an eagle), and other game species home for their families or for sale. The present level of hunting appears to have depleted animal populations and may have a pronounced and negative effect on the welfare of human communities and native biodiversity. Current levels of timber extraction, and scattered ranching, may be compatible with maintaining a full array of native species in the region if local communities develop and follow plans for the management of cattle, fire, and hunting. Widespread removal of the canopy in the taller, well-drained (non-pampa) forests remains a threat to biodiversity but is not occurring at present. Increases in human migration to the region and lack of trust in governmental and non-governmental agencies will add to the difficulty of conservation efforts.
Principal recommendations for protection and management	(1) ***Together with community members of Blanca Flor, Naranjal, and Villa Cotoca, develop a natural-resource management plan for the area now included in the Área de Inmovilización Madre de Dios.*** This plan can provide a blueprint for a future in which humans have a healthy relationship with the landscape of central Pando. The plan also can serve as a framework for all decisions about land use, wild habitats, and wild plant and animal populations, and may include the designation of a municipal or regional wildlife reserve.

(2) ***Stem current over-harvesting of mammals and birds.*** Investigate carrying capacity for hunting in this area. Set conservative upper limits for harvest on the basis of these results. Involve local residents in monitoring game and human responses to these limits. Identify community incentives and enforcement mechanisms necessary to accomplish goals for game-species protection.

(3) ***Maintain a diversity of ages and types of pampas habitats***, from newly burned, open, grassy pampas, to a diverse array of older pampas on which shrubs and trees have become dominant. Cattle should be excluded from 25 to 50% of the area of these pampas, to provide control areas to better understand the effects of grazing on pampas biodiversity.

(4) ***Maintain large blocks of tall, old secondary forest on good soils by minimizing large-scale removal of canopy trees.***

(5) ***Develop and disseminate educational materials for children and adults to broaden the basis of understanding and support of conservation and natural resource management.***

(6) ***Work with local residents to secure funding for community-based inquiry aimed at ecologically sensitive management of their resources.*** Recommended foci for study include (a) new sources of protein that can reduce their need for wild game, (b) monitoring of game and timber-tree populations, (c) the role of fire and grazing in maintaining open pampas, (d) detailed inventories of mammals, birds, amphibians, and reptiles, especially in the pampas, (e) the response of local birds amphibians, and reptiles to disturbance, and (f) the extent and mechanism of successful natural reproduction of Brazil-nut populations in the region.

Long-term conservation benefits

(1) ***Human communities in a stable relationship with a landscape of forests and pampas*** that provides renewable forest products such as Brazil nuts and timber, and long-term sources of protein from wild game.

(2) ***Maintenance of a complex array of young and old pampas, which are unique habitats in northern Bolivia.*** These pampas are, in essence, habitat "islands" surrounded by a "sea" of forests. Because of their isolation from other pampa habitats, they may harbor significant numbers of local or regional endemics and generate special patterns of evolution in the populations of plants and animals found within them.

Why Madre de Dios?

In the Landsat 7 satellite image of central Pando (Figure 1), the Orthon, Madre de Dios, and Beni Rivers run northeast toward the Amazon. Between these rivers, tall, upland, western Amazonian forests with abundant Brazil-nut trees appear in a coppery brown color. In the southeast (lower right) corner of the image, long fingers of open pampas (in blue) reach up from the Department of Beni. These extensions of the southern pampas barely reach into Pando. North of the Beni River, they break up into isolated, puzzle-shaped pieces of open habitat surrounded by the extensive matrix of tall forests. Wine-colored areas adjacent to the open pampas are older pampas now covered by shrubs and trees.

At this intersection of pampas vegetation on poor soil, and tall-forest habitats on better soils, the Bolivian government designated the Área de Inmovilización Madre de Dios (literally, an "Immobilized Area" awaiting final designation for land use). The goal of our rapid inventory team was to gather the biological and sociological information necessary to support conservation and ecologically sensitive use of this complex mixture of habitats.

Overview of Results

From 7 through 12 July 2002, the biological inventory team occupied a single campsite a few kilometers south of Villa Cotoca, a small settlement on the Cobija-to-Riberalta road. We worked in six sites in and around the Área de Inmovilización Madre de Dios, including the area immediately surrounding the Cotoca camp. Access to these sites was provided by an existing network of roads, and, within sites, via trails used by hunters and Brazil-nut harvesters. Overall elevation did not vary greatly (155–175 m). However, the rolling topography of the uplands on well-drained, more easily eroded soils was strikingly different from the conspicuously flat, poorly drained areas constituting the open and overgrown pampas. The social-asset inventory team worked in the region from 25 to 27 July 2002.

BIOLOGICAL OVERVIEW

Vegetation and Flora

The satellite image of the region (Figure 1) exhibits bright blue areas that signify open pampas. Adjacent to the bright blue areas are purple areas covered by relatively low forest, often dense and full of vines, with a canopy ranging from 5 to 15 m in height. These purple areas on the image are overgrown pampa (*pampa arbolada*), formed by natural succession in the absence of fire. The pampas, in all stages of regeneration, are significant in that they are unique habitats in Pando and the northernmost extension of this type of habitat in Bolivia (and adjacent Brazil). This type of habitat "jumps" the Beni River but does not seem to cross the Madre de Dios River to the north and west.

Surrounding the pampas and appearing in a mottled orange color on the satellite image (Figure 1) are taller forests on well-drained soil. These forests were lightly logged about 40 years ago and now are harvested heavily for Brazil nuts and game, but generally are in good condition. Selective logging on a tree-by-tree basis still occurs for the most economically valuable species. Notable in these forests were the Brazil-nut seedlings and saplings (*Bertholletia excelsa*) along the roadsides in the forest surrounding Cotoca. Actively reproducing populations of Brazil nuts are rare and thus a significant asset for Pando.

During our six days of fieldwork, we registered 523 species of vascular plants (Appendix 1) and estimated 800 for the region. We did not encounter species

that we knew to be new to science, but we did register species that were new to Pando, rare in Bolivia, or otherwise notable. These include *Qualea albiflora* (Vochysiaceae), a 20-m-tall tree that dominates several of the overgrown pampas. To our knowledge, this species has been collected only once before in Bolivia.

Amphibians and Reptiles

We recorded 19 species of reptiles (8 of snakes, 10 of lizards, and one crocodilian) and 19 species of amphibians (all frogs) from the study site (Appendix 2). All species except for one lizard (*Pantodactylus schreibersii*) were from forest habitats; we made only a brief reconnaissance of the pampas in the area because of extreme dryness. All of the species we recorded are common elements of herpetofaunas in southwestern Amazonia, and have been recorded at other well-inventoried sites in southeastern Peru (Manu National Park, Tambopata Reserve, Cuzco Amazónico) and northern Bolivia (Reserva Nacional de Vida Silvestre Amazónica Manuripi). Many are widespread Amazonian species and no species we observed are local or regional endemics.

Because we were sampling during the dry season, we detected only a small portion of the amphibians and reptiles that are expected for the study site. Judging from the species richness of more thoroughly inventoried sites in southwestern Amazonia, we suspect that the total herpetofauna for the Madre de Dios study site would total 120–160 species. Our rapid inventory probably detected only about 25–30% of the frog species and 25% of the reptiles that might be expected.

Birds

The bird team recorded 241 species in the area. We found 210 species in the forest areas of our base camp and southward, where we concentrated the majority of survey efforts, and 81 species in pampas and associated woodland areas. Our survey protocols tended to favor detection of forest species, and we believe that many more species than we observed are present in the pampas.

The composition of the forest avifauna was typical of southwest Amazonia. Canopy-flocking species seemed particularly numerous. In contrast, we encountered few mixed flocks in the understory, and species that are typically found in such flocks seemed rare. This pattern could be the result of past logging activity, which may have disproportionately altered the structure of the subcanopy forest strata through the retention of large Brazil-nut trees. Apparently scarce also were large birds such as guans, parrots, and terrestrial doves, whose inconspicuousness we attributed to heavy hunting pressure in the area. We encountered the eagle *Morphnus guianensis* in forest near our base camp. This species is a top predator that requires large areas of relatively intact forest.

Our surveys of the pampas yielded several new records for the Department of Pando. The avifauna of the pampas is probably more species-rich than our results indicate, yet we did not detect several typical pampas species that tend to be highly visible where they occur. This suggests that the avifauna, while containing elements not found in the forests of the surrounding area, is probably depauperate compared to that of the more extensive pampas of the Department of Beni, to the south.

Large Mammals

We registered 23 species of mammals, mostly from tracks but also by visual, auditory, and olfactory observations, as well as by dens, burrows, and nests. In comparison to forested areas in other parts of Pando and the western Amazonian basin, we observed few mammals. In particular, we noted a low species richness and population density of large mammals, especially primates and other species hunted by humans.

