Rapid Assessment Program

RAP

Working

Papers

2

Status of Forest Remnants in the Cordillera de la Costa and Adjacent Areas of Southwestern Ecuador

CONSERVATION INTERNATIONAL

OCTOBER 1992

Conservation Priorities: The Role of RAP

Our planet faces many serious environmental problems, among them global climate change, pollution, soil erosion, and toxic waste disposal. At Conservation International (CI), we believe that there is one problem that surpasses all others in terms of importance because of its irreversibility, the extinction of biological diversity. Conservation efforts still receive only a tiny fraction of the resources, both human and financial, needed to get the job done. As a result of this, we must use available resources efficiently, applying them to those places with the highest concentrations of diversity which are at most immediate risk of disappearing.

CI uses a strategic, hierarchical approach for setting conservation investment priorities. At a global level, we have targeted the "hotspots," 15 tropical areas that hold a third or more of all terrestrial diversity and are at great risk. Our global priorities also focus on major tropical wilderness areas and the "megadiversity" country concept, which highlights the importance of the national entities that harbor high biodiversity. We are now undertaking a series of priority-setting exercises for other major categories of ecosystems, among them marine systems, deserts, and dry forests.

The next level of priority setting is the bio-regional workshop, a process where experts assemble their combined knowledge of an area to map regional conservation priorities using CI's geographic information system (CISIG). We have also taken a taxon-based approach, working with the Species Survival Commission of IUCN to produce action plans for key groups of organisms.

These priority-setting exercises provide the scientific underpinning for urgent conservation decisions in hotspot regions. Although the hotspots we have identified occupy less than 3-4 percent of the land surface of the planet, they still cover several million square kilometers, only small areas of which have been properly inventoried. To fill the gaps in our regional knowledge, CI created the Rapid Assessment Program (RAP) in 1989.

RAP assembles teams of world-renowned experts and host country scientists to generate first-cut assessments of the biological value of poorly known areas. An area's importance can be characterized by its total biodiversity, its degree of endemism, the uniqueness of an ecosystem, and the degree of risk of extinction. As a conservation tool, RAP precedes long-term scientific inventory.

When satellite images of an area targeted for a RAP assessment are available, the team consults them prior to a trip to determine the extent of forest cover and likely areas for exploration. Once in-country, the scientists make overflights in small planes or helicopters to identify forest types and points for field transects. Ground travel often requires a combination of vehicles, boats, pack animals, and foot travel to get the team to remote sites where few, if any, roads exist. Trips last from two to eight weeks.

On each trip, in-country scientists form a central part of the team. Local experts are especially critical to understanding areas where little exploration has been undertaken. Subsequent research and protection of habitats following a RAP trip depends on the initiatives of local scientists and conservationists.

The RAP concept was born during a field trip by Murray Gell-Mann of the MacArthur Foundation, Spencer Beebe, one of CI's founders, and Ted Parker, current leader of the RAP team. RAP has been generously funded by the John D. and Catherine T. MacArthur Foundation's World Resources and Environment Program, headed by Dan Martin.

RAP reports are available to the host governments of the countries being surveyed and to all interested conservationists, scientists, institutions, and organizations. We hope that these reports will catalyze the effective conservation action on behalf of our planet's biological diversity, the legacy of life that is so critical to us all.

Russell A. Mittermeier
President

Adrian Forsyth
Director, Conservation Biology

Heliconia latispatha in the Jauneche reserve, July 1991.
Watercolor by Bonnie Mitsui.

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Status of Forest Remnants in the Cordillera de la Costa and Adjacent Areas of Southwestern Ecuador

Edited by

Theodore A. Parker, III and
John L. Carr

The research presented in this report was conducted in collaboration with the Escuela Politécnica Nacional, Quito, Ecuador.

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OCTOBER 1992

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Preface

By the time this document is published, much of the forest that we saw during our travels through western Ecuador will have been destroyed. Indeed, the forests at Bilsa and near Pedernales were being felled faster than we could study them. It is our fervent hope that this report will serve to inform a wide audience concerning the grim conservation status of the varied forest types in this biologically priceless region. We further hope that the national and local governments, military authorities, private conservation organizations, and concerned citizens, will act quickly and decisively to preserve at least some of the forests described in this report. Failure to do so will result in the loss of countless species of plants and animals found nowhere else on earth. Once gone, the unique forests of the region will never be regrown. Tree plantations may one day at least partially meet the needs of the human population, but many valuable plant species adapted to the soils and climates of the region will have been lost forever. The extinction of such species—indeed of entire ecosystems—will severely limit the possibilities for long-term economic growth and prosperity in western Ecuador. We hope that this call for action will not go unheeded.

