A Call to Protect
Sierra Bermeja for
Future Generations
Contact

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A Call to Protect Sierra Bermeja for Future Generations

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Figure 2, map prepared by Manuel Cruz and Ilse Sanders

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President's Message

We are living in times where the conservation of our natural areas has become more significant due to the pressures we have created ourselves over our own land. Puerto Rico's economic and urban development over the past decades has cast a difficult situation over many of our bird species and other living beings that share our territory, including ourselves as human species. We have torn down our traditional communities, our natural areas, and our agricultural resources endangering our health and our quality of life. This is why, harmonizing the conservation values and the protection of our fauna with the needs of a growing human population (though a hard task that requires a lot of time and effort) has become even more critical for our survival.

The Puerto Rican Ornithological Society (PROS), celebrating ten years of conservation work, has resolved in its five-year plan to become the essential leader and voice for the conservation, management and all issues related to birds in Puerto Rico. As a vital organization for environmental conservation, PROS will base its opinions in the best scientific evidence available and will actively participate leading the efforts to create conscience of the need to protect, restore, and manage areas of great importance to birds. It has been four years now that SOPI, in partnership with BirdLife International and the support of many organizations, has worked in Puerto Rico on the Important Birds Areas Program (IBA), which has become the standard for the conservation goals of our organization.

Sierra Bermeja is a unique place with extraordinary characteristics that deserve protection. PROS chose the Sierra as the IBA pilot project with the hope for it to become one of the most important community supported conservation efforts in Puerto Rico. The most fundamental goal to achieve the conservation for this notorious place is going to be the education and environmental conscience building of the local people. This will be the programs greatest challenge as well. We know that integrating the program into the school curriculum will have a lasting impact on the new generations of children in the community, who will be the future caretakers of the land. To protect something, you have to know it first.

Moreover, scientific research supported by the program will be the essential tool to support the educational work planned. The integration of scientists to the conservation work will positively impact the response from the area’s decision makers. A well-informed land use planning and an understanding from politicians and landowners about the importance of Sierra Bermeja will be the key to its conservation. To know something, you have to understand it first.

Alliances with similarly oriented organizations and governmental agencies are the threads that strengthen the fabric of conservation. Globally every successful conservation effort has been achieved through the integration of many actors to join in the works. This interlace permits the distribution of responsibilities and sews the mutual support needed for such big undertakings as the protection of natural areas. PROS is going to be the needle sowing the conservation thread for Sierra Bermeja because to know and proteect something you must share it.

In summary, the Puerto Rican Ornithological Society is proud to present this call for the conservation of Sierra Bermeja. The road still needs to be built but we have a clear direction of where we are going. Only with enthusiasm and dedication from everyone, we can share with future generations this marvelous place so important for us and for our birds.

Humbly we thank all people involved in the preparation of this document, which is not simply the end of some work that has been done. It is a reflection of all the effort undertaken and, at the end of the day, a map for those things we still need to do.

Blessings

Joel Franqui Gil de Lamadrid
Sierra Bermeja is a 1,537 ha range of hills lying on the most ancient rocks of the Caribbean plate between the municipalities of Cabo Rojo and Lajas, in southwestern Puerto Rico. This area is within the Subtropical dry forest life zone and has great conservation value due to its high biological diversity, geological significance, and comparatively low urbanization.

Sierra Bermeja was selected as the demonstration project of the Puerto Rican Ornithological Society’s (PROS) Important Bird Areas Program because it is home to the globally critically endangered Puerto Rican Nightjar. It is also one of the few locations within the island where a large number of endemic birds coexist. The main threat to bird species in Sierra Bermeja is habitat loss and fragmentation due to deforestation.

The area also boasts large numbers of endemic plants, some of which are only found in Sierra Bermeja or in the southwest of the island. The geology of Sierra Bermeja is unique and of historical importance for the Caribbean. Furthermore, the position of Sierra Bermeja makes it a critical area for the connectivity of a number of protected Commonwealth Forests and many unprotected but important natural areas. Like most of Puerto Rico, Sierra Bermeja was almost entirely deforested by the early 20th century. However, it has experienced relatively less urban development than other parts of the island. Thus most of the Sierra remains in recovering forest or agriculture amenable to conservation and restoration.

PROS proposes the following conservation activities for Sierra Bermeja:
- land acquisition and conservation easements
- sustainable land use through collaboration with local landowners
- public education and participation, particularly focused on children.

The next steps in protecting this unique area are:
- develop the capacity and infrastructure (or identify a partner) to engage in land acquisition
- plan strategies for land and biodiversity conservation
- develop an environmental curriculum for local schools.

Long-term protection of Sierra Bermeja’s unique landscapes, flora, and fauna will depend on the participation and motivation of the local community.
A Case for Protecting Sierra Bermeja

Sierra Bermeja

Sierra Bermeja is a range of hills that covers 1,537 ha in the municipalities of Cabo Rojo and Lajas, in the southwest of Puerto Rico (Figure 1). The range extends 9 km from west to northeast and is approximately 3.25 km at its widest part. Elevations range from 15 m to 301 m above sea level on Cerro Mariquita. Sierra Bermeja (17°59’N, 67°7’E) is within the subtropical dry forest life zone, with an annual rainfall of 600-1,100 mm (Ewel and Whitmore, 1973). Sierra Bermeja lies on 195 million-year-old serpentine rocks, considered the most ancient rocks of the Caribbean plate. Red-ribbon chert rock is abundant and gives Sierra Bermeja (“vermillion hills”) its name.

Conservation Significance: An Internationally Important Ecosystem

Puerto Rico, the easternmost island of the Greater Antilles, is part of the Caribbean hotspot of biodiversity (Myers et al., 2000). More than 3,100 plant species are found on the 8,897 km² island, including at least 250 endemic plants (Liogier and Martorell, 2000). In addition, at least 203 introduced trees and shrubs are found on the island (Little et al., 1988). In Puerto Rico, 354 bird species, including 16 endemics, have been reported (Raffaele et al., 1998). Eleven of these species are considered globally threatened (Raffaele et al., 1998). Puerto Rico, like most islands in the Caribbean, has been heavily deforested and subject to exotic species invasions (Franco et al., 1997; Lugo and Brown, 1999; Rivera et al., 2000). Habitat loss and fragmentation, as well as introduced or recently arrived species are responsible for the precarious status of many native plant and animal species.

Sierra Bermeja has been selected as the demonstration project of the Important Bird Areas Program on the island because of its critical importance for conservation.

At least 85 (20 %) bird species are found in this area (see Avifauna, page 13) and it is one of the few locations within the island where a large number (12, or 75 %) of endemics coexist. These include two globally endangered species, the Puerto Rican Nightjar (Caprimulgus noctitherus) and the Yellow-shouldered Blackbird (Agelaius xanthomus) (IUCN, 2004).
In addition to the avifauna present, Sierra Bermeja has global biodiversity value because of its ancient geology and the floral diversity found in its soils. Serpentine soils are well-known for the high biodiversity they sustain (Kruckeberg, 1954). Indeed, the flora of Sierra Bermeja comprises many endemics and threatened species. Also present in these hills are five federally endangered plants that are restricted to southwestern Puerto Rico (USFWS, 1996). This area is also one of the only known locations of a rare, endemic mistletoe, *Dendrophthora bermejae* (Viscaceae) (Kuijt et al., 2005).