For example, the abundance of agoutis (jochis, *Dasyprocta variegata*), pacas (jochi pintado, *Agouti paca*), and peccaries (*Tayassu* sp.) was much lower than we expected. Even small primates like tamarins (chichilos, *Saguinus* spp.) occurred in very low densities. This low abundance of large mammals may be due in part to the natural history of the area. However,

in view of the number of mammals we observered as hunters' kills and the presence of an active market for bushmeat, the dearth of large mammals seems primarily due to excessive and indiscriminate hunting.

In contrast, we observed abundant signs of small cats (Felidae), especially along dirt roads and forest trails. We also observed a high density of small nocturnal rodents, perhaps because of the pampa habitats and the absence of some large predators.

HUMAN COMMUNITIES

The Área de Inmovilización Madre de Dios is contained within the Municipality of San Lorenzo. The municipality comprises 33 villages or towns, of which 11 are mixed indigenous communities. Solicitation for a *Tierra Comunitaria de Origen* (TCO) has been made and is pending reconciliation with municipal authorities over determination of boundaries. Blanca Flor is currently the municipal seat.

Modern settlement in the region began in the early 1930s when large estates devoted to rubber and Brazil-nut gathering were established, as they were in other settled areas of Pando and adjacent areas in Beni. Tacana Indians from Ixama were among the people brought to work on the estates. With the collapse of the rubber boom (1950s–1980s), workers took ownership of the lands and petitioned for *personería jurídica* (legal status) for the towns or villages.

The regional economy is still principally dependent on Brazil-nut harvesting. The gap in income due to the collapse of rubber apparently has been filled by livestock herding, small-scale commercialization of rice, and in some instances sale of wild game.

Social assets that can be used to build participatory programs for conservation intervention and education include (1) residents' familiarity with the ecosystem and continued engagement with low-impact extractive activities (i.e., Brazil-nut harvesting), (2) expressed interest in implementing low-impact alternatives for resource use, (3) efforts by indigenous communities to recoup cultural practices and values, (4) active environmental education efforts in the municipal schools, and (5) active municipal government interested and willing to enforce agreements.

THREATS

The primary threat to the biological diversity of the region is the intense hunting by local residents. Secondary threats include degradation and loss of forest and pampas.

Overhunting

Despite relatively low human population density in the region, the hunting pressure on mammal and bird populations is strong. Our observations suggest that overhunting for food and medicine may be depressing the abundance of many large mammals and birds to dangerous levels. Hunting appears to have already changed the ecological roles that native mammals can play in the forests and pampas of the region. We predict that the current intensity of hunting, if unchecked, will result in the loss of some game species in the region.

Overgrazing of Pampas

Although studies are needed to verify this history, the openness of the pampas probably was maintained in the past by periodic fires, rather than by grazing. Some native plant species, genetically adapted to disturbance by fire but not to grazing by cattle, may disappear from the region unless cattle are excluded from a portion of the pampas.

Widespread Removal of Tall-forest Canopy

The tall forest on well-drained soils now serves as a source of (1) building materials and firewood for local communities, (2) selectively logged timber for market, (3) Brazil nuts, (4) medicinal plants, and (5) game mammals and birds for local consumption. Removal of the canopy trees of this forest for increased grazing or agricultural lands will cause the forest to become much drier and will result in the loss of some of the community resources listed above.

CONSERVATION TARGETS

Because of (1) their national or regional rarity, (2) their influence on community structure or dynamics, or (3) their indication of relatively intact habitats or ecosystem functions, the following species and communities should be the primary foci for conservation in the region including the Área de Inmovilización Madre de Dios.

ORGANISM GROUP	CONSERVATION TARGETS
Plant Communities	Pampas in all stages of succession Large blocks of old secondary forest on well-drained soils
Tree Species	Healthy, regenerating populations of Brazil nuts (*Bertholletia excelsa*), tumi (*Amburana cearensis*), cedro (*Cedrela odorata*), and other timber species
Reptile and Amphibian Assemblages	Herpetofauna representative of southwestern Amazonia, along with the moist understory habitats that support it
Bird Species and Communities	Large birds hunted for food and medicine Pampas birds, and parrots
Large Mammals	All large mammals, including the globally rare *Leopardus pardalis* and *L. wiedii* (ocelot and margay), *Lontra longicaudis* (Neotropical otter), *Panthera onca* (jaguar), *Puma concolor* (puma), *Speothos venaticus* (bush dog); and, if present, *Priodontes maximus* (giant armadillo), *Pteronura brasiliensis* (giant otter), and *Herpailurus yaguarondi* (jaguarundi) (CITES I species) *Alouatta sara* (Bolivian red howler monkey), *Aotus* sp. (night monkey), *Cebus albifrons* and *C. apella* (capuchin monkeys), *Saguinus fuscicollis weddelli* (saddleback tamarin), *Tapirus terrestris* (tapir), *Tayassu tajacu* (collared peccary); and, if present, *Ateles chamek* (black-faced black spider monkey), *Bradypus variegatus* (sloth), *Callicebus* sp. (titi monkey), *Myrmecophaga tridactyla* (giant anteater), *Pithecia irrorata* (saki monkey), *Saimiri boliviensis* (squirrel monkey), *Saguinus labiatus* (red-chested mustached tamarin monkey), *Tamandua tetradactyla* (southern tamandua), and *Tayassu pecari* (white-lipped peccary) (CITES II species)
Human Communities	Brazil-nut harvesting as a primary economic activity Long-term sources of wood and protein (including wild game)

The Área de Inmovilización Madre de Dios is a high priority for conservation at the municipal (San Lorenzo) and departmental (Pando) levels but not at national or international levels.

Local residents and community leaders are very interested in developing sound natural-resource management plans for the region. The interest and enthusiasm generated by the rapid biological inventory opened a path to initiate community-based land-use plans, game management, monitoring and research efforts, and conservation education for adults and children.

With these tools and resources, the residents of Blanca Flor, Naranjal, and Villa Cotoca could moderate hunting efforts and retain populations of game mammals and birds, Brazil nuts, timber, firewood, and other natural products of the forest and pampas for their children and grandchildren. By retaining substantial blocks of intact tall forest and pampas, local residents also could retain healthy populations of nongame animals and plants designated as conservation targets in this region.

The designation of a regional or municipal wildlife refuge within the boundaries of the Área de Inmovilización Madre de Dios is one of the options available to the local communities. Formal designation of a wildlife refuge may facilitate a process of land-use planning on a regional scale, in which some lands are zoned for intensive use (with great alteration of wild communities), and other lands for less intensive uses that are compatible with native biodiversity.

RECOMMENDATIONS

This rapid biological survery has laid the foundation for future conservation efforts through a coarse-grained identification of the region's ecological context, biological values, threats, and conservation opportunities. Our inventory results also suggest the following recommendations.

Protection and management

(1) **Together with the residents of Blanca Flor, Naranjal, Villa Cotoca, and other local communities, develop natural-resource management plans** that make explicit these residents' desires for future land use, forest and pampa habitats, and populations of game and other wild species.

(2) **Consider formal designation of a wildlife refuge as an effective means to achieve management objectives.**

(3) **Avoid overharvesting by enacting effective controls that reduce hunting of wild mammals and birds to levels that can persist in the long run.** Through communities' decision-making channels, set conservative upper limits for harvest on the basis of studies of carrying capacity (see Research, below). Adjust bag limits and other protection strategies on the basis of monitoring results (see Monitoring, below). Identify community incentives and enforcement mechanisms necessary to accomplish goals for game-species protection.

(4) **Manage pampas to maintain a range of ages and types, from newly burned, open, grassy pampas, to a diverse array of older pampas on which shrubs and trees have become dominant.** Cattle should be excluded from 25 to 50% of the area now covered by pampas vegetation until the effect of their grazing on native biodiversity is better understood. Periodic burning of some pampas should continue.

(5) **Over the next decade, limit reduction of tall-forest cover to no more than 10% of its current area.**

(6) **Develop and employ educational materials for children and adults to broaden the basis of understanding and support of conservation and natural-resource management.** For example, the education of local residents could reduce the killing of animals for ineffective folk medicines.

Research

(1) **Investigate the carrying capacity for hunting of the most heavily exploited game species in the area** and identify alternative protein sources for local residents to reduce their heavy reliance on wild game.