Organizational Profiles

CONSERVATION INTERNATIONAL

Conservation International (CI) is an international, nonprofit organization based in Washington, D.C., whose mission is to conserve biological diversity and the ecological processes that support life on earth. CI employs a strategy of "ecosystem conservation" that seeks to integrate biological conservation with economic development for local populations. CI's activities focus on developing scientific understanding, practicing ecosystem management, stimulating conservation-based development, and assisting with policy design.

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DEPARTAMENTO DE CIENCIAS BIOLÓGICAS ESCUELA POLITÉCNICA NACIONAL

The Departamento de Ciencias Biológicas of the Escuela Politécnica Nacional is a center for research in systematics, zoogeography and ecology of the vertebrates of Ecuador. With over 50 years of research and publication in vertebrate zoology, the department houses the most important research collections of freshwater fish, amphibians, reptiles, and mammals in the country. The department's research results serve as scientific support for conservation activities and programs developed by governmental institutions and nongovernmental organizations.

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FUNDACIÓN ECUATORIANA DE INVESTIGACIÓN Y MANEJO AMBIENTAL

The Fundación Ecuatoriana de Investigación y Manejo Ambiental (FEDIMA) is a nonprofit, nongovernmental organization whose principal objectives are the conservation of representative areas of Ecuadorian ecosystems, scientific investigation, suitable management of natural resources, and environmental education. FEDIMA was established in 1990 with official recognition by the government.

FEDIMA
Gaspar de Escalona 524 y Diguja
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593-2-441-495

ECOCIENCIA

EcoCiencia is a private, nonprofit, scientific organization dedicated to research, education, and communication for the conservation of wildlife species and their habitats. The foundation was established in 1989 by a group of professional biologists interested in planning, management, and execution of multidisciplinary projects that permit rational and sustained use of natural resources.

EcoCiencia
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HERBARIUM PONTIFICIA UNIVERSIDAD CATÓLICA DEL ECUADOR

The Herbarium of the Pontificia Universidad Católica del Ecuador is a private, state-supported scientific center that is part of the Biology Department of the University. It was founded 22 years ago and now has a collection of 120,000 specimens, mainly of the flora of Ecuador. Taxonomic and ecological research is carried out by students and staff of the herbarium.

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FUNDACIÓN NATURA—GUAYAQUIL CHAPTER

The Guayaquil Chapter of Fundación Natura is part of a private, nonprofit, national conservation organization, with its own Board of Directors that deals with regional matters. Although the Guayaquil Chapter participates in several of the national programs of Fundación Natura, it also has programs and projects of its own, including environmental education campaigns, urban tree planting, and the Bosque Protector Cerro Blanco Project, a nature preserve with an environmental education center 15 kilometers from the city of Guayaquil.

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Acknowledgments

Investigators from the Departamento de Ciencias Biológicas of the Escuela Politécnica Nacional (EPN) were our national counterparts on both RAP trips to Ecuador. Their participation — and the use of Politécnica facilities and equipment — were made possible through an agreement between CI and EPN, and we extend our thanks to Ing. Alfonso Espinosa R., Rector of the Escuela Politécnica Nacional, for his help in arranging this cooperative venture. The success of both trips was due in large measure to the expertise and experience of Luis Albuja and Ana Almendáriz, and to logistical support, information and encouragement provided by Alfredo Luna, Rosa Almendáriz and Ramiro Barriga.

We also thank Sr. Danilo Silva of EcoCiencia for allowing Carmen Josse to participate on the first expedition, and Dr. Sergio Figueroa (of the Ministerio de Agricultura y Ganadería) for arranging permits. Carmen Ulloa and Benjamin Ollgaard at the Herbarium of the Pontificia Universidad Católica del Ecuador were also helpful in many ways.

Many other people contributed in a wide variety of ways to the success of the two expeditions. We extend special thanks to Bonnie Mitsui for skillfully organizing and running the camp kitchen on the second trip; Power Foods of Berkeley, California, for their generous donation of Power Bars; the Universidad de Guayaquil for access to the Jauneche reserve. We thank Eduardo Aspiazu-Estrada (of Fundación Natura - Guayaquil Chapter) for logistical support and for arranging overflights of the Cordillera de la Costa west of Guayaquil; the latter flights were generously provided by the Empresa Cemento Nacional, S.A., which also facilitated our fieldwork at Cerro Blanco. We also acknowledge the enthusiastic support and help of the following people at Cerro Blanco: Jimmy Andrade, Clarice Strang, and Peace Corps volunteer Walter Herzog. Eduardo Aspiazu and Ralph Jones, U.S. Consul in Guayaquil, kindly gave us tours of Cerro Blanco, and provided useful information on the birds, mammals, and vegetation of the reserve.

At Parque Nacional Machalilla our field efforts were aided greatly by Lcdo. Carlos Zambrano, Intendente of the park, and the Merchan family (Nestor, Samuel, and Cecilio). Others who provided assistance of one kind or another included Carmen and Angelita Altapuya, Antonio, Manuel and Wilson García, René, Fermín, Luis Zank, and Don Pedro at Bilsa; Lucas Goyes, Gustavo Holquin, and Pablo Loor at Jauneche; and Antonio, Manuel, and Peace Corps volunteer Karl Berg at Manta Real.