Furthermore, the position of Sierra Bermeja makes it a critical area for connectivity of a number of protected and privately owned but important natural areas (Figure 1).

Sierra Bermeja is surrounded by Peñones de Melones, the Cabo Rojo salt flats, Punta Guaniquilla and Boquerón State Forest to the west, Cartagenas Lagoon and the Lajas Valley to the north, the Bioluminescent Bay and La Parguera to the east, and Pitahaya State Forest to the south. It is also less than 25 km from three other important state forests in the subtropical dry forest life zone with which it shares many species. Guánica State Forest, a Man and the Biosphere Reserve (UNESCO), lies to the east. To the north of Sierra Bermeja are Susúa and Maricao State Forests, both of which also have primarily serpentine soils and share plant species that are restricted to this soil type. Thus, Sierra Bermeja contains critical habitat for conservation of birds and other species and is crucial for the connectivity that can help to maintain the long-term persistence of these species in a rapidly developing landscape (Wiens, 1989; Tillman and Kareiva, 1997).

**A Critical Time for Conservation**

Puerto Rico experienced near total deforestation in the last century. By the late 1940’s, the total forest cover on Puerto Rico was reduced to approximately 6 % (Birdsey and Weaver, 1987) and even those areas considered primary forest have been impacted by human activity (Harcourt and Sayer, 1996; Foster et al., 1999). However, changing economic conditions led to the abandonment of many agricultural fields and plantations, and by the 1990s forest cover had increased to approximately 33-42% (Birdsey and Weaver, 1987; Helmer, 2004). Many of these formerly altered lands have developed into species-rich and structurally complex forests that support a range of ecosystem services and processes. This transformation offers a ray of hope for the preservation of species and the maintenance of functioning ecosystems.

However, today these newly recovered forests are being threatened by commercial, residential, and agricultural development. Urban development in Puerto Rico is proceeding at an unprecedented rate. For example, urban or built up lands increased 7.2 % between 1991 and 2000 (Helmer and Ruefenacht, 2005). This puts plants, animals, and ecosystem services at risk and increases the danger of species extinctions and damage from natural catastrophes such as flooding.

Sierra Bermeja is in an area of Puerto Rico that has experienced relatively less urbanization than many parts of the island. Thus most of the Sierra remains in recovering forest or agriculture. However, only 78 ha (approximately 4 %) of the Sierra - La Tinaja section of the Laguna Cartagena National Wildlife Refuge - is under protection as a U.S. Fish and Wildlife Service...
(USFWS) National Wildlife Refuge. The remaining 96% of this habitat lies on private properties. Even though the Sierra has been designated as a conservation zone by the State government, the area is susceptible to unsustainable farming practices and is threatened by deforestation for cattle ranching, arson fires, land segregation for sale into small residential lots, off road vehicle damage, and installation of communication antennae. There are also plans to build a landfill and UFO landing strip in the area.

The main threat to bird species in Sierra Bermeja is habitat loss and fragmentation due to deforestation. In addition to the direct effects of habitat loss, deforestation and fragmentation also increase the amount of forest edge habitat. Disturbed areas, agricultural lands, and forest edges are the preferred habitats of the Shiny Cowbird (*Molothrus bonariensis*), a brood parasite that reached Puerto Rico in the 1950’s (Post and Wiley, 1977). These parasitic birds lay their eggs in the nests of other bird species, often physically displacing the host bird’s eggs. The host birds care for the cowbirds as if they were their own, to the detriment of their own offspring (Dorst, 1974). Because they are recent immigrants to the island, the native avifauna has not yet had time to evolve defenses to these birds and some species, including the Yellow-shouldered Blackbird, have suffered serious population declines due to cowbird parasitism (Wiley et al., 1991). Finally, exotic predators including mongoose, rats, feral cats and dogs, and escaped populations of Rhesus (*Macaca mulatta*) and Patas (*Erythrocebus patas*) monkeys are found in the Sierra (González-Martínez, 1998), species that have been implicated in nest predation in other countries.

Little is known about how land-use practices and the presence of introduced predators affect the local avifauna, but it is likely that bird species in the Sierra, including the Puerto Rican Nightjar and the Yellow-shouldered Blackbird, could suffer from nest predation by exotic species.
Targets and Opportunities
Landscape Assessment and Land Cover

Map Development
The aim of the landscape assessment was to examine land uses within Sierra Bermeja and to evaluate the conditions and availability of the preferred habitats of the Puerto Rican Nightjar and Yellow-shouldered Blackbird in the Sierra. For this component a land use map of the area of interest was prepared.

The land use classes used in the analysis were pasturelands, shrubs and grassland, high-density woodlands, low-density woodlands, and rural development. Land use was based on visual interpretation of 2002 IKONOS satellite imagery in combination with an island-wide land use interpretation of 1977 aerial photographs and the Coastal Land Use Layer Map of Puerto Rico (DNER, 1999).

The map of land use of Sierra Bermeja (Figure 2) comprises the area where the Puerto Rican Nightjar is known to occur. The nightjar is usually restricted to densely forested habitat with full overstory canopy and understory cover. This habitat is most commonly found in the slopes and ravines of Sierra Bermeja. Open pasture is not a preferred habitat of the nightjar and therefore, pastureland that fell on the outside skirts of the hills was excluded from the map. The boundaries of the land-use map were based on elevation and potential habitat for the Puerto Rican Nightjar. On the north side, the lowest elevations ranged from 15 to 35 meters, while on the south side, ranged from 65 to 85 meters. The highest elevation was found in the center at 300 meters above sea level.

The northern boundary of the map was delimited by the Cartagena lagoon, the “Camino Toro” in the Maguayo Community, and the “Camino el Zapato” road to the southeast of Cartagena lagoon. The eastern limit was delimited by P.R. State Road #301 “Interior” and the southern limit was delimited by P.R. State Road # 303. The western limit was delimited by the easterly extent of the Olivares Community.

Dry grasslands in Sierra Bermeja harbor endemic endangered species of grasses such as Aristida chasseae and A. portoricensis.

Figure 2. Land use in Sierra Bermeja
(Manuel Cruz and Ilse Sanders)
Land Cover

The land use/land cover assessment showed that the area of interest in Sierra Bermeja was dominated by shrub and grassland (42%), followed by low density woodland (29%) and pastureland (27%). Rural development occupied a small portion (less than 1%) of the area of interest (Figures 2 & 3). Pastureland was found primarily on the outer edge of the interest area, with a few interior patches. Dense woodland was intermixed with bushes and grassland, while low-density woodland appeared in very small patches (Figure 3).