RECOMMENDATIONS	
Research	(2) **Investigate the extensive Brazil-nut regeneration seen in parts of the Área de Inmovilización Madre de Dios** to understand why it is occurring and whether these favorable conditions can be encouraged in other Brazil-nut-producing areas of Bolivia. (3) **Study the effects of disturbance on particular species of amphibians and reptiles.** We know of just one study of such effects in tropical forest, near Manaus, in Amazonian Brazil. Historical records of forest disturbance in Pando offer an opportunity to compare the responses of amphibians and reptiles in forest types of southwestern Amazonia to those studied near Manaus. (4) **Conduct a study of the responses of the understory bird community to maturation of the tall forest habitats.**
Further inventory	(1) **Conduct additional, more thorough inventories of amphibians and reptiles during the rainy season, with special attention to pampas habitats,** as these are the most likely to harbor amphibians and lizards that are locally or regionally endemic. (2) **Undertake a more thorough inventory of birds in the pampas** to better understand the species present and their conservation needs. (3) **Inventory small mammals and conduct a more thorough inventory of nocturnal mammals, especially in pampas.**
Monitoring	(1) **Building on the organizational assets of local communities, develop and implement a regional monitoring program.** Through this program resident stewards can measure progress toward conservation goals set in community management plans (see Protection and management, above). We recommend particular attention to the following: (1.1) **Monitor populations of game birds and mammals, as well as parrots and other animals vulnerable to the pet trade.** At the same time, monitor hunting behavior in local communities to evaluate responses to management strategies (see Protection and management, above). Use results to modify these strategies. (1.2) **Monitor the population status of important timber species** such as tumi (*Amburana cearensis*), and cedro (*Cedrela odorata*). Use the results to establish guidelines for harvest so that these species are available to the children and grandchildren of current residents.

Technical Report

OVERVIEW OF INVENTORY SITES

The inventory took place from 7 to 12 July 2002 in the Área de Inmovilización Madre de Dios, an irregularly shaped piece of land of 51,112 ha near the southern edge of central Pando (Figures 1, 2A). The Área de Inmovilización lies in the middle of a narrow tongue of land running northeast between the Madre de Dios River (to the northwest) and the Beni River (to the southeast). In this tongue of land, habitats are transitional between the wetter forests characteristic of well-drained uplands in western Pando and the drier forests and pampas of Beni.

The biological inventory team occupied a single campsite, situated a few kilometers south of Villa Cotoca, a small settlement on the Sena-to-Riberalta road (which was called Mangal in maps dating from the late 1970s and early 1980s). We worked in six sites (Figure 2A), including the area immediately surrounding the Cotoca Camp. Access to these sites was provided by an existing network of roads, and, within sites, via trails used by hunters and Brazil-nut harvesters. Variation in elevation (155–175 m) was low. However, the rolling topography of the uplands on well-drained, more erodible soils differed strikingly from the conspicuously flat, poorly drained areas constituting the open and overgrown pampas.

Latitude and longitude values are from hand-held GPS units, unless otherwise specified.

Cotoca Camp and vicinity

(11°33.78' S, 67°07.62' W, from 1:50,000 topo map: Mangal, 1982, Instituto Geográfico Militar Boliviano)

We established this camp in and around a small clearing and thatched structure used seasonally to sort Brazil nuts. The road running south from the main highway at Cotoca first passes through fields and recently disturbed forest, then through old secondary forest on well-drained soils before arrival at the Cotoca Camp. We inventoried along existing trails and roadsides around this site on 7–12 July 2002.

Trails West of Cotoca Road—A few kilometers south of the Cotoca Camp, another old logging road branches off to the southwest. This western road, passable by foot, then forks to a small, abandoned homestead at 11°35.08' S, 67°09.55' W, and to a small pampa at 11°35.63' S, 67°10.06' W. We explored both forks on 11 July.

Cotoca Road South—The dirt road bearing south of the Cotoca Camp, presumably constructed 40 years ago for timber extraction, is passable by four-wheel drive truck for about 25 km. It passes through old secondary forest dominated by Brazil nuts and other emergent trees not removed for timber harvest, and through patches of younger, more recently disturbed secondary forest. The road crosses rolling terrain with many small streams and several homestead clearings, continues past two small pampas and the entrance to the large settlement named Barraca Canadá, and then becomes impassible at about 11°47' S, 67°11' W, just north of an overgrown pampa (*pampa arbolada*) visible on the satellite image. We traveled this road by truck and by foot on 8 July and again, in part, on 11 July.

Pampa de Blanca Flor
(11°43.84' S, 66°57.54' W)
On 9 July, we traveled by truck to the village of Blanca Flor, then west through a large open pampa to its western edge where, on foot, we could easily enter open pampa, old pampa with trees (pampa arbolada), and old secondary forest on well-drained soils.

Pampa Arbolada Naranjal Noroeste
(11°29.13' S, 67°01.84' W)
On the morning of 10 July, we traveled by truck to an open pampa dominated by *Pteridium* ferns and an adjacent, complex mix of vegetation in an older, overgrown pampa approximately 12 km northwest of the village of Naranjal. We did not visit the small village immediately northwest of this inventory site, which appears as "El Turi" on Instituto Geográfico Militar Boliviano maps compiled in 1982.

Pampas Abiertas Naranjal Este
(11°32.65' S, 66°54.32' W, at the first big pampa east of Naranjal; to the easternmost pampa visited at 11°31.64' S, 66°48.99' W)
On the afternoon of 10 July, we examined three open pampas, each adjacent to the main road running northeast between Naranjal and the Beni River. All were grassy, with few trees, and the eastern border of the easternmost pampa was conspicuously wetter than other pampa areas seen.

VEGETATION AND FLORA

Participants/Authors: William S. Alverson, Janira Urrelo, Robin B. Foster, Julio Rojas, Daniel Ayaviri, and Antonio Sosa

Conservation Targets: Pampas in all stages of succession; large blocks of old secondary forest on well-drained soils; healthy, regenerating populations of Brazil nuts (*Bertholettia excelsa*), tumi (*Amburana cearensis*), cedro (*Cedrela odorata*), and other timber species

METHODS

We had six days to assess the large complex of forest and pampa vegetation in and around the Área de Inmovilización Madre de Dios. The Cotoca Camp was within the matrix of old secondary forest on well-drained soils, which we explored using existing trails and roads. We targeted additional types of vegetation visible in a Landsat 7 (EMT+) image taken in August 2000—open pampas, and reforested ("overgrown") pampas with varying densities of trees, in particular—and traveled by truck to sites that allowed us to explore these habitats on foot.

We did not gather quantitative data with transects. Instead, we kept running lists of species identified in the field and recorded qualitative information about their abundance and presence in various habitats. We took several hundred photographs as documentation of species presence and as a tool to identify unrecognized species later; once processed and digitized, a representative subset of these photographs will be made available at *www.fieldmuseum.org/rbi*. We also collected 304 herbarium specimens representing at least 215 species in a number series under the name "Janira Urrelo." All specimens were field-treated with alcohol, and dried at the university in Cobija. They will be deposited in herbaria at the Universidad Amazónica de Pando, Cobija (UAP), the Herbario Nacional, La Paz (LPB), and The Field Museum (F).

FLORISTIC RICHNESS, COMPOSITION AND DOMINANCE

Our preliminary list of vascular plants (in Appendix 1) lists 523 species within the area in and around the

Área de Inmovilización Madre de Dios. Judging from the variation within habitat types that we were able to explore on the ground, and on the presence of several habitat types that we did not visit, we estimate a total vascular plant flora of around 800 species.

This moderate species richness is due to the intermixing of floras adapted to poorly drained and well-drained soils, but without significant elevational variation or an extensive epiphyte flora. Many of the species in the old secondary forest on well-drained soils were the same as those seen in the Tahuamanu region in western Pando (Foster et al. 2002). In contrast, species occurring in the pampa habitats had stronger affinities to those in pampas such as the Pampas del Heath in Departamento La Paz, and the Pampas of Beni. They also showed affinities to cerrado and pampa vegetation to the south and east, in the Bolivian Departments of Beni and Santa Cruz, and adjacent Brazil (cf. Killeen 1998).

Fabaceae and Moraceae were the families most commonly encountered in the upland forests on well-drained soils, with at least 54 species (in 29 genera) and 24 species (in 10 genera), respectively. Although only 4 species in 3 genera of Lecythidaceae were recorded, many large, emergent individuals of the Brazil nut (*Bertholletia excelsa*) were present, together with emergent Moraceae (e.g., *Ficus schultesii*) and other species passed over for timber harvest.

The vegetation of the pampas was more complex. Some pampas were very open, nearly treeless expanses dominated by grasses (Poaceae) and sedges (Cyperaceae). One formerly overgrown pampa, apparently subject to a recent, intense burn, was completely dominated by the fern *Pteridium aquilinum*. Others were dominated by shrubs and small trees such as the fire-resistant *Physocalymma scaberrimum* (Lythraceae), a thick-barked, pachycaulous *Himatanthus* (Apocynaceae, Figure 3A), a *Mollia* sp. (Tiliaceae), *Vismia* spp. (Clusiaceae), and several Bignoniaceae, Fabaceae, and Malpighiaceae. Some are dominated by the small palm *Mauritiella armata*. The older, revegetated pampas (pampas arboladas), having had more time to regenerate since the most recent fire, were dominated by a mix of shrubs and trees. Some of these species are found also in the surrounding well-drained terra firme forest, but most are species characteristic of poorly drained, acid soils, including *Qualea albiflora* (Vochysiaceae), a *Vernonianthus* sp. (Asteraceae), *Maprounea guianensis* (Euphorbiaceae), *Mouriri* spp. (Melastomataceae), *Graffenrieda limbata* (Melastomataceae), *Schefflera morototoni* (Araliaceae, Figure 3C), *Psychotria prunifolia* (Rubiaceae), and *Vismia* spp. (Clusiaceae). A large area of one overgrown pampa south of the Cotoca Road South was dominated by Vochysiaceae, as seen during an overflight in March (by RF; also conspicuous on the satellite image, Figure 2A).