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For assistance in the office, we would like to thank Ali Lankerani, Stephen Nash and Luci Betti for work on the illustrations, Lisa Famolare for document processing, and comments on the manuscript from Brent Bailey and Robin Bell, and Carlos Reynel (Missouri Botanical Garden).

Overview

INTRODUCTION

The forests of western Ecuador are among the most severely threatened of the world's ecosystems (Dodson and Gentry 1991, Gentry 1977, 1979, Myers 1988). Primarily as a result of an alarming explosion in the human population of the country between 1960 and 1980 (from 4 to 10.2 million), more than 90 percent of the Pacific lowland and foothill forest below 900 m has been converted to agriculture — especially plantations of bananas, oil palms, soybeans, and rice — in addition to the more traditional cacao and coffee (Dodson and Gentry 1991).

Dodson and Gentry (1991) estimate that the aboriginal forests of western Ecuador once covered nearly 80,000 km^2. Of the three major lowland forest types in this relatively small area, less than 6 percent remains: tropical wet forest (0.8 percent), tropical dry forest (1 percent), and tropical moist forest (4 percent). There is one large area of forest north of the Río Guayllabamba in Esmeraldas, Imbabura and Carchi provinces. Included in this area are two forest reserves totalling about 280,000 ha (Reserva Ecológica Cotacachi-Cayapas and Reserva Etnica y Forestal Awa). Otherwise, only scattered fragments of forest survive, most of which are less than 100 ha in size. Until the late 1970s, the largest wet and moist forest reserves south of Esmeraldas were the Río Palenque Science Center (100 ha) and the Jauneche reserve (138 ha). Larger areas of dry, moist, and wet forest are now protected by law in Parque Nacional Machalilla, Reserva Ecológica Manglares-Churute, Bosque Protector Cerro Blanco, and Bosque Protector Molleturo (but see below). Another important area of coastal dry forest lies within the Reserva Militar de Arenillas.

The coastal and foothill forests of western Ecuador are of great biological importance due to the large numbers of species and high levels of endemism they support. Dodson and Gentry (1991) estimated that as many as 6,300 species of vascular plants occur in western Ecuador (only 16,000 species are known from all of North America). Of that total,

about 1,200 species (or 20 percent) may be endemic, that is, they have geographic ranges smaller than 75,000 km^2 (Gentry 1986b). In fact, many of these endemic plants are known only from one or a few small islands of suitable habitat such as isolated ridgetops along the base of the Andes, some of which are only a few square kilometers in size (Gentry 1986b). This extreme local endemism renders many of these species especially vulnerable to extinction.

The vertebrates of western Ecuador are similarly diverse, and some groups (e.g., birds) show levels of endemism that approach those of plants. More than 800 bird species are known to occur in western Ecuador (Ortiz et al. 1990), including 40 species and 140 well-marked subspecies that are restricted to the dry forests and scrub habitats of southwest Ecuador and adjacent northwest Peru (Parker et al., MS), and 30 species confined to the humid evergreen forests to the north — the Chocoan forest that extends from extreme eastern Panama south into Ecuador (Cracraft 1985). Of approximately 142 lowland mammal species known from western Ecuador, 54 species (17 percent of the total Ecuadorian mammal fauna of 324 species) are not found elsewhere in Ecuador (Albuja 1991). Fifteen of these are endemic to coastal forests along the Pacific coasts of Colombia, Ecuador, and northern Peru. Regional endemism is highest among bats, with approximately 24 percent of Ecuador's total bat fauna of 125 species being confined to the western lowlands (Albuja 1991). To date, 253 species of amphibians and reptiles have been recorded in western Ecuador below 2,000 m; about 60 percent of the frogs are endemic (Almendáriz 1991). As in the case of plants, many of these vertebrates are globally threatened due to habitat destruction within their small geographic ranges.

The dire plight of the forests (and their flora and fauna) in western Ecuador has aroused much concern on the part of biologists and conservationists worldwide (Dodson and Gentry 1991, Gentry 1979, Myers 1988). Attempts to identify and describe existing forests have been a high priority over the past decade, but relatively few studies have been published — two as yet unpublished surveys compiled by EcoCiencia and Fundación Natura will prove valuable when they are finally released (García et al. 1989, Mejía et al. 1990). Unfortunately, however, action to protect surviving forests from total destruction has been limited and largely ineffective. Without a concerted effort by the national and local governments, military authorities, conservation organizations, and concerned citizens, these biologically rich forests — as well as the huge numbers of plant and animal species they support — will disappear from the earth within 20 years.