Flora

Throughout the world, serpentine soils are known for their unusual flora and high levels of endemicism (Kruckeberg, 1954). Adaptation of tolerance to the chemical characteristics of serpentine soils (e.g. calcium, high heavy metal content) is believed to be largely responsible for the flora found on them. In Sierra Bermeja a total of 365 plant species in 82 families have been collected (Breckon, 1998). Of these, at least 10 species of trees or shrubs are endemic to Puerto Rico (Weaver and Chinea, 2003) and two endangered species are only known from Sierra Bermeja.

Species of Special Status

Lyonia truncata var. proctorii (Ericaceae) is federally listed as endangered; it is an evergreen shrub reaching up to two meters in height. It is only known from the very steep slopes of Cerro Mariquita in Sierra Bermeja (USFWS, 1996).

Vernonia proctorii (Asteraceae) is a federally endangered small shrub (reaching 1.5 meters). It is only known from the summit area of Cerro Mariquita in Sierra Bermeja.

Eugenia woodburyana (Myrtaceae), federally endangered and globally critically endangered, is an evergreen tree that can reach up to six meters and is known only from southwestern Puerto Rico. It occurs in Sierra Bermeja and the Guánica Commonwealth Forest, and the Cabo Rojo National Wildlife Refuge, where two cultivated individuals were transplanted (USFWS, 1996; IUCN, 2004).

Aristida chaseae (Poaceae) is a federally endangered perennial grass. It is currently known from only two sites in southwestern Puerto Rico: the Cabo Rojo National Wildlife Refuge and the upper slopes of Sierra Bermeja.

Aristida portoricensis (Poaceae), or Pelos del Diablo, is another federally endangered perennial grass from the southwestern part of the island. It is currently known from only two locations, Cerro Las Mesas and Sierra Bermeja. The species was reported from the Guanajibo area and from Cormigueros, also in southwestern Puerto Rico, but these populations appear to have been eliminated as a result of urban and commercial development. Sierra Bermeja site was only recently discovered.
Ottoschulzia rhodoxylon (Icacinaceae), also known as Palo de Rosa, is a federally endangered evergreen tree (reaching 4 to 5 meters) that occurs in Puerto Rico and Hispaniola mostly in karstic forests. A small population is known from Cerro Mariquita (Breckon, 1998; J. Schwagerl, USFWS, pers. comm.).

Stahlia monosperma (Cesalpiniaceae) is federally listed as threatened and globally endangered. Locally called Cóbana Negra, it was originally known only from Puerto Rico but populations have been discovered in the southwest of Hispaniola. In Puerto Rico, remnant native populations of this rare tree are found in Cabo Rojo. Its wood is hard and durable and used to be highly valued, a contributing factor to its current rarity. Sierra Bermeja report of this tree is in a south-facing ravine locally called “pozo de las cóbanas” about 300 meters from road 303 (USFWS, 1996; IUCN, 2004).

Dendrophthora bermejae (Viscaceae) is a recently described, rare mistletoe occurring in Sierra Bermeja (including Arroyo Cajul) and the surrounding Llanos Costa and Punta Melones areas (Kuijt et al., 2005). Mistletoes are hemiparasitic plants that are usually dispersed by frugivorous birds and represent an important food resource for birds and insects (Watson, 2001; Aukema, 2003). In Puerto Rico, mistletoes are most commonly dispersed by Euphonia musica, but many birds consume their fruits (Carlo et al., 2003). Dendrophthora bermejae is only known from one species of host tree, Guaiacum officinale or Guayacán. This unusually specific host requirement makes protection of the plant particularly difficult (Norton and Reid, 1997) since Guaiacum officinale, which occurs throughout the Caribbean, is globally endangered itself (IUCN, 2004).

**Avifauna**

Bird populations in Sierra Bermeja were surveyed to assess species diversity and abundance, with a focus on the globally endangered Puerto Rican Nightjar and Yellow-shouldered Blackbird. Surveys were conducted by skilled birdwatchers from the Puerto Rican Ornithological Society during the summer of 2004. Surveys for the endangered Puerto Rican Nightjar were conducted separately at night during the spring of 2003 and 2004. The species list also includes records from the Cabo Rojo’s Audubon Christmas Bird Counts that included Sierra Bermeja and a list from the USFWS (Shaffner, 1992). The Christmas Bird Counts provided valuable information on the migratory bird species found in Sierra Bermeja that were missed during the summer surveys of 2004.

**General Bird Community**

A survey covering most of Sierra Bermeja was conducted to estimate the species composition of the bird community. Surveys were conducted once a month in the morning, walking on existing trails during the months of May, June, July, and August. A different section of Sierra Bermeja was covered each month. Birds were recorded by sight and song and their location within transects was noted. Teams of two to four observers participated in each survey.
A total of 42 bird species were recorded in the census of 2004 and an additional 43 species have been recorded in Christmas Bird Counts and by USFWS personnel for a total of 85 (Appendix 1). Of these, 12 species are endemic to Puerto Rico, with the commonwealth and federal governments and the World Conservation Union (IUCN) considering two of them as threatened or endangered. Twenty-four species migrate from North America and eight species are exotic (Appendix 1).

**Bird-Habitat Relationships**

The terrestrial avifauna of Puerto Rico is generalized with few bird species showing strong affinities for specific forest types in a strict sense (e.g., rainforest specialist vs. dry forest specialist, etc.). Broad species assemblages tend to occupy diverse vegetation types throughout the island, from lowland dry forest to montane rainforests. However, many bird species can be accurately classified as specialists of broad habitat classes such as forests (of any type), woodlands, grasslands, riparian or aquatic habitats, etc. Under such classifications, some species can be highly specialized and limited to just one or two habitat types. For example, the Puerto Rican Tody is limited to forest habitats of closed canopy, but within that category it is found in any kind of forested habitat ranging from mangroves to montane rainforests (Raffaele *et al.*, 1998). It is important to consider that historical events, like disturbances such as deforestation, can shape species distributions in space and time, sometimes causing particular species to be restricted to specific habitats. This appears to be the case for the Puerto Rican Nightjar. Historically the nightjar was also found in wet forests in the north coast of the island, but now it is restricted to dry forests of the southwest (Kepler and Kepler, 1973).

The following is a list of the main habitat categories found in Sierra Bermeja and some of the bird species that frequent each one.

**Forest and dense woodland** This habitat includes secondary forests and possibly small remnants of the original forests of Sierra Bermeja. It contains the highest diversity of native trees (see Flora above, Weaver and Chinea, 2003) and represents about 29% of the vegetation cover of the area (Figure 3). Most endemic bird species reported in Sierra Bermeja are associated with this vegetation type. Bird species restricted to this habitat include the Puerto Rican Nightjar, Puerto Rican Tody, Puerto Rican Screech Owl, Key West Quail Dove, Puerto Rican Pewee, Puerto Rican Vireo, Puerto Rican Lizard Cuckoo, Puerto Rican Bullfinch, and Puerto Rican Vireo. Other species common to this habitat but not restricted to it are Adelaide’s Warbler, Puerto Rican Spindalis, Black-cowled Oriole, Caribbean Euphonia, and Antillean Euphonia. Migratory birds common to this habitat are Black and White Warbler, American Redstart, Kentucky Warbler, and Ovenbird.