VEGETATION TYPES

We used a simple scheme to classify the vegetation inventoried in and around the Área de Inmovilización Madre de Dios:

<u>*Vegetation on well-drained soils*</u>

- Logged forests harvested 30–40 years ago, with remnant old forest trees
- Recently disturbed areas (young secondary forests, fields, roadsides)

<u>*Vegetation on poorly drained soils*</u>

- Open pampas dominated by grasses or scattered shrubs and trees (*pampas abiertas*; also *pastizal* on old topo maps)
- Overgrown pampas with a relatively continuous tree cover (*pampas arboladas*; also *bosque bajo*, or *chaparral*)

LOGGED FOREST ON WELL-DRAINED SOILS

The vegetative matrix of the region is that of old secondary forest on sandy-clayey soils. From a bird's-eye view, the tall canopy of this forest is discontinuous and composed of large Brazil-nut trees (*Bertholletia excelsa*) and other emergents, such as *Ficus* spp. (Moraceae) and *Dipteryx micrantha* (Fabaceae) that were not removed for timber harvest in the last four decades. Between these emergents is a continuous canopy of smaller trees with

crowns as tall as 15–20 m, providing reasonably moist subcanopy and understory conditions for at least half of the year. The composition of the forest is similar to that of the Tahuamanu region of western Pando (Foster et al. 2002) but without some of the moister elements. In both forests, figs and relatives (Moraceae), legumes (especially Tachigali), and Brazil nuts and relatives (Lecythidaceae) were both species-rich and common.

The midcanopy and understory layers of much of the forest were relatively undisturbed and well developed. Palms, including *Attalea maripa*, *Chelyocarpus chuco*, *Oenocarpus bataua*, and others, were conspicuous and common. Other common plants included the giant herb *Phenakospermum guyannense* (Strelitziaceae), *Theobroma bicolor* (Sterculiaceae), *Apeiba tibourbou* (Tiliaceae), *Pseudolmedia laevis* (Moraceae), *Zanthoxylum ekmanii* (Rutaceae), an *Alseis* sp. (Rubiaceae), *Leonia glycycarpa* and *Rinoreocarpus ulei* (Violaceae), and several species of *Cecropia* and *Pourouma* (Cecropiaceae). *Piper* (Piperaceae), *Costus* (Costaceae), and a few species of Marantaceae and Melastomataceae were abundant in the understory.

Few trunks were covered by mosses at chest height, suggesting periods of drought. The few epiphytes found in this forest grew mostly on the larger, older Brazil-nut trees, which may be the best substrates because they are long-lived and seem to have bark that favors colonization (perhaps because of its ability to retain moisture).

OPEN PAMPAS (PAMPAS ABIERTAS)

In a broader regional context, the pampas in central Pando are outliers—peninsulas and islands, so to speak—in an archipelago of more continuous pampas that extend north-northwestward from the Departments of Beni and Santa Cruz. The annual rainfall decreases from north to south along this archipelago (Killeen 1998, p. 49), and the open pampas of Pando receive more rain on average than the pampas to the south. Because we have little information on runoff and surface retention, we cannot evaluate whether higher rainfall translates into higher relative humidity, and thus a lower propensity for fire, in the northern pampas.

One of the most striking characteristics of the pampas we visited was their remarkable flatness, in contrast with the rolling terrain of the surrounding forests. This lack of relief suggests very poor drainage, comparable to that of *sartenejal* habitats visited elsewhere in Pando (Alverson et al. 2003). We observed areas that were clearly seasonal pools. Other areas were covered by lateritic crusts and hard nodules of what appeared to be oxidized iron or aluminum. In contrast to many other pampas in Bolivia, termite mounds were rare or absent.

The open pampas varied from almost completely grassy (Figure 2C) to covered with discontinuous clumps of fire-resistant trees and shrubs, such as *Physocalymma scaberrimum* (chaquillo, Lythraceae), *Mollia* cf. *lepidota* (Tiliaceae), *Macairea* (Melastomataceae, Figure 3E), and several genera of Bignoniaceae, Fabaceae, and Malpighiaceae. A stipoid grass and another, large, sterile grass species with a hairy ligule margin (both yet to be determined) were ubiquitous.

We do not know how the pampas in the Área de Inmovilización Madre de Dios were generated, though we expect that the proximal cause is fire. The pampas we examined occurred on extremely flat, poorly drained, acid, and often seasonally inundated soils. The vegetation on these soils appears to be prone to drought and fire in dry years. In some overgrown pampa stands visited, the soil surface was covered with a thick and very dry layer of leaf litter beneath which was a thick, spongy root mat—a single match or lightning strike could start a hot and quickly spreading fire. We did observe charred trunks and stumps scattered across the pampas, but whether these fires were set by humans or lightning was not evident. Though florisitically similar to some types of open savannas present in Parque Nacional Noel Kempff Mercado, 600 km to the southeast in the Department of Santa Cruz (Killeen 1998), the open pampas of Pando may not be formed by the same soil characteristics or flooding regimes.

The most open pampas that we visited, east of Naranjal, were recently and conspicuously grazed by cattle. Cattle may also be present in other pampas in the area, but the relative importance of grazing (versus fire) in preventing the encroachment of trees and shrubs is not known. Once the specimens become available, we should be able to determine whether any of the grasses encountered on these pampas were exotics, brought in as pasturage for cattle.

OVERGROWN PAMPAS (PAMPAS ARBOLADAS)

The satellite image of the Área de Inmovilización Madre de Dios exhibits purple areas that are adjacent to, or surround, bright blue areas that signify open pampas (Figures 1, 2A). These purple areas are covered with relatively low forest, with a canopy that ranges from 5 to 15 m in height and is often dense and full of vines (Figure 2B). These overgrown pampas are apparently formed by natural succession in the absence of fire, but the rate of invasion of trees and shrubs is not known. The current distribution of open pampas and overgrown pampas, as seen in recent satellite images, is essentially the same as that shown on Instituto Geográfico Militar topographic maps compiled in 1982, from 1978 field data. This similarity suggests that change occurs slowly.

The overgrown pampas were complex. *Qualea albiflora* (Vochysiaceae) is often present and emergent to 20 m in the pampas north and east of Naranjal, but the other dominants changed from place to place. At the edge of the overgrown pampa at the end of the road south of Cotoca, *Qualea wittrockii* and a *Vochysia* sp. were emergent and common. Medium-sized trees of *Maprounea guianensis* (Euphorbiaceae), *Crepidospermum* (Burseraceae), and *Schefflera morototoni* (Araliaceae, Figure 3C) were common, as were the smaller *Miconia tomentosa*, *Graffenrieda limbata*, *Tococa guianensis*, and *Mouriri* (all Melastomataceae), *Psychotria prunifolia* (Rubiaceae), and *Vismia* spp. (Clusiaceae).

Ground cover varied greatly among the overgrown pampas visited. Some open areas were grassy or with bare soil, indicating that ponds were formed during the rainy season. Other areas had moderate to very deep leaf litter. On some of the poorest soils, we sank to our knees in the spongy litter and root mat. Nearby, the ground was covered by *Cladonia* lichens, in which two species of diminutive *Schizaea* ferns occurred, reminiscent of highly acid, sterile soils that we observed in central Peru at 1,200 m altitude (Foster et al. 2001).

We were not able to sample the full range of variability of the overgrown pampas during our short stay in the area. During overflights in March 2002, one of us (RF) observed another distinct type of overgrown pampa, dominated by a species of Vochysiaceae which can be seen on the satellite image as a very dark purple-gray area. This image suggests that other variants of overgrown pampas also remain unexplored in the area.

SIGNIFICANT RECORDS

Perhaps most notable of all was the presence of Brazil-nut seedlings and saplings (*Bertholletia excelsa*) along the roadsides throughout the old logged forest surrounding Cotoca. An actively reproducing population of Brazil nuts is rare and a significant asset for Pando. In the active *barracas* (Brazil-nut estates), humans collect virtually all of the Brazil nuts produced, reducing the number of seeds available for germination and growth. But perhaps many seeds fall off the tractor trucks used for harvest, or the intense hunting pressure in the area reduces the number of seed predators, thus increasing the number of viable seeds in at least part of the forest. We encourage further study of Brazil-nut reproduction, and protection of the upland forests here. This unique situation can yield potentially valuable information for *castañeros* (Brazil-nut harvesters) and the Brazil-nut industry throughout Bolivia.