In keeping with the urgent need for better scientific inventories of the region, the Rapid Assessment Program team of Conservation International and biologists from the Escuela Politécnica Nacional (Quito) spent a total of six weeks (in January-February and July 1991) in the coastal hills and low mountains that parallel the Ecuadorian coast between Guayaquil and Esmeraldas, as well as in adjacent areas of southwest Ecuador. Our objectives were: 1) to undertake a rapid biological evaluation of the deciduous and evergreen forest types of the coastal region; 2) to inventory the flora and fauna of representative examples of these forest types, with emphasis on plants, birds, mammals, reptiles, and amphibians; 3) to determine the conservation status of various endemic species of vertebrates and plants thought to be threatened with extinction, with emphasis on large mammals, birds, and tree species of economic importance; 4) to identify areas of forest that remain and to determine their relative biological importance with respect to levels of species diversity, species richness, endemism, and the presence of threatened forms; and 5)

Without a concerted effort by the national and local governments, military authorities, conservation organizations, and concerned citizens, these biologically rich forests …will disappear from the earth within 20 years.

The scientific results of our studies reflect the paucity of distributional and ecological data available for plants and animals of forests along the Pacific coast of Ecuador.

to use the results of our studies to increase awareness of the potential biological (and economic) losses that Ecuador will suffer if these biotic communities and their species are not protected. In the following report we present the results of our fieldwork.

SUMMARY

During six weeks of fieldwork at nine localities along the Pacific coast of Ecuador from Esmeraldas to Arenillas (Fig. 1), the Rapid Assessment Program (RAP) team of Conservation International inventoried plants, birds, mammals, amphibians and reptiles. The results of these surveys confirm that while the region's plant and animal communities are not as species-rich as similar communities in the upper Amazon Basin, levels of endemism in plants, birds, and frogs are unusually high. In contrast, most of the mammal fauna is widespread, but small numbers of endemic species do occur in the region. As previously reported by Dodson and Gentry (1991), we estimate that up to 20 percent of the plant species at most sites visited are endemic to western Ecuador and small areas of adjacent Colombia and Peru. Bird endemism ranged from ca. 10 percent in the wet forest at Bilsa to more than 40 percent in the dry forest and scrub vegetation at Arenillas. This underscores the conservation importance of the severely threatened dry forests in this region. As with other organisms studied, bird species richness declined dramatically from wet to dry forests, with ca. 160 species at Bilsa and only 70 species at Arenillas.

Considering the accessibility of Pacific forests in Ecuador — even those of the coastal mountaintops — we were surprised by the large number of range extensions obtained for all groups, and by the discovery of plant taxa new to science.

The scientific results of our studies reflect the paucity of distributional and ecological data available for plants and animals of forests along the Pacific coast of Ecuador. Most of the tree species at Bilsa apparently constitute new records for Esmeraldas Province and others (e.g., *Schlegelia dressleri* and a *Moutabea* sp.) are new to Ecuador. Especially intriguing is our discovery at Bilsa of a genus new to science (*Exarata*, Gentry 1992) that is a large, locally common tree well known to local people. Indeed, we even ate our meals while sitting on sections of a trunk of this species. Several large tree species found at Bilsa were previously known only from the Río Palenque Science Center, including the rare *Caryodaphnopsis theobromifolia* and *Daphnopsis occulta*.

Other sites also yielded exciting botanical finds. At least two tree genera found at Cerro Mutiles, *Ampelocera* and *Lecointea*, are new to Ecuador. The latter had never been recorded west of the Andes. One of the most common trees at Cerro Mutiles is a subspecies of *Pseudolmedia rigida*, an endemic with a small geographic range. What may be the largest surviving population in the coastal range of the valuable hardwood *Carapa guianensis* was discovered on Cerro Pata de Pájaro near Pedernales; 95 percent of all canopy trees in the summit forest on this mountain were either *Carapa* or an *Eschweilera* sp. An unusual new species of *Bauhinia* was also found on the upper slopes of this mountain. The discovery of endemic plant species previously known only from the Río Palenque Science Center (e.g., *Erythrina megistophylla*) in upper elevation forests on Cerro Achi and at Machalilla indicates that these forests were once connected and that new populations of these species remain to be found in unexplored parts of the coastal cordillera. A large tree (*Phytolacca* sp.) found in the Machalilla moist forest (and once near Río Palenque) might represent an amazing disjunction of the Argentinian *P. doica*, of which there is one old record of a native plant