**Ravines** Because of the moderate to low annual precipitation in Sierra Bermeja, the greater water availability in ravine soils tends to host vegetation of greater stature. The greater stature of vegetation, increased soil moisture, and protection from wind that plants obtain in ravines is probably correlated with a greater and more frequent production of fruit, and larger and more diverse arthropod populations on plants. Therefore, it is not surprising that ravines can be “hotspots” for many forest birds, especially during the dry seasons. Some of the forest bird species that can be frequently found in ravines include the Puerto Rican Pewee, Puerto Rican Screech Owl, Puerto Rican Tody (nesting grounds), Puerto Rican Vireo, Red-legged Thrush, and migrants like the Chuck Will’s Widow, Louisiana Waterthrush, American Redstart, and Black and White Warbler.

**Open low-density woodland** This habitat consists of abandoned cattle pastures in transition to secondary forest and covers approximately 1.5% of the Sierra Bermeja area. Exotic tree species like *Prosopis* spp. and *Leucaena glauca* as well as native columnar cacti can be dominant throughout the habitat. Typical bird species of this habitat are Grey Puerto Rican Bullfinch eating fruits of *Pithecellobium unguis-cati*, a pioneer tree, highly favored by birds, that aids in the succession of grassland to forest

Puerto Rican Bullfinch (Melanerpes portoricensis), an endemic bird that breeds in Sierra Bermeja
Kingbird, Puerto Rican Flycatcher, Smooth-billed Ani, Common Ground Dove, Zenaida Dove, Mangrove Cuckoo, Troupial, Yellow-shouldered Blackbird, and Antillean Mango. Certain migratory species have been found to be especially common in Mesquite-dominated open woodlands including Prairie Warbler, Cape May Warbler, and Yellow-rump Warbler. Indigo Buntings are also commonly seen in this type of habitat.

**Pastures** Pastures occupy approximately 27% of Sierra Bermeja. Bird species that occur this habitat are Grasshopper Sparrow, Yellow-faced Grassquit, Black-faced Grassquit, Mannikins (*Lonchura* spp.), Short-eared Owl, Doves (*Zenaida* spp.), American Kestrel, and all local species of swallows.

**Seasonal Ponds** Sierra Bermeja has several artificial ponds built in drainages as part of past cattle-ranching activities. These ponds do not hold water permanently and become completely dry in dry seasons. The average days that these ponds hold water throughout the year is unknown. However, when filled with water, these ponds provide breeding habitat for Least Grebes and foraging habitat for Egrets and shorebirds like Lesser Yellowlegs and Spotted Sandpipers.

**Seasonality, Food, and Bird Movements**

The rainfall regime of Sierra Bermeja produces wet and dry seasons that cause marked fluctuations in the overall supply of fruits, seeds and invertebrates that birds use as food. Normally, most of the rain falls between the months of September and January (Murphy et al., 1995). The flowering and fruiting pattern (phenology) of important fruiting plants for the bird community is unknown in the area, but it is reasonable to expect a peak of fruit production by the end of the rainy season. It is probable that some plants specialize in fruiting during the dry season as they do in other seasonal environments (Frankie et al., 1974). The relationship between fruit production and bird use of the habitats of Sierra Bermeja is likely to be very important for heavily frugivorous species like the Puerto Rican Spindalis, Puerto Rican Bullfinch, Antillean Euphonia, and Black-whiskered Vireo (Carlo et al., 2003). In north-central Puerto Rico, birds tracked fruit abundance in forested habitats (Carlo et al., 2004). Because most bird species from that study are found in Sierra Bermeja, it should be expected that birds track fruit abundance in Sierra Bermeja as well, and probably in a more pronounced way due to the stronger seasonality. Studies in different regions of the world have documented similar tracking of fruit resources at local and landscape scales (Levey, 1988; Levey and Stiles, 1992; Sallabanks, 1993; Rey, 1995; Marquez et al., 2004; Saracco et al., 2004). It is likely that an important fraction of the bird community found in Sierra Bermeja moves among other forested areas of the region (e.g., Pitahaya, Lomas de Parguera, and Punta Melones). Information on the phenological patterns of important fruiting plants in Sierra Bermeja and how they relate to habitat selection by the bird community at local and landscape scales would be useful in designing specific conservation strategies.

**Puerto Rican Nightjar**

The Puerto Rican Nightjar is a globally critically endangered species (Birdlife International, 2004). This species was first found in Sierra Bermeja in a forest tract next to a mine (*tosquero*) close to Barrio Las Palmas in the spring of 1992, and several official surveys have been conducted since then by the USFWS. Although no nests have been found, the species probably breeds in Sierra Bermeja given its population size, vocalizations during reproductive season, and constancy of detections since its discovery. Sierra Bermeja population is estimated to represent 2-3% of the total Puerto Rican Nightjar population (estimated at 670-800 pairs, BirdLife International, 2004). Although it is a small proportion of the total
population, this is important as a safeguard for the species in case of catastrophic events (e.g., hurricanes, fires, disease) that may cause other populations to decline or disappear.

The most recent inventory of the Puerto Rican Nightjar population in Sierra Bermeja has been the most extensive and was conducted by counting individuals observed or heard in transects at dawn or dusk through the forest during the reproductive period of 2003 and 2004. A total of 25 transects of 250 m were completed several times each year. A tape recorder with the Nightjar’s vocalizations was played every 50 meters along each transect in order to attract individuals present in the area. Each stop lasted 10 minutes, 5 minutes for the play back and an additional 5 minutes afterwards. When Nightjars were observed, the coordinates of their position were noted using GPS.

Puerto Rican Nightjars were found in tracts of closed canopy forests (dense woodlands) of Sierra Bermeja. This is in accord with the reported habitat preferences of this species (Vilella and Zwank, 1993). A total of 16, 12 and 14 singing males were recorded in 2003, 2004 and 2005 respectively (Table 1). Because only males call in this species, the total population size could be up to 20-30 individuals assuming all males were paired with mates. Most nightjar detections occurred in the western hills of Sierra Bermeja, followed by the central valley area. Few birds occurred in the eastern hills of Sierra Bermeja (Table 1). In the central valley, nightjars were concentrated in the north-facing slopes along the Cajul creek area.

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<td><strong>15</strong></td>
<td><strong>16</strong></td>
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Table 1 – Numbers of detections of Puerto Rican Nightjar (Caprimulgus noctitherus) during surveys in transects throughout the Sierra Bermeja

**Yellow-shouldered Blackbird**

The Yellow-shouldered Blackbird is a globally endangered species (BirdLife International, 2004) and has been recorded for Sierra Bermeja in Christmas Bird Counts though is not commonly seen there. The species went undetected during the census of 2004. The Yellow-shouldered Blackbird is primarily found in the coastal plains south of Sierra Bermeja where it is associated with flocks of Greater Antillean Grackles. The main population of Blackbird breeds 1-2 miles south of Sierra Bermeja in the Pitahaya Unit of the Boquerón State Forest. It is unclear how often or how many individuals use Sierra Bermeja, but it is likely that it serves as an important corridor for the safe movements of flocks of this endangered species and may regularly serve as their feeding grounds. Sierra Bermeja might become more important for this species in the future if more land in the surrounding area falls into rural or urban development.