In the well-drained, upland forest, the occurrence of the palm *Chelyocarpus chuco* was notable because it is at or near the western limit of its distribution here. To the west and north it is replaced by another species, *C. ulei*, which is common northwards through Ecuador. Another palm, *Oenocarpus distichus*, was both striking in appearance (Figure 3B) and notable in the pampas. It, too, is at the western limit of its range.

The pampas themselves, in all stages of regeneration, are unique habitats in Pando and significant in being the northernmost extension of this type of habitat in Bolivia (and adjacent Brazil). This type of habitat "jumps" the Beni River but does not seem to cross the Madre de Dios River to the north and west.

In one of the pampas, we were surprised to encounter *Caryocar brasiliensis*. This may be the northern– and westernmost record of the species. The presence of *C. brasiliensis* suggests that the habitat conditions here have something in common with *cerrado* vegetation. This species may be a rare outlier from the pampas just to the east of the Beni River, which from our previous observations have a high percentage of cerrado species.

The very common *Qualea albiflora* (Vochysiaceae) dominated several of the overgrown pampas that we examined and has been collected only once before in Bolivia, by R. Foster near Guayaramerín. Thus, it is a new record for Pando and is likely near the western edge of its range. We also observed this species in overgrown pampas on the eastern side of the Madera River during our travel between inventory sites.

The *Schizaea* ferns in the low forest at the overgrown pampa north of Naranjal seemed anomalous at such a low altitude. Their occurrence is probably due to the very poor, acid soils and poor drainage creating conditions like those in high, wet habitats in the Andes (where we have seen similar *Schizaea*), but we need to confirm the identity and distributions of the two species involved before we can say more.

PLANTS IMPORTANT TO WILDLIFE

The well-drained, upland forests contained many species of Moraceae (figs), Fabaceae (legumes), and large-fruited Arecaceae (palms) that provide edible fruits and seeds for wild animals. However, unlike the upland forests in western Pando that we inventoried in 1999, the populations of trees providing food and fiber to wild animals and humans in the Área de Inmovilización Madre de Dios do not appear to be considerably enhanced by long-term human intervention, with exception of the Brazil nuts.

In the pampas we saw far fewer species that would provide large quantities of food for wildlife. A few species of palm were present and relatively common, and several species of Melastomataceae and Rubiaceae produced edible, fleshy fruits.

INFERRED HISTORY OF HUMAN USE

According to Antonio Sosa E., who accompanied us and had worked in the area for five years, the roads that we used in the Cotoca area were built approximately 40 years ago to transport valuable timber to the main road and to the nearby tributaries of the Beni and Madre de Dios Rivers. Since that time, a large proportion of these upland forests has not been disturbed, except for hunting. Thus, the overall loss of plant species appears to be minimal in the region, though populations of many species were greatly altered.

The extraction of timber and other forest products in the immediate vicinity of the barracas and other settlements is relatively intense, as seen in the satellite images. Elsewhere in the forest, individual trees of value, such as *Amburana* (Fabaceae, locally called tumi or roble) or *Cedrela* (Meliaceae, cedro), are scarce. They are located and often branded when less than 50 cm in diameter and later extracted seasonally. At present, the net effect of this selective logging on forest quality seems small, except that the roads facilitate hunting. However, if additional access roads are constructed, we expect to see more severe consequences.

Virtually every Brazil-nut tree that we saw was tended and harvested. In contrast, we did see rubber trees (*Hevea brasiliensis*, Euphorbiaceae, locally called *goma*), scattered throughout the forest, but the trees bore only old tapping scars.

THREATS AND RECOMMENDATIONS

In the well-drained, upland forests, complete removal of the forest canopy for agriculture or cattle ranching is the

biggest threat. If it occurs, forest conversion will cause the local loss (extirpation) of some plant species, a great reduction in the number of individual trees that provide food for wild animals and humans in the area, and greatly increased soil erosion. For this reason, we recommend that the current forest cover be maintained and that care be taken not to drive economically important timber species to local extirpation through overharvest. We also strongly recommend a study of the population biology of Brazil nuts to understand better their exceptional success of reproduction in these forests.

In the pampas, the threats include (1) conversion to cattle pastures, (2) excessive burning, (3) too little burning, and (4) introduction of exotic grasses for pasturage. The third threat—lack of fires to which the ecosystem is adapted—is comparable to the loss of prairie and savanna habitats in the Midwestern United States when settlers began to suppress natural fires in the 1880s. We may never know the degree to which humans influenced the historical fire regime in these pampas, but we can predict that if fire is suppressed, diversity will erode slowly through loss of species favoring open conditions.

We recommend a study to document the speed at which unburned pampas are recolonized by woody vegetation and become overgrown pampas (pampas arboladas, or chaparral). We also recommend a study to determine whether grazing by cattle is a substitute for fire in maintaining species adapted to open conditions or, alternatively, a serious cause of species loss within the pampas.

AMPHIBIANS AND REPTILES

Participants/Authors: John E. Cadle and Marcelo Guerrero

Conservation Targets: A typical southwestern Amazonian herpetofauna and the intact, moist understory habitats that support it

METHODS

We sampled the forested region near Cotoca from 7 to 12 July 2002. Coordinates and general descriptions of these sites are given in the Overview of Inventory Sites section, above.

We primarily used transect sampling and random-encounter survey methods to inventory amphibians and reptiles. We also set out a linear, 60-m-long, drift-fence/pitfall trapline using 35-cm-deep buckets spaced at 6-m intervals. The trapline was placed in an area of minimally disturbed forest near the campsite. We attempted to obtain voucher specimens for all species encountered except for crocodilians, which were photographed. However, some species were recorded only by sight or (for frogs) by calls, as indicated in Appendix 2. We walked trails during both day and night surveys. In addition, we focused on specific kinds of microhabitats, such as ponds, streams, and rivers, that might be used by amphibians and reptiles. Voucher specimens are deposited in the Museo de Historia Natural "Pedro Villalobos" (CIPA, Cobija), the Universidad Nacional de Pando (Cobija), and the Museo de Historia Natural "Noel Kempff Mercado" (Santa Cruz). Representative samples will ultimately be deposited in The Field Museum (Chicago).

Our survey methods did not yield results interpretable as quantitative measures of species' relative abundances. Because we conducted the survey during the dry season, the most unfavorable period for activity of most amphibians and reptiles in the region, we did not detect certain species that we are reasonably sure are common or abundant elements of the fauna surveyed. In addition, reliably assessing relative abundance of most tropical rainforest herpetofaunas requires repeated measurements of relative abundances at the same site over long periods because of the strong dependence of amphibian and reptile activity on microclimatic variables at small spatial scales.

RESULTS

We recorded 19 species of reptiles (8 of snakes, 10 of lizards, and one crocodilian) and 19 species of amphibians (all frogs) from the study site (Appendix 2). All species except for one lizard (*Pantodactylus schreibersii*) were from forest habitats; we made only

a brief reconnaissance of the pampas in the area because of extreme dryness. Only one specimen (*Bachia* sp.) was obtained from the pitfall traps, and another specimen of this species was obtained by random search underneath a small rotting log. All of the species we recorded are common elements of herpetofaunas in southwestern Amazonia, and have been recorded at other well-inventoried sites in southeastern Peru (Manu National Park, Tambopata Reserve, Cuzco Amazónico [Rodríguez and Cadle 1990, Morales and McDiarmid 1996, Duellman and Salas 1991, R. McDiarmid pers. comm.]) and northern Bolivia (Reserva Nacional Manuripi [L. Gonzales, pers. comm.]). Many are widespread Amazonian species and are found, for example, in the region of Iquitos, Peru (Dixon and Soini 1986, Rodríguez and Duellman 1994); Santa Cecilia, Ecuador (Duellman 1978); or Manaus, Brazil (Zimmerman and Rodrigues 1990). The species of amphibian or reptile we observed are not local or regional endemics. The fauna is characteristic of other areas of northern Bolivia and southeastern Peru (Cadle and Reichle 2002).

Because we were sampling during the dry season, we detected only a small portion of the amphibians and reptiles that are expected for the study site. Frog activity was especially low, manifested by few active individuals, few species calling, and the absence of egg masses or tadpoles in aquatic habitats. Judging from more thoroughly inventoried sites in southwestern Amazonia, we suspect that the total herpetofauna for the Madre de Dios study site would be 140–160 species (approximately 80 species of reptiles and 60–80 species of amphibians). Our rapid inventory probably detected only about 25–30% of the frog species and 25% of the reptiles that might be expected. More complete inventories of amphibians and reptiles need to be conducted during the rainy season, and special attention should be given to pampa habitats, as these are the most likely habitats to harbor local or regional herpetofaunal endemics.