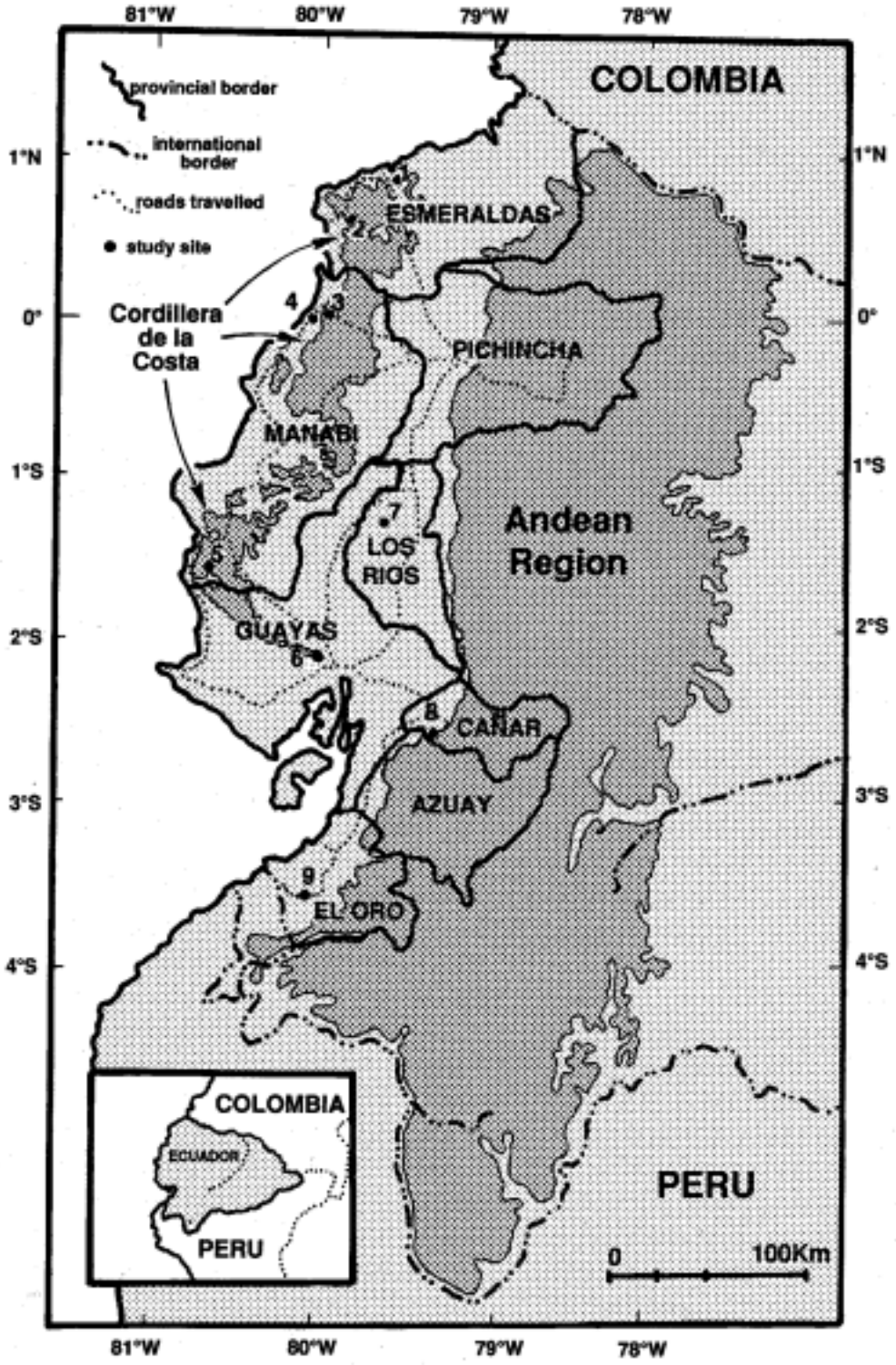

Figure 1. *Map of western Ecuador showing the study sites, road network travelled, and provinces visited in the course of our travels. The numbered study sites correspond with: (1) Cerro Mutiles, (2) Cabeceras de Bilsa, (3) Cerro Pata de Pájaro, (4) Tabuga-Río Cuaque, (5) Parque Nacional Machalilla, (6) Cerro Blanco, (7) Juaneche, (8) Manta Real, and (9) Reserva Militar de Arenillas. This and subsequent figures (unless otherwise noted) are based on maps produced by the Instituto Geográfico Militar, Quito.*

The most interesting result of ornithological surveys was our discovery on the highest ridges at Machalilla of a montane avifauna comprised of at least 17 species not previously known in Ecuador away from the Andes.

collected at an unknown locality in Peru. Another interesting large tree found at Machalilla is apparently a species of Simaroubaceae that is generically unknown to us, but may represent the same genus recently collected in the Cauca Valley of Colombia. Several other plant species collected by us in moist forest at Machalilla may be new to science, including a pendant *Heliconia* with yellowish green, pubescent bracts, and several of the more than one dozen Bromeliaceae found on Cerro San Sebastián.