**Summary**

Sierra Bermeja harbors a species-rich bird population where endemic and native species dominate numerically. The presence of a permanent population of 10-15 Puerto Rican Nightjars is one of the most significant conservation components. Another endangered endemic bird species, the Yellow-shouldered Blackbird, is occasionally recorded in Sierra Bermeja but the proximity of Sierra Bermeja to the breeding and foraging grounds of this species underscores the importance of the site. It is also an important site for Neotropical migratory species. The variety of habitats that include pastures, forested ravines, scrubland, and dry forest likely promotes the presence of the diverse avian assemblage recorded in Sierra Bermeja.
Other Fauna

Only birds were surveyed for this conservation plan, but it should be noted that Sierra Bermeja is home to a diverse fauna, including reptiles, amphibians, fish, bats, land snails, and insects. Although quantitative data on these taxa are not available, they are critical parts of the ecosystem and warrant further assessment.

Geology

Sierra Bermeja is in the southern part of the Bermeja Complex, and is the formation from which the complex takes its name. The Bermeja Complex is composed of three mountain chains containing serpentinite, amphibolites, basalt, and chert (Mattson, 1960; Schellekens, 1998). Serpentinite is a rock composed of magnesium iron silicate formed from metamorphosis of peridotite (Walker, 1954). It varies in color from light or dark green to nearly black. Because it had a lower density than the rocks on the earth’s crust, the serpentinite ascended, carrying fragments of other types of rocks with it (marine sediments). Serpentinite facilitate the formation of lateritic soils high in iron oxides and thus soils are often reddish. Serpentinite soils are typically low in adsorbable calcium and are frequently high in heavy metals (Walker, 1954). Amphibolites and basalt are also metamorphic rocks, formed from igneous rocks that underwent a physical or chemical change. Amphibolites have a combination of white (feldspar) and black (amphiboles) minerals in approximately a 1:1 ratio. They can usually be identified by the alternating bands of black and white. Amphibolites outcrops can be seen in Arroyo Cajul in the Sierra (Jolly et al., 1998). Basalt has a volcanic origin and comes in a variety of colors from red to green-black. In Sierra Bermeja, these rocks can be found embedded within the serpentinite (Mattson, 1960).

Cherts are rocks composed of silica, primarily formed by marine microorganisms from deep waters. They are found as layers in sedimentary rocks. In Sierra Bermeja, red ribbon cherts are usually found inclined and folded, suggesting that the layers were deformed by great force over time (Schellekens, 1998). These forces are the product of tectonic movements. Cherts have a variety of colors including yellows, reds, and quartz-like, but from a distance the rocks look red. This rock type is found throughout Sierra Bermeja, and the most important chert formation in Puerto Rico is the Mariquita Chert in Cerro Mariquita.

The oldest rocks of the Caribbean Plates. Based on fossils of radiolarians (microscopic marine organisms), the age of chert in the north of Sierra Bermeja has been estimated at 195 million years (Montgomery et al., 1994b). This represents the oldest rocks known in Puerto Rico and in the Caribbean Plate. These fossils are very similar to typical fossils found in the Pacific Ocean. This finding and other studies indicate that Puerto Rico and the Caribbean Plate originated in the Pacific Ocean to the west of present-day Peru (Montgomery et al., 1994a,b; Schellekens, 1998). Thus Puerto Rico had a marine origin in an area of low sedimentation and deep waters. While the volcanoes in the center and east of Puerto Rico emerged approximately 120-130 million years ago, it is difficult to calculate with certainty when the Bermeja Complex emerged. It is believed to have been exposed and resubmerged periodically from approximately 85 million years ago (Pindell and Barrett, 1990).

Sierra Bermeja exhibits a great variety of geological formations. Some of the most important include: Pedernales Mariquita, Anfibolitas Las Palmas, Cuerpo Intrusivo de Maguayo, Basaltos Cajul, and the serpentinite throughout. Studies of these and other formations have greatly contributed to our understanding of the geologic history of the Sierra, the island, and the Caribbean. This makes Sierra Bermeja an ideal site for scientific education for students and the general public.
Archaeology

Archaeological artifacts from the Taino culture, such as pottery, collars, religious crafts, and hunting devices, have been found in Sierra Bermeja and its surrounding areas. Approximately 88 archaeological sites have been found in Sierra Bermeja, suggesting that the site may have been important for some Taino communities (J. Irizarry, Institute of Puerto Rican Culture, pers. comm.).

Ecosystem Services

Well-functioning ecosystems provide a variety of important services to surrounding lands. Foremost among these services is erosion and flood control. Forested land is much less prone to soil erosion, landslides, and catastrophic flooding than deforested or highly degraded lands. Soils are one of the least understood of the essential resources that make human civilizations possible, and their non-renewable condition makes their preservation imperative (Suzuki, 1997). Maintaining adequate vegetation cover on steep slopes (the most susceptible to erosion) and along riparian corridors to reduce the effects of flooding and preserve running bodies of water is the best way to protect soils. Because Sierra Bermeja is under a dry and seasonal precipitation regime, the soils are not able to absorb large amounts of rain quickly, making the area prone to flash floods and erosion. Forested riparian areas can help moderate the impacts of such floods and the soil erosion that goes with it. Additional ecosystem services provided by forests include pollination services and pest control. Because of the variety of resources available in them, forests sustain a diversity of insect pollinators important for local agriculture (De Marco and Monteiro-Coelho, 2004; Ricketts, 2004). Forests also support insect predators and parasitoids, as well as abundant bird life, both important in controlling agricultural pest insects (Altieri, 1999; Luck and Daily, 2003). Finally, forests play an important role in carbon sequestration. Plants absorb carbon dioxide during photosynthesis and trees store this carbon as wood, which is then released as carbon dioxide when wood is burned. Forest soils also accumulate high levels of carbon. Restoring forests has the potential to help offset atmospheric CO2 emissions (e.g. from burning fossil fuels), the largest contributor to the greenhouse effect and global warming (Silver et al., 2000).

Relationships with the Local Community

To create partnerships with the local community, the proposal for a conservation plan for Sierra Bermeja was presented to landowners and residents of Cabo Rojo and Lajas on September 13, 2003. Thirty-three people attended the meeting, including five landowners and representatives from the President of the Senate of Puerto Rico, U.S. Fish and Wildlife Service, Puerto Rico Department of Natural and Environmental Resources (DNER), and two environmental groups: Defensores de los Poblados Costeros and AmeriCorps (College Coastal Conservation Corps). The activity was promoted in the press (El Nuevo Día, Sunday, September 7, 2003, p. 61) and 44 invitations were individually sent. The activity was held at the Lajas Agricultural Experimental Station in collaboration with the community group Caborrojeños Pro Salud y Ambiente and the college program Sea Grant, University of Puerto Rico, Mayagüez campus.