All of the species we observed or collected are characteristic of forest habitats. We did not sample the pampas in the region for two reasons. First, pampas are open habitats and much more subject to the effects of the dry season than the adjacent forests; our initial assessment of the lack of moisture in the pampas suggested that our time could be more productively spent sampling the adjacent forests. Second, the lack of trails or other access through the pampas made an adequate sample of small cryptic organisms, such as most amphibians and reptiles, difficult because these habitats have a dense cover of woody and herbaceous vegetation. However, we think that future surveys of the herpetofauna of this region should pay particular attention to the pampas (see recommendations for research below).

THREATS AND RECOMMENDATIONS

The herpetofauna represented in our sample does not suggest any particular importance of this area in terms of amphibian and reptile conservation. None of the species observed is recognized as endangered either regionally or internationally. Other sites in the general region of Pando probably have herpetofaunas at least as intact as that represented at Cotoca, and many are probably less disturbed by logging and hunting. Nonetheless, future studies should focus specifically on the pampas in the region to assess endemism and species richness of these habitats that we did not sample.

The most general threat to maintenance of this herpetofaunal assemblage is forest disturbance and clearing, though we cannot specify or quantify these effects in detail. The most damaging influence of forest disturbance insofar as the herpetofauna is concerned is a general drying of forest microhabitats (e.g., leaf litter) that are very important for many species of amphibians and reptiles. Any management of these forests should strive to maintain more or less intact moisture, light, and temperature regimes of the understory, leaf litter, and ground surface.

NEEDS AND OPPORTUNITIES FOR FUTURE INVESTIGATION

Long-term surveys of herpetofauna are in short supply in most of Amazonia. Although several sites have been

surveyed within southwestern Amazonia, the micro-geographic scale of the distribution of some species indicates that we can learn much from surveys in new regions. Obviously, for amphibians and reptiles, these surveys should be conducted during the seasons most favorable for activity (i.e., the rainy season).

We need to understand the effects of disturbance on particular species of amphibians and reptiles. This phenomenon has been studied in Amazonia only in the vicinity of Manaus, Brazil (Zimmerman and Rodrigues 1990). These studies should be replicated, especially in the different forest types that are present in southwestern Amazonia but not in central Amazonia. Historical records of forest disturbance in Pando offer an opportunity to evaluate these effects on individual species of amphibians and reptiles.

Specific targets for future inventories and research, and some special opportunities, are afforded by the pampas in the sampled region of Madre de Dios. The pampas are the least known, herpetologically, of any habitats in northern Bolivia and southern Peru. This provides a strong motivation to inventory them thoroughly. These habitats are also the most likely to harbor locally or regionally endemic amphibians or reptiles. Furthermore, the pampas offer an opportunity to conduct a multifactorial study of the effects of habitat fragmentation and other factors on the composition of local herpetofaunas. The pampas are, in essence, islands surrounded by a sea of forest. They vary in size, vegetation cover, frequency of burns, frequency and duration of inundation, and many other characteristics. Both the theory of island biogeography and its empirical results can be applied to the series of pampa islands in northern Bolivia and southern Peru. In addition to its considerable theoretical and empirical value, such a study would have direct conservation implications because the effects of varying levels and types of disturbance on herpetofaunal communities could be assessed and applied to management of these ecosystems. Such an approach should also be applicable to organisms other than amphibians and reptiles that are reasonably sedentary and unlikely to cross expanses of forest to reach other pampa islands (e.g., plants with limited dispersal ability, certain insects).

BIRDS

Participants/Authors: Brian O'Shea, Johnny Condori, and Debra Moskovits

Conservation Targets: Large birds hunted for food and medicine; pampas birds; parrots

METHODS

From 7 to 12 July 2002 we walked roads and trails in and around the Área de Inmovilización Madre de Dios to locate and identify birds. Observers usually walked alone, and did not travel far within sites because of the short duration of our visits. We concentrated our survey effort in forest along the road near our base camp at Cotoca and spent all of our early mornings there. On days when we traveled by vehicle to sites away from base camp, O'Shea and Condori departed camp well before first light, walking down the road in the direction in which we were to travel, to be picked up by the rest of the team about one hour after sunrise. On these days, we usually did not return to camp before dark, but if any light was available upon our return, O'Shea walked the road until dusk.

We never reached pampas before midmorning, when bird activity had virtually ceased, but we attempted to locate birds in these areas by walking available trails and roads. We also walked along the edges between pampas and tall forest and, in late afternoons, across the pampas themselves. In all cases we were limited in our coverage by time—some sites were surveyed only for a few hours—and consequently by the need to remain relatively close to our vehicle.

All field observers carried binoculars, and O'Shea carried a cassette recorder with a directional microphone to record bird sounds.

RESULTS

We observed 241 species at the Madre de Dios study sites. Of these species, we recorded 210 from the forest near Cotoca and southward, and 81 from pampas and associated forest islands and edges. The forest avifauna seemed incomplete for southwest Amazonia.

We noted many mixed-species canopy flocks of flycatchers and tanagers, some of which were very species-rich. On several occasions, we recorded flocks containing more than 40 species. Common species in these flocks included *Ancistrops strigilatus*, *Myrmotherula sclateri*, *Tolmomyias poliocephalus*, *Hylophilus hypoxanthus*, and *Tachyphonus cristatus*. By contrast, we observed few understory flocks, and several thamnophilid and furnariid taxa that occur in such flocks elsewhere seemed rare or absent. For example, *Automolus ochrolaemus* was not common, and we noted *Thamnomanes ardesiacus* on just two occasions, and never in association with other species. *Habia rubica*, a highly vocal species that often forms the nucleus of understory flocks, was not detected. We found little evidence of army ants, but we recorded *Gymnopithys salvini*, an obligate army ant follower.

The logging that has occurred in and around the Área de Inmovilización may have affected the structure of the forest to make it unsuitable for species usually associated with the dim understory of primary forest. The retention of large Brazil-nut trees, combined with a well-developed middle stratum, seems to provide canopy birds with acceptable habitat, though we noted some unexpected absences. For example, *Pitylus grossus* and *Lanio versicolor*, two species that are typically common members of canopy mixed flocks in southern Amazonia, were not detected in the area.

Bird species usually hunted in Amazonia were rare at our study sites. Most surprising was the low abundance of terrestrial doves (*Geotrygon*, *Leptotila*); we heard them on very few occasions and saw only one, flushed by our vehicle along the road near the Cotoca Camp. Large tinamous (*Tinamus*) were also rare, with only one species encountered; we never saw one, and heard them only rarely, always very late at night (between midnight and 5:00 a.m.). *Penelope*, a large guan that is intensively sought for food, also seemed rare; we saw only one, though we heard one or two daily at dawn. We found no evidence of curassows (*Crax*). Large parrots, particularly macaws (*Ara*), were very scarce. Virtually every local person encountered along the roads was carrying a shotgun or rifle, and frequently a bag of freshly killed game (Figure 4D). The rarity (or perhaps extreme shyness) of these bird species, combined with our observations of hunting by local people, suggests that hunting pressure is very heavy on large forest birds in this area.

The most noteworthy forest species that we encountered in our survey was *Morphnus guianensis*, a raptor that needs large areas of intact forest and healthy populations of its preferred prey (small- to medium-sized arboreal mammals) to survive. Its presence was surprising given the disturbed state of the forest and the apparently low populations of large birds and mammals. Unfortunately, the only individual that we encountered was a fledgling that had been killed by a local hunter, apparently for medicinal purposes.

The pampas avifauna was not surveyed adequately. We never reached these sites before midmorning and usually departed to base camp in midafternoon. We thus surveyed the pampas when the resident birds were least active. Strong breezes during midday further hampered our survey effort. As a result, we recorded relatively few species from these areas. We did survey one patch of pampas near Naranjal until sunset on 10 July. Despite the sub-optimal conditions during our surveys, we recorded several species expected in the pampas but not in forested landscapes in the region. All of these species (except *Schistochlamys*) are new records for the Department of Pando: *Gampsonyx swainsonii*, *Micropygia schomburgkii*, *Formicivora grisea*, *Elaenia cristata*, *Tyrannus albogularis*, *Xenopipo atronitens*, *Schistochlamys melanopis*, and *Ammodramus humeralis*. The presence of these birds indicates that several savanna-inhabiting species have colonized the relatively small and isolated patches of pampas in Madre de Dios, presumably from the much larger

savannas to the south and east, in the Departments of Beni and Santa Cruz. However, we did not find other conspicuous savanna species that are characteristic of Beni. These species include *Xolmis cinerea* and *Nystalus chacuru*, which have been recorded from the even more isolated, but larger, Pampas del Heath in Peru. Given the apparent absence of these species, we question the ability of the pampas of Madre de Dios to sustain a representative suite of obligate savanna species, especially those that are typically associated with wet savanna (all areas surveyed were very dry). A more thorough survey of the characteristics of Pando's pampas is necessary before we can draw more concrete conclusions regarding their value to bird conservation.