Important botanical discoveries in the Machalilla dry forest include a *Simira* species (the third most common tree species in the Estero Perro Muerto transect) which is now virtually extinct locally and perhaps generally in western Ecuador, and a small number of adults and scattered saplings of *Myroxylon balsamifera* at Estero Manta Blanca may represent the only extant population of this tree species in the country. Other Machalilla trees of interest include a striking *Capparis* found at Estero Manta Blanca; this 25 m tall individual makes this species among the largest known for the genus. This and another large-leaved *Capparis* with banana-sized, striped fruits may be undescribed species.

The Cerro Blanco reserve was found to be particularly important because it is apparently the only protected limestone flora in western Ecuador and it supports a great diversity of plants whose populations can recover with time. The Cerro Blanco flora also includes a prospective new species of *Salacia*, several other species only recently described from Ecuador, and a species of *Rinorea* (the only dry forest species in the genus) that was previously known only from the type collected in 1844.

Manta Real, the southernmost locality inventoried for plants, also produced some surprising discoveries. In wet forest between 400 and 500 m, the most abundant tree is *Metteniusa nucifera* (Icacinaceae), a rarely collected genus (and a species) unknown from western Ecuador. Below 400 m the forest is dominated by a large species of *Browneopsis* (Leguminosae) with extraordinary hanging inflorescences 2 m long, bearing very large, pink and white flowers.

The most interesting result of ornithological surveys was our discovery on the highest ridges at Machalilla of a montane avifauna comprised of at least 17 species not previously known in Ecuador away from the Andes. Many of these (e.g., *Anabacerthia variegaticeps*, *Grallaria guatimalensis*, *Mecocerculus calopterus*, *Catharus dryas*, and *Amaurospiza concolor*) survive in very small numbers in the uppermost 100-200 m of humid forest along ridgetops that approach 800 m in elevation. These populations have undoubtedly been genetically isolated from Andean forms for an extremely long period of time. Genetic and morphological studies are badly needed to determine the degree to which they have differentiated.

Also of zoogeographic interest was our discovery of *Hylocryptus erythrocephalus* and *Grallaria watkinsi* at Cerro San Sebastián. These species were previously known only from a small area of semideciduous forest in the Andes ca. 200 km to the southeast. Twelve additional dry and moist forest endemics were also found at Machalilla, most of which are considered globally threatened (by the International Council for Bird Preservation) due to massive deforestation within their small geographic ranges in SW Ecuador and NW Peru.

Several moist forest species (e.g., *Brotogeris pyyrhopterus*, *Lathrotriccus griseipectus*, and *Basileuterus fraseri*) not previously known to occur regularly north of the Río Chone were found as far north as the Río Cuaque near Pedernales, where some large patches of suitable habitat survive. Others, including *Ortalis erythroptera* and *Leucopternis occidentalis*, were observed even farther

north on Cerro Mutiles southeast of the city of Esmeraldas. The highest reported densities for the moist forest endemics *Lathrotriccus griseipectus* and *Onychorhynchus occidentalis* were noted in vine-rich forest at Jauneche. The latter species appears to be on the verge of extinction in most of its small range. The flycatcher *Cnipodectes subbrunneus* was also observed at Jauneche; there are only a few, widely scattered records of this species from west of the Andes over the past 100 years. Our sighting of a Spotted Rail (*Pardirallus maculatus*) at Jauneche, appears to be only the second record for the country.

In dry forests at Cerro Blanco and in the Reserva Militar de Arenillas more than 30 percent of all bird species recorded are endemic, including at least 12 species that are globally threatened. Wet forests at Bilsa and Manta Real were found to support more diverse avifaunas (up to 160 spp.), but lower levels of endemism.

A potentially important wintering population of Acadian Flycatcher (*Empidonax virescens*) was discovered in moist forest at Cerro Mutiles and smaller numbers were noted as far south as Parque Nacional Machalilla. Other Neotropical migrants found to be wintering in small numbers in coastal and adjacent montane forests include Olive-sided Flycatcher (*Contopus borealis*), Western Woodpewee (*Contopus* (*sordidulus*)), Swainson's Thrush (*Catharus ustulatus*), Blackburnian Warbler (*Dendroica fusca*), Bay-breasted Warbler (*Dendroica castanea*), Northern Waterthrush (*Seiurus noveboracensis*), Summer Tanager (*Piranga rubra*) and American Redstart (*Setophaga ruticilla*).

Although mammal diversity and endemism are relatively low in the forests of western Ecuador, 54 species, or 17 percent of the mammalian fauna of Ecuador, are found in the Pacific lowlands. We obtained evidence that most of the large mammal species known from the areas visited still survive, albeit in very small numbers. For example, we found small, vulnerable populations of two primate species (*Alouatta palliata* and *Cebus albifrons*) in most of the forests studied; of these, the endemic *C. albifrons aequatorialis* appears to be the most threatened due to its more restricted and isolated distribution. More fieldwork may reveal the presence of additional new or poorly known mammal species restricted to the coastal forests, particularly among bats and rodents.