At the meeting, the documentary "La Sierra Bermeja" was presented, describing the importance of the birds, geology and flora found in Sierra Bermeja. Staff from the Important Bird Areas (IBA) program explained and promoted existing governmental alternatives to conserve private lands. At the end, questionnaires (Appendix 2) were distributed to participants to assess their opinions about the conservation of the Sierra. Five landowners and fifteen other participants answered the questionnaire. An additional four landowners, who did not attend the activity, answered the questionnaire as well.
The community meeting revealed a high degree of interest among participants in protecting Sierra Bermeja. Nine landowners returned the Sierra Bermeja conservation questionnaires. There are approximately 40 landowners in Sierra Bermeja. About half of the landowners surveyed (5 out of 9) responded that they did not have specific future plans for their lands. Eight of the nine respondents were not interested in selling their lands for a natural reserve, but five out of six would participate in a community group to conserve Sierra Bermeja. All of the landowners responding were interested in participating in the forest incentives program of DNER and habitat restoration program of the USFWS (Appendix 3); seven of these would consider a collaborative arrangement with conservation organizations and agencies. On the other hand, of the 15 survey respondents who do not own land in Sierra Bermeja, 13 were interested in conserving the habitat of the Sierra, 9 were willing to help protect it, and 13 wished to participate in a community group to conserve the area.

Reforestation partnerships between two landowners and the Puerto Rican Ornithological Society (PROS) were initiated in May 2004. The PROS visited the lands to evaluate and establish a pre-agreement. The Puerto Rico Conservation Trust and the DNER agreed to donate some native trees to be planted by the owners. These reforestation projects were funded by a grant from the US Fish and Wildlife Service to enhance the habitat for the Puerto Rican Nightjar and other bird species.
**Protecting and Restoring Sierra Bermeja: Recommendations for Action**

**Priority Areas for Conservation**

Within Sierra Bermeja, forested slopes around Arroyo Cajul and Cerro Mariquita stand out as particularly important areas. The north facing slopes of Arroyo Cajul, as well as the creek itself contain dense woodland, which tends to have more native plant and bird species than any other land cover types in the area. Two species of interest have been found in this area, the Endangered Puerto Rican Nightjar and the rare Bermeja mistletoe (D. bermejae). In addition, important geological formations are found in the creek such as Cajul Basalt formations. Cerro Mariquita is the only known location of the endangered plants V. proctorii and L. truncata var. proctorii and is the site of an important geological formation, the Pedernales Mariquita. Besides these areas, the western hills of Sierra Bermeja, where the majority of Nightjars were found, and all areas with closed canopy forest or dense woodland should receive priority.

**Land Acquisition**

The most effective means of protecting land and habitat is land acquisition and management by an organization or agency dedicated to the long-term conservation of habitats and species, and this should be a primary goal of conservation in the area. However, this strategy requires several elements including funds to purchase and manage lands indefinitely (the cost of which will vary depending on what type of restoration, fence maintenance, vigilance, etc. the site needs); an organization with the willingness, infrastructure, and paid staff to take responsibility for the purchasing and management of the land; and willing sellers. Moreover, a strategy based on land acquisition alone fails to take into account the landscape matrix and connectivity, the long-term effects of reduced habitat area (Rosenzweig, 2003a,b), and the value of community participation which are critical factors in long-term conservation.

In addition to buying land, purchasing or encouraging donations of conservation easements can be an effective conservation strategy. Purchasing easements is usually a less expensive option than outright purchase of land. Conservation easements offer great flexibility, allowing the owner to continue to own and use the land, sell it or bequeath it, while limiting particular activities, such as the construction of permanent structures, to protect its conservation values. Donated easements can often be taken by donors as a tax deduction for charitable contribution. A land trust or agency would be responsible for enforcing the terms of the easement agreement with current and subsequent landowners. Another option would be to make formal or informal agreements of rights of first refusal with landowners. In this case, landowners would agree that in the event that they decide to sell the land, they will first allow the organization or agency involved in the agreement to make an offer or counter-offer on the land.

Finally, while lands with closed-canopy forest, native forest vegetation, or populations of species of interest should be the first priority for land purchase or conservation easements, Mesquite forests, shrubland, and pastureland certainly have conservation and restoration value and should not be dismissed.

**Partnership with Local Communities**

The importance of working with local communities to achieve long-term interest, participation, and buy-in cannot be overstated. Even under a land acquisition scenario, the participation of the community is critical to ensure that reserves don’t end up as islands within a sea of development. In the absence of land acquisition, conservation efforts in this area will be impossible without the active participation of the community.

Reforestation, tree planting, or fencing projects that will enhance habitat in Sierra Bermeja also present opportunities for education and community participation. Whenever possible, these projects should be public events in which children and community members can become involved. This can also help reduce the labor costs of the projects. Tree planting is a prime example of a project that can capture the interest of the community and foster a long-term awareness of conservation issues. Not only is the planting fun, but participants can return year after year to watch the progress of the
trees or forest that they planted. Local businesses may be willing to donate supplies or refreshments in exchange for acknowledgement, further expanding the sense of ownership in the conservation project. Using volunteers should be balanced against the benefits of creating local jobs and countering perceptions that conservation and jobs are incompatible. In many cases, a combination of volunteers and paid workers will be most effective.

Working with Land Owners

Meetings with local landowners revealed a high degree of interest in conserving and protecting Sierra Bermeja. This interest should be cultivated, encouraged, and facilitated. The connectivity of organisms, habitats, and ecological processes should be emphasized. Ideally, land owners eventually would take on the role of educating their neighbors about the benefits of conservation because they would have an interest in how neighboring lands are being managed.

There are a number of incentive programs run through the Department of Natural and Environmental Resources (DNER), the U.S. Department of Agriculture (USDA), and the U.S. Fish and Wildlife Service (USFWS) that encourage and assist landowners interested in protecting the natural resources on their land (See Appendix 3). These are voluntary programs in which agencies provide landowners with technical, educational, and financial assistance to restore and protect their land. Financial assistance is usually in the form of cost-share, which means that the agency will pay up to a specified percentage of costs either in direct payment or through services or labor. Different programs have different eligibility requirements, expectations, and duration. For example the Conservation Reserve Program (USDA) is a long term program to set aside fragile land. This program encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover. Cost-sharing is used to establish the vegetative cover and landowners receive an annual rental payment for the duration of the contract.

The Wetland Reserve Program (USDA) gives landowners the option of placing eligible land in permanent easements, 30-year easements, or cost-share restoration. The Forest Lands Enhancement Program (USDA) is open to non-industrial private forest landowners to promote sustainability of the forests. The Wildlife Habitat Incentives Program (USDA) and the Partners for Fish and Wildlife Program (USFWS) are open to conservation-minded landowners whose land does not meet the specific eligibility requirements of other USDA conservation programs. These programs provide technical and cost-share assistance to establish and improve fish and wildlife habitat.