THREATS AND RECOMMENDATIONS

The avifauna of Madre de Dios faces threats from hunting and degradation of habitat. We recommend a more thorough inventory of the pampas, as well as monitoring of the populations of game birds and parrots. A study of the responses of the understory bird community to maturation of the forest would also be of interest. Finally, education of local residents could reduce the killing of animals for ineffective folk medicines.

LARGE MAMMALS

Participants/Authors: Sandra Suárez and Gonzalo Calderón

Conservation Targets: CITES I and II species; large mammals

METHODS

We inventoried nocturnal and diurnal large mammals with a combination of methods, including visual sightings; secondary clues such as distinctive odors, tracks, vocalizations, nests or dens; and other evidence such as chew marks, holes, urine, and feces. These data were collected by walking transects and roads between the hours 6:30 a.m. and 6:30 p.m. for diurnal mammals and from 6:30 p.m. to 12:15 a.m. for nocturnal animals. We completed 48.5 observer hours over three days. We visited the following sites: Cotoca Camp and vicinity (22.75 h); Cotoca Road South (8 h); Pampa de Blanca Flor (8 h); Pampa Arbolada, Naranjal Noroeste, and Pampas Abiertas Naranjal Este east of Naranjal (9.75 h). Records at other sites are based on observations from other biologists.

To complement this simple survey method, we created "track scrapes" along one transect at Cotoca. These scrapes were produced by clearing all the leaf and other organic debris from an area along a transect and sifting approximately 1 cm of dirt over the clearing using 2-mm plastic mesh. We made 14 scrapes approximately 100 m apart, each measuring approximately 50 by 100 cm. These pits were revisited once after 24 h to check for animal tracks. Unfortunately, this method did not prove to be very effective. We recorded most animal tracks along stream edges, roadsides, and in mud wallows.

Each group or solitary animal recorded was counted as one registry, and we were careful to count only once the same group or animal seen by several observers. For tracks, we counted one record per site, wallow, stream edge, or mud pit along a road. Whether one animal/group or several animals/groups left tracks in an area, we noted a single record, as we could not distinguish among the tracks of individuals or assess the age of the tracks, which in most cases were drying out. Therefore, we believe our records to be underestimates of the actual numbers of individuals present.

We estimated abundance per taxon based on the number of registries during our field inventory. The five categories for abundance are as follows in descending order: abundant, more common, common, less common, and rare. Species that were expected but not registered are listed as such. These categories are broad and take into consideration the expected abundance for the animal in question and whether the records are based on sightings or secondary evidence.

"**Abundant**" describes species that are commonly seen, or which may be difficult to see, but with very common secondary evidence.

"More common" describes species that are sometimes or commmonly seen, or whose secondary evidence is commonly seen.

"Common" refers to animals that are not difficult to see, or whose secondary evidence is normally present in an area, but are not as widespread as "more common" species.

"Less common" is a category including species that are not normally common to see, but are registered more than once.

"Rare" is used for species that are usually almost never seen but were registered at least once.

We placed some species in different categories, even though they were registered almost the same number of times, by comparing their abundance at the rapid inventory sites with their abundance elsewhere in the region. For example, agoutis (*Dasyprocta variegata*) are abundant in most regions of Pando but are heavily hunted in the Madre de Dios study sites. We saw none, and registered only four records based on tracks, so we estimated their abundance to be "less common." On the other hand, we recorded ocelots (*Leopardus pardalis*) five times, and three of these records were actual sightings. Since ocelots are not commonly seen elsewhere in the region, we categorized these animals as "common" in Madre de Dios.

RESULTS

We recorded 23 species of large mammals in Madre de Dios, half of the 46 species that we expected in the area. Our expectations were based on observations in other areas of Pando and on distribution maps in Emmons (1997). Most of our records came from tracks, with very few sightings of large mammals during the inventory. When compared to the rest of Pando and other Amazonian regions, the area appears to have a low density and species richness of large mammals (in particular, primates, which are very common and species-rich in most of Pando). We recorded only 5 out of a possible 10 primate species, of which the most common was the brown capuchin monkey (*Cebus apella*), which was seen only three times during the inventory (including one sighting in a hunter's knapsack). Even small primates such as saddleback tamarins (*Saguinus fuscicollis*) and night monkeys (*Aotus nigriceps*), which are very abundant throughout Pando, were very rare at the Madre de Dios inventory sites.

Small cats (*Leopardus*), including ocelots (*Leopardus pardalis*) and to some extent margays (*L. wiedii*), were the only large mammals that may be more common than expected. We spotted them several times. The reason for their apparent high density is unclear but may be due to an abundance of prey items. Although small mammals were not formally inventoried, we noted a high level of nocturnal activity of small rodents (Muridae and Echimyidae) and opossums (Didelphidae), which are primary prey items for *Leopardus*.

Especially scarce were the mammals most commonly hunted by humans. These include all very large-bodied species, such as deer (*Mazama* spp.), tapirs (*Tapirus terrestris*), and peccaries (*Tayassu* spp.), and large primates like howler monkeys (*Alouatta sara*). Even smaller mammals, such as agoutis (*Dasyprocta variegata*) and pacas (*Agouti paca*), that are usually very abundant in Pando despite hunting were relatively rare at the Madre de Dios study sites. We recorded these species primarily by tracks. Given how often we saw human-killed animals in the short time that we were in Madre de Dios (Figure 4D), we suspect that the primary reason for these low densities is excessive hunting. Similar observations were recorded for large-bodied, commonly hunted bird species (see Birds, above).

THREATS

The low abundance and density of large mammals at Madre de Dios may be due, in part, to the natural history of the area, where open pampas and pampas in various stages of secondary growth may reduce colonization by large forest mammals. Logging 30–40 years ago may have reduced populations of large mammals, although other logged areas of Pando do not have such dramatically low

densities, and mammal populations should have recovered at least partially after so many years.

Although habitat destruction is a threat to large mammals everywhere, it does not seem to be a primary threat to these populations. At present, neither large cattle pastures nor agricultural developments characterize this region.

We believe that the primary threat to large mammals in the area is intense hunting. With a local market for bushmeat nearby, and a heavy demand for animal protein by local inhabitants, the density of large mammals has suffered. If large-mammal populations were depressed by logging or limited by the natural history of this area prior to the arrival of human settlements, they may not recover because of the intense hunting pressure now exerted by the human inhabitants of the region.

RECOMMENDATIONS

We recommend educational efforts devoted to natural-resource management and aimed at local communities. The primary concerns should be hunting and programs for long-term sources of protein. If residents understand the severe, long-term consequences of their current consumption of bushmeat, they will have a foundation for changing their behavior and for securing protein sources for themselves and future generations.
The danger to the mammal populations presented by the local market for wild meat is no doubt linked to a lack of economic alternatives for local people. Any program developed and implemented in the region should address such alternatives concurrently with conservation issues.

For a further understanding of mammals in this region we recommend more inventories, particularly in the pampas areas, where we were unable to inventory at night. Small rodents (Rodentia) would also be interesting to study in the pampas. A small-mammal inventory is needed to understand fully the mammal populations in Madre de Dios. Nocturnal rodents were moderately to highly abundant in the forested areas; they should be evaluated as a conservation target and their species richness should be assessed.

HUMAN COMMUNITIES

Participants/Authors: Alaka Wali and Mónica Herbas

Conservation Targets: Brazil-nut harvesting as a primary economic activity; long-term sources of wood and protein (including wild game)

From 25 to 27 July 2002 we visited three communities: Blanca Flor, the municipal seat of the Municipality of San Lorenzo; and Naranjal and Villa Cotoca, both of which are within an area petitioned for status as a *Tierra Comunitaria de Origen* (TCO; the designation that affords legal status for indigenous lands). Because we had only three days for the visit, interviews with key informants and town meetings in each community were the sources for the information reported here.

HISTORY

The three communities share a common history.
In the early part of the twentieth century, wealthy elites established estates (*barracas)* to harvest rubber and Brazil nuts and brought laborers from other parts of Bolivia, including Tacana Indians from the Ixama region of the Department of La Paz (who came during the 1940s), as well as Ese-Eja Indians and people from the Department of Beni. Between 1950 and 1980, the economy based on rubber and Brazil nuts collapsed and the estate owners largely abandoned their operations, leaving the workers to fend for themselves. Gradually, the communities organized and obtained *personería jurídica* (legal status as an incorporated community): Blanca Flor (founded on the barraca of Nicolás Suárez) obtained its status in 1953, and Naranjal and Villa Cotoca in 1995.

In the late 1990s, the community of Naranjal, together with the other indigenous communities in the municipality, decided to petition the national government for designation as a TCO. The community claimed the former lands of the Empresa Hecker, then a prominent family-owned enterprise. The petition is still pending as the indigenous communities and the government of the municipality attempt to reconcile a dispute about the TCO boundaries. Villa Cotoca joined the petition only

very recently (in May 2002), because initially they were not sure if they constituted an indigenous community, since they have a mixed population.