Our collections of amphibians and reptiles from the Cordillera de la Costa indicated the presence of a herpetofauna comparable to that already known from lowland, western Ecuador. However, the presence of species in the Cordillera de la Costa with Andean slope affinities and the prevalence of unidentifiable species (especially in the species-rich genus *Eleutherodactylus*) suggest the possibility of altitudinal zonation in the herpetofauna like that on the western Andean slopes and a herpetofaunal component restricted to the humid montane forest of the Cordillera.

Among the significant records made during our trips in western Ecuador were new localities for poorly known species and rather large range extensions. At Bilsa, we obtained a specimen of the dendrobatid frog *Epipedobates erythromos*, previously known only from the type locality, and a caecilian (*Oscaecilia equatorialis*) previously known only from the type, and both endemic to western Ecuador. Also at Bilsa, were two species of the colubrid snake genus *Tantilla*, both of which were significant additions to the known range in Ecuador (one was previously known only from the type locality at San Lorenzo). We also collected only the second reported specimen of the treefrog *Phrynohyas venulosa* from western Ecuador (at Jauneche) and the first specimen of the bufonid *Atelopus balios* since the 1920s (at Manta Real).

CONSERVATION OPPORTUNITIES (T. PARKER)

The following forested areas were visited by our group. They are among the few remaining islands of forest left in western Ecuador below 900 m, and are critically important reservoirs of biological diversity, especially the large numbers of plant and animal species found nowhere else on earth.

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1 Cerro Mutiles. The interesting tropical moist forest on Cerro Mutiles, a ridge behind the Jardín Tropical of the Universidad Técnica Luis Vargas Torres (Esmeraldas), is an example of a once widespread forest type that is now confined to scattered, small fragments in western Ecuador. Although this is said to be a protected area, we were dismayed to find that many of the tall trees in the oldest, most diverse forest on the upper slopes of the ridge had recently been felled. Studies of the fauna were made difficult by the constant whine of chain saws being put to use in the forest, both inside and around the reserve. We hope that university officials will decide to place greater importance on the full protection of this reserve, and that they will continue to use it (and the Jardín Tropical) as an educational center which is so desperately needed in this part of the country. The addition to the reserve of surviving patches of forest farther along the ridge — or those on adjacent ridges — would greatly increase the biological value of the reserve.

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2 Cabeceras de Bilsa. This region, near the headwaters of the Río Bilsa south of the city of Esmeraldas and east of Muisne, is near the northwestern margin of what is apparently the last large (to ca. 20,000 ha) block of wet forest remaining south of the Río Esmeraldas. We were not able to determine the southern limit of continuous forest in this region, although an overflight and fieldwork along the Pedernales-El Carmen highway revealed only scattered, small (<10 ha) forest patches south of the Esmeraldas/Manabí border. We learned during our stay at Bilsa that this forest is rapidly being opened up from all sides. Without immediate intervention from the government or conservation organizations, this forest will deteriorate into numerous tiny fragments, or be gone altogether within five years.

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3 Cerro Pata de Pájaro. This mountaintop, isolated wet forest of ca. 800 ha is said (by local people) to be protected, but is obviously being cleared continuously around the entire lower periphery. The watershed importance of this forest to surrounding communities, especially to Pedernales, is obvious to us, but apparently not well understood by local residents. Protecting the watershed would be a useful and manageable project for a conservation group.

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4 Río Cuaque drainage. The semideciduous and moist forests on low, coastal ridges south of Pedernales could perhaps be included in a conservation plan for Cerro Pata de Pájaro. Delimitation of the remaining forested area through overflights and terrestrial reconnaissance, as well as additional floral and faunal surveys, is urgently needed.

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5 Parque Nacional Machalilla. This is the only national park in western Ecuador. The flora and fauna of this biologically important reserve are at risk due to timber harvest, small-scale agriculture, livestock grazing, and hunting by the human population living within and around its borders. Private land ownership within the park is a major problem. According to one source up to 75 percent of the surface area of the park is in private hands (Arriaga 1987); this contradicts earlier reports that 80 percent of the park belonged to the state (IUCN, 1982). Clearly, the acquisition of private lands within the park is essen-

tial to the long-term protection and maintenance of this important area.

All of the deciduous and evergreen forests of Parque Nacional Machalilla have been altered to some degree, and much of the damage is severe. The few families living on or at the base of Cerro San Sebastián continue to clear small areas of forest for agriculture, and their cattle and goats graze and trample the undergrowth throughout the entire area. We suggest that a core area, perhaps centered on Cerro San Sebastián (the most biologically diverse section of the park) be fully protected from these activities. The local residents need not be expelled, but rather employed as park guards or guides — or encouraged in nondestructive, sustainable practices such as the harvest of *tagua* palm nuts, which are abundant locally. We would hope that a protected core area would encompass as many habitats as possible, in particular, large tracts of the globally important deciduous and semideciduous forests at middle elevations (300-600 m) in the mountains and the small patches of fog forest remaining on the mountain peaks. Protection of smaller examples of other plant communities within the park is also recommended, perhaps through the use of fenced exclosures that would allow for the regeneration of native vegetation presently being devoured and trampled by goats and cattle.