A high priority for conservation in Sierra Bermeja should be to educate interested landowners about these programs, through meetings such as the one held in 2003 or by disseminating an information packet with contact information. In addition, when allocating limited funds, Partners for Fish and Wildlife Program gives special consideration to projects that are identified as high priority by agencies or other partners and it may prioritize funding for projects that involve greater non-Service partnerships and/or cost-sharing. USDA programs have similar funding constraints and may be similarly convinced. Therefore, local conservation groups can help provide evidence of the importance of particular projects in Sierra Bermeja and can offer to be partners in cost-sharing.
Maintain Existing Forest

Those landowners who currently have native forest or Nightjar habitat on their property should be encouraged to maintain this habitat and, in some cases, to enhance it. It may be appropriate to discuss conservation easements in these cases. Furthermore, in the event that landowners are interested in clearing part of the land, assistance should be offered to help mitigate the effects on wildlife and native plants. This could involve identifying parcels that have particularly high conservation value, recommending buffers around critical habitat, ensuring that some trees are left standing, particularly animal-dispersed fruiting trees, and native or rare trees. Before modifying any land that is habitat for Nightjars or other endangered or threatened species, landowners must consult with the USFWS and the DNER to ensure compliance with the Endangered Species Act and local laws and regulations.

Reforestation and Restoration

For non-forested or very degraded land, reforestation and restoration can substantially enhance the conservation value of lands. Reforestation of pasture or agricultural lands can begin with Rolón (*Pithecellobium unguis-cati*) and Mesquite (*Prosopis juliflora*). Although Mesquite is an exotic species, it is fast growing and provides habitat for many native and migratory bird species. Furthermore, an overstory of Rolón and Mesquite can facilitate the establishment of native trees that do not recruit well in the open. Eventually, the Mesquite forests are likely to become mixed with native tree species (as can be seen in older Mesquite forests in the Sierra) and eventually may disappear as the forest matures (Weaver and Chinea, 2003). Some funds may be available from U.S. Fish and Wildlife Service for reforestation efforts. Other types of restoration may include repairing roads or culverts to prevent soil erosion or removing pervasive invasive species.

Sustainable Agricultural Practices and Compatible Uses

Education and assistance should be offered to landowners actively farming or grazing their land to ensure that agricultural practices are as sustainable as possible. This may include advising on issues such as reducing overgrazing, fencing cattle out of streams and washes that form important corridors or refugia for birds and plants, keeping cattle out of pools, seeps or other areas that may be important for breeding amphibians, keeping cattle out of areas with high erosion potential, or limiting use of pesticides, herbicides, and chemical fertilizers. In many cases, conservation goals can be reconciled with low intensity agriculture or limited construction (Rosenzweig, 2003a,b). For example, live fences, hedgerows, and windbreaks form important corridors and refugia for birds, bats, insects, and native plants, and can improve natural pest control and pollination services (Altieri, 1999; Estrada *et al.*, 2000; Sykes and Hannon, 2001). Planting fruiting trees, including Guayacán (globally endangered and host of the rare mistletoe *D. bermejeae*), along fencerows will attract birds and insects (important for control of agricultural pests and for pollination), and encourage the recruitment of additional plant species dispersed by the birds, without negatively impacting farmers (Luck and Daily, 2003). This type of vegetated corridor can also reduce soil erosion.

Education

Education of the public, lawmakers, and especially children, is key to conservation. Because children represent the future land stewards, voters, and lawmakers, and are more flexible in their thinking, focusing efforts on primary and secondary school environmental education is critical. Fostering an awareness of conservation issues and a value for the environment will have immediate and long-term benefits for local conservation. Educational opportunities abound and may include presentations in classrooms, public meetings, booths at local festivals, field trips to natural areas, involving classes and the public in conservation projects and monitoring activities, and distributing posters or informational flyers, among others. This is an excellent opportunity to develop strong partnerships between conservationists and school districts or summer programs in parks and recreation. Already, PROS has engaged in numerous educational activities in the area including presentations in schools and festivals, a workshop offered to school teachers from Cabo Rojo and Lajas, and participation in radio and television programs. In addition, conservationists and teachers could work together to develop curriculum...
that incorporates conservation science and local history for classroom and online teaching. Such teaching modules could be distributed on the internet for use in schools throughout Puerto Rico and beyond. Science projects based on local conservation needs (for example, reforestation or monitoring bird populations) can serve multiple purposes of teaching critical thinking and science skills, useful conservation, and developing a land-care ethic.

**Zoning and Enforcement**

One of the problems facing conservation efforts in Puerto Rico is a lack of enforcement of zoning and permitting laws. A public event to educate people about these laws, current zoning in Sierra Bermeja, and avenues for enforcement would enable interested people to take more responsibility for protecting the land they care about.

Conservationists can work with lawmakers to enforce existing protections and to support new conservation legislation. The Government of Puerto Rico has laws that could help in the protection of Sierra Bermeja like the "Ley Del Programa Del Patrimonio Natural de Puerto Rico (Ley #150, 4 de agosto de 1988)" which allows for the protection of important areas for wildlife. Also the "Nueva Ley De Vida Silvestre De Puerto Rico (Ley # 241, 1999)" which declares that all wildlife within the territorial area of Puerto Rico belongs to the Commonwealth of Puerto Rico, including all endemic, endangered, and migratory species. The "Ley de Bosques de Puerto Rico (Ley # 133, 1 julio de 1975)" and the "Ley Para La Unificación De Bosques Estatales (Ley # 14, 9 de enero de 1999)" also provide mechanisms and procedures for the acquisition of valuable lands for the enjoyment of all Puerto Ricans.

**Ecotourism**

Tourism is an important part of the economy of Puerto Rico, and the Southwest is one of the least developed parts of the island. The proximity of Sierra Bermeja to several Commonwealth Forests, Puerto Rico National Parks, beaches, and a marine reserve makes it ideally situated to take advantage of visitors (both local and international) interested in the natural world. It may be particularly attractive to bird watchers due to the diversity of native and endemic birds and the presence of two endangered birds. Ecotourism can have positive economic benefits for local communities. If ecotourism is to be developed for Sierra Bermeja, infrastructure will need to be developed and maintained to support it and to mitigate the ecological impact of large numbers of visitors. Infrastructure may include walking trails, trash cans, camping or picnic areas, and educational signs, for example.

**Summary**

Sierra Bermeja boasts a rich fauna, flora and history. It is home to several endangered plant and bird species, has unique geological features, and is a critical link in the network of wildlife refuges, forests, reserves and parks in the southwest of Puerto Rico. Sierra Bermeja is almost entirely privately owned; yet, it is still one of the least urbanized areas of the island, due in part to zoning restrictions. A conservation project for Sierra Bermeja offers a prime opportunity to engage actively in protecting a valuable part of our natural heritage, important for local, island, and regional conservation goals and a treasure for future generations.

It offers a prime opportunity to engage actively in protecting a valuable part of our natural heritage, important to local, island-wide, and regional conservation goals and a treasure for future generations.