DEMOGRAPHY

The Municipality of San Lorenzo, of which Blanca Flor is the municipal seat, comprises 33 communities, of which 11 consider themselves primarily indigenous (Tacana, Ese-Eja, and Cobiana). Blanca Flor has approximately 450 inhabitants, Naranjal has 197, and Villa Cotoca 91 (according to leaders in each community). The three communities have similar settlement patterns, with the majority of houses concentrated together and a few houses dispersed on the outskirts of the settlement. Blanca Flor (Figures 4E, 4F) has a main central plaza, which at the time of the visit consisted mainly of a large grassy field (big enough for landing a small airplane), although a more formal plaza was also under construction. Surrounding the main field are the municipal office buildings, some residences, and the health clinic, which was built in 2000 and has inpatient capacity. The school is at one end of the central field. Several small streams run through the town; they provide drinking water and are used for bathing and washing clothes. Naranjal, which also lies near a stream, is situated about 20 km northwest of Blanca Flor along the main road between Cobija, Sena, and Riberalta. It does not have a major plaza and houses more commonly have thatched roofs. Villa Cotoca is approximately 14 km west of Naranjal on the road between Naranjal and Sena. It appears much smaller than the other two villages and is set back from the road a short distance, with a few houses on the opposite side of the road. Here a grassy field seems to serve as a soccer field.

In the last ten years, migration apparently has increased due to the opening of the road between Riberalta and Cobija. Most of the migrants are from the Department of Beni. Although only 11 of the settlements in the municipality are self-declared indigenous communities, almost all of the communities are multi-ethnic, according to the mayor of Blanca Flor. The mayor stated that in the other communities there is a reluctance to recognize the indigenous heritage of the people.

ECONOMY

The economy of all three communities is based primarily on subsistence-oriented horticulture. The principal source of income for the majority of people is the sale of Brazil nuts. Secondary sources of income are the sale of rice and fruits from the horticulture plots and (apparently) the sale of game meat (principally in Naranjal and Villa Cotoca). We do not know the extent of the trade in bushmeat, or how much revenue it generates, but the biological team observed hunters carrying fresh game every day in the field. A third source of income is day labor on the nearby cattle estates scattered along the roadsides (this seems to apply more to residents in Blanca Flor), but we were unable to ascertain the number of cattle estates in the municipality. Additionally, in Blanca Flor some residents work full time for the municipal government and may not even have horticultural plots. Most of the sale of products occurs in exchange with entrepreneurs from Riberalta. Either residents of the communities travel to Riberalta and sell their products there, or middlemen come from Riberalta to buy the products from community members. Knowledge about, or exchange with, Cobija did not appear to be extensive. Residents from Blanca Flor seem to work primarily as nuclear family units. Residents of Naranjal and Villa Cotoca stated that they did horticultural work communally.

Particularly in Blanca Flor, occupations and specialization are diverse. Naranjal and Villa Cotoca, which are smaller and more oriented toward subsistence horticulture, do not appear to have the same level of occupational diversity.

SOCIAL ORGANIZATION AND INFRASTRUCTURE

The three communities all orient themselves administratively to the municipality. Now that Naranjal and Villa Cotoca have joined in the petition for the TCO, they

also work with the primary organization representing indigenous communities in the Pando, the Central Indígena de Pueblos Amazónicas de Pando (CIPOAP); Naranjal is more closely connected to CIPOAP than is Villa Cotoca. The communities involved in the TCO petition also rely on a Santa Cruz-based nongovernmental agency—(CEJIS)—to provide legal advice for their petition.

Blanca Flor, as the municipal seat, has the closest relationship with the municipal government and is home to the mayor of the municipality as well as other government officials. Naranjal and Villa Cotoca also have communal governance mechanisms, such as a community president and an *Organización Territorial de Base* (OTB). The municipality counts on the strong presence of a *sindicato*, a type of citizens' organization designed to monitor local government activities and hold elected officials accountable. The head of the municipal branch of the sindicato indicated that he was trying to mediate between the municipal government and the communities advocating for the TCO. *Comités de Vigilancia*, whose role is to monitor the governmental structures, also are present in the various communities.

Blanca Flor has the largest health center in the region, staffed by several nurses and visiting doctors who come on regular rotation. Also, Blanca Flor has an integrated school system (i.e., several levels unified under one administration) and includes a secondary school. Both Naranjal and Villa Cotoca have primary schools only; Naranjal's school has two classrooms, and Villa Cotoca one. Blanca Flor has a large meeting hall for municipal assemblies and several small churches. Villa Cotoca has a Catholic church.

All three communities have easy access to the main road between Cobija and Riberalta. Additional means of communication are afforded to Blanca Flor by a public telephone connection maintained by ENTEL, the national telephone agency. All three communities use radio as a communication medium as well (although only Blanca Flor has a radio communication system). Vehicular traffic is frequent in these communities, and some residents have motorbikes for personal use.

When asked about the role of women in Blanca Flor, people at a town meeting asserted that women are active participants in the economic and social life of the community and are perhaps more concerned than are men for the protection of the natural resources because they must pay attention to the use of water, fuel, and other resources used in daily domestic life. One woman spoke of her concern that fires set to clear land for planting were not carefully monitored and could be potential threats to the environment.

RESIDENTS' CONCERNS AND ATTITUDES ABOUT CONSERVATION

Although the short duration of our inventory did not permit us to delve into details, interviews and town meetings revealed that community leaders and residents definitely were interested in local biological diversity and desired to learn more. In Blanca Flor, local municipal authorities were eager to obtain the results of this rapid biological inventory (and the inventory team has been informally invited to return and make a public presentation), as was also the case in Naranjal and Villa Cotoca. Curiosity about how the RBI team conducts its inventories was high, particularly in Villa Cotoca, where residents had the opportunity to visit the base camp or witness team members collecting the data. Also, in Blanca Flor the director of the integrated school system and the head of the Asociación de Padres de Familia (APAFA; the equivalent of the Parent–Teachers Association in the United States) were extremely interested in developing teaching materials about the local biological diversity and integrating environmental education into the curriculum for all grade levels. In general, although attitudes toward the environment are heterogeneous, residents' primary concern is maintaining a viable livelihood, but with some sensibility toward sound management of natural resources.

Expectations in the three communities center on obtaining access to technical assistance for developing sound resource management strategies. In Blanca Flor, these expectations have high priority for municipal leaders and also for the residents, who hope

that collaborating with conservation efforts can assist in improving the quality of their lives. However, residents assert that any intervention should be accomplished through full consultation with community and municipal authorities. Municipal council members at a meeting expressed skepticism about nongovernmental organizations, which they stated had often started projects but then abandoned the community or otherwise failed to follow through.

Residents stated their need for improved means of transport to gain more efficient access to the market. They expressed concern that the new forestry law (Ley Forestal) is not evenly applied and that large-scale lumber operators could benefit at the expense of small communities. For example, the mayor of Blanca Flor stated that the municipality was not receiving any "royalties" from concessions, and that because the Superintendencia Forestal in the vicinity lacks a forestry unit, they had no way to monitor illegal logging. For authorities in Naranjal and Villa Cotoca, obtaining final approval from the Instituto Nacional de Reforma Agraria (INRA) for the TCO petition was a paramount concern. They perceive that a secure land title is a necessary first step to better management of their natural resources.

THREATS, ASSETS, AND RECOMMENDATIONS

Threats to effective conservation efforts include the increase in migration to the zone, the lack of trust in departmental-level government and international development efforts (because of a history of failed projects, implemented with little or no follow-through), and historical lack of technical support for the development of resource management plans. Also, natural resources have been overexploited, as evidenced, for example, by the sale of bushmeat (which deserves further investigation). Another potential obstacle for conservation efforts is the dispute over the boundaries of the proposed TCO between the municipal government and the indigenous communities.

The social assets we identified during our visit include (1) the apparent mechanisms for achieving consensus at the community level, (2) an indication of a solid form of social organization, (3) a history of efforts to organize the communities and obtain legal recognition of their incorporation as well as the efforts to establish the TCO, and (4) the active participation of community residents in civic life. Also, the enthusiasm of the school directors for access to environmental education program indicates a willingness to collaborate with conservation efforts. The efforts to recuperate and revitalize indigenous knowledge systems and cultural practices in Naranjal and Villa Cotoca also indicate a desire to maintain a distinct cultural identity that can be compatible with a low-impact, ecologically sensitive mode of livelihood.

Our recommendations for conservation efforts in this region are the following:

(1) Work through municipal and local community leaders after providing a detailed presentation of the rapid biological inventory results. The presentation should be organized with sufficient advance notice to allow authorities to inform community residents about upcoming assemblies.

(2) Investigate further possibilities of creating environmental education programs that incorporate the rapid biological inventory findings through development of curricular materials, maps, and other products for classroom use.

(3) Conduct a full-scale asset mapping prior to designing active intervention efforts.