**Next Steps:**

- develop the capacity and infrastructure (or identify a partner) to engage in land acquisition,
- plan strategies for land and biodiversity conservation, and
- develop an environmental curriculum for local schools
- continue to involve community members in all aspects of conservation planning
References


### Appendix 1 – Bird species found in Sierra Bermeja

Total individuals detected in surveys in 2001 and 2002. Range of detections is the minimum and maximum numbers of birds detected in transect surveys.

Bold indicates species endemic to Puerto Rico.

* indicates species known only from Christmas bird counts.

** indicates additional species detected by USFWS staff.

E=Endemic, R= resident, M= migrant, X = Exotic.

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<th>Species</th>
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<th>Total Individuals detected</th>
<th>Range of Detection per transect</th>
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<td>Vidua macroura</td>
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<td>Asio flammeus</td>
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<td>Chordeiles gundlachi</td>
<td>Antillean Night Hawk</td>
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<td>Dendroica palmarum</td>
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<td>Passerina caerulea</td>
<td>Blue Grosbeak</td>
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<tr>
<td>Seiurus aurocapilla</td>
<td>Ovenbird</td>
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Appendix 2 – Questionnaire given to landowners and other interested parties September 7, 2003, Cabo Rojo

Sierra Bermeja provides habitat to a great avian diversity, including endemic and endangered species. For that reason, the Important Bird Areas Program wants to promote the conservation of this habitat with the community.

We have prepared this questionnaire to assess your interest in engaging in the development of a conservation plan for Sierra Bermeja. Thanks for your cooperation.

General Information from the Participant

Name ____________________________

Physical address ____________________________

Postal address ____________________________

Phone ____________________________ Email ____________________________

1) Do you own lands in Sierra Bermeja? □ Yes □ No

2) Are you the property-owner or a renter? ____________________________

3) What use do you give to those lands? ____________________________

4) What are the future plans for your lands? ____________________________

5) Do you wish the habitat of Sierra Bermeja to be protected? □ Yes □ No

6) Are you willing to conserve it? □ Yes □ No

7) How would you protect it? ____________________________

   i) Participating in the DNER Forest Incentives Program □ Yes □ No
   ii) Participating in the USFWS Land Conservation Program □ Yes □ No
   iii) Establishing Conservation Easements □ Yes □ No
   iv) Selling your lands for conservation □ Yes □ No
   v) Establishing a collaborative agreement with agencies or conservation organizations □ Yes □ No

8) Do you wish to participate in a support group to conserve Sierra Bermeja? □ Yes □ No

Additional comments (you could continue on the back)

________________________________________

________________________________________

________________________________________

________________________________________
### Appendix 3 – Government agency programs available for habitat restoration

<table>
<thead>
<tr>
<th>Program</th>
<th>Agency</th>
<th>Eligibility</th>
<th>Duration of agreement</th>
<th>Rent</th>
<th>Cost covered by agency</th>
<th>Obligations of participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation Reserve Program</td>
<td>USDA</td>
<td>Erosion-prone land that has been cultivated for 4 of the past 6 years preceding the law of 2002. Marginal grazing lands are eligible.</td>
<td>10-15 years</td>
<td>Annual payment based on duration of agreement</td>
<td>50%</td>
<td>Develop and implement a plan to preserve agricultural land. Should assist with the costs of implementing and keeping conservation practices.</td>
</tr>
<tr>
<td>Wetland Reserve Program</td>
<td>USDA</td>
<td>Wetlands in private property that had been turned to agriculture prior to 1985 are eligible. The wetland must be restorable and appropriate for wildlife.</td>
<td>10-30 years; permanent</td>
<td>Amount paid in advance</td>
<td>Up to 100%</td>
<td>Develop and implement a plan to restore wetlands. Should assist with the costs of implementing and keeping conservation practices.</td>
</tr>
<tr>
<td>Grassland Reserve Program</td>
<td>USDA</td>
<td>Actual or historic grasslands and/or shrublands.</td>
<td>10,15,20 or 30 years; permanent</td>
<td>Annual payment based on duration of agreement. Amount paid in advance</td>
<td>Up to 90%</td>
<td>Develop and implement a plan to preserve grasslands. Should assist with the costs of implementing and keeping conservation practices.</td>
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<tr>
<td>Wildlife Habitat Incentive Program</td>
<td>USDA</td>
<td>All land is eligible unless it is already participating in CRP, WRP, or a similar program.</td>
<td>5-15 years</td>
<td>Up to 75%</td>
<td></td>
<td>Develop and implement a plan to preserve wildlife. Should assist with the costs of implementing and keeping conservation practices.</td>
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<tr>
<td>Environmental Quality Incentives Program</td>
<td>USDA</td>
<td>All land with agricultural activity is eligible including grasslands and non-industrial forested areas.</td>
<td>1-10 years</td>
<td>Annual payment based on duration of agreement</td>
<td>Up to 75%</td>
<td>Develop and implement a plan for environmental restoration. Should assist with the costs of implementing and keeping conservation practices.</td>
</tr>
<tr>
<td>Program</td>
<td>Agency</td>
<td>Eligibility</td>
<td>Duration of agreement</td>
<td>Rent</td>
<td>Cost covered by agency</td>
<td>Obligations of participant</td>
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<tr>
<td>Conservation Security Program (CSP)</td>
<td>USDA</td>
<td>All agricultural land and forested land that is part of an agricultural practice is eligible.</td>
<td>5-10 years</td>
<td>Annual payment based on duration of agreement</td>
<td>Up to 75%</td>
<td>Develop and implement a conservation plan. Should assist with the costs of implementing and keeping conservation practices.</td>
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<tr>
<td>Forest Land Enhancement Program (FLEP)</td>
<td>USDA</td>
<td>All non-industrial land with forested areas are eligible for financial, educative, and technical aid.</td>
<td>10 or more years</td>
<td>Up to 75%</td>
<td></td>
<td>Develop and implement a management plan. Should assist with the costs of implementing and keeping conservation practices.</td>
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</table>

<table>
<thead>
<tr>
<th>Program</th>
<th>Agency</th>
<th>Eligibility</th>
<th>Assistance offered</th>
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</thead>
<tbody>
<tr>
<td>Partners for Fish and Wildlife</td>
<td>US FWS</td>
<td>Farmers, ordinary citizens, government agencies, and corporations interested in environmental preservation of private lands.</td>
<td>Help in the planning and support of projects to the restoration of flora and fauna. Reforestation with native species, restoration and enhancement of endangered species habitat, etc.</td>
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</table>
A Call to Protect Sierra Bermeja for Future Generations

The Important Bird Areas Program (IBA) of Puerto Rico is part of the conservation efforts of the Puerto Rican Ornithological Society (SOPI) as a joint initiative of the global partnership of BirdLife International. SOPI is a non-profit organization dedicated to the education, promotion and conservation of Puerto Rico’s birds. It was established in 1995 and is recognized as an objective, independent resource in matters related to the avifauna of Puerto Rico.

The Sierra Bermeja Conservation Project has been supported by:

www.avesdepuertorico.org