We also suggest that remnants of the fog forest on low hills along the coast just south of the Río Ayampe should be immediately considered for inclusion in the park.

We understand that conservation organizations are attempting to educate the local communities concerning the need for alternative economic activities in this region, but wonder whether there will be much to conserve in the way of watersheds, economically valuable trees, or, in a broader sense, biological diversity, when these programs finally begin to make an impact. We sincerely hope that immediate steps are taken to preserve some of the last remnants of original vegetation in the park before they are further damaged or totally destroyed.

Increased efforts should be made to promote awareness of park boundaries, both by the erection of signs at borders and by the posting of signs warning against hunting and lumbering.

With regard to one potential source of income for the small communities that surround the park, we were surprised by the lack of accommodations and restaurants in what would appear to be a mecca for tourists. The scenic coastline and wide beaches, offshore islands including the Galapagos-like Isla de la Plata, and hiking trails to verdant forests such as those on Cerro San Sebastián, would surely attract large numbers of "ecotourists" if their basic needs could be met. Employees in the small but nice hotel in Machalilla acted as if we were the first tourists they had ever seen, and even finding any kind of food in the town was a challenge. There seems to be a tremendous untapped potential for tourism in the area.

In summary, Parque Nacional Machalilla is of great biological value due to the presence of extensive dry and moist forests with large numbers of endemic plants and animals. Whether and how the ecosystems of the park can be saved from further degradation or outright destruction is another matter. In addition to convincing local people of the advantages of protecting watershed areas or source populations of valuable trees, a strong case could be made for all-out promotion of the park as a showcase for environmental tourism.

Parque Nacional Machalilla is of great biological value due to the presence of extensive dry and moist forests with large numbers of endemic plants and animals.

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6 Cerro Blanco reserve. This recently established reserve will hopefully become a model for how to manage a protected area in a densely populated region fraught with social, economic, and political problems. The di-

verse dry to moist limestone forest flora, and its highly endemic avifauna are well-protected in this 2,000 ha area. The newly constructed environmental center at Quebrada Canoa, only a few kilometers west of Guayaquil, will serve to educate the public concerning the local and global importance of forests such as those of Cerro Blanco and areas farther west and north in the coastal cordillera.

We hope that Fundación Natura and the Empresa Cemento Nacional will be able to acquire or manage existing forests that lie adjacent to the present reserve boundaries, for every hectare of original forest vegetation is biologically priceless, and the addition of any large pieces of forested land to the north or south of the reserve would increase the survival prospects of larger vertebrates such as primates or parrots. Identification and acquisition of such areas should be given high priority by conservation organizations in Guayaquil. During an overflight of the Cordillera de Chongón-Colonche about 75-95 km west of Guayaquil, we located a large, rectangular area of what appears to be moist forest at low elevations along the northeast side of the Colonche. This forest is probably similar to that of Jauneche, but is potentially much more valuable because of its larger size and proximity to extensive (though degraded) drier forests of the Cordillera de Colonche. Rapid biological inventory and immediate conservation action in this area are urgently needed.

On a positive note, our overflights of the Cordillera de la Costa between Guayaquil and Machalilla revealed the presence of extensive, albeit heavily impacted tracts of dry forest dominated by large trees of little economic value such as *Cavanillesia platanifolia* and *Ceiba trichistandra*, interspersed among lesser numbers of small individuals of valuable species such as *Tabebuia chrysantha* that have not yet been cut out. With some degree of protection, as well as reforestation of native species that were once numerous, these forests would undoubtedly flourish and yield economic benefits far into the future. Abandonment of these forests will surely lead to the inexorable processes that have turned the Portoviejo region, for example, into a Sahel-like desert.

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7 Jauneche. The history and conservation status of this reserve were discussed in detail by Dodson et al. (1985); a management plan has also been prepared (Valverde et al. 1990). Whereas the University of Guayaquil is to be commended for its protection and maintenance of the biological station and reserve, it is difficult to understand why such a small forest (138 ha) — and one of the only surviving examples of moist forest in lowland southwest Ecuador — needs to be "managed" at all. Total protection of the flora and fauna should be given very high priority. Such a small island in a densely settled sea of agricultural land cannot possibly serve as a viable source of plant or animal products for very long. The importance of Jauneche lies in its function as a reservoir of economically valuable trees, a few of which are known from nowhere else in the world. We heard from local people that trees are still being cut from time to time, and we encountered men with guns well inside the reserve. This is analogous to the situation we encountered at Cerro Mutiles near Esmeraldas; both reserves are managed by university personnel who are surely aware of the massive loss of biological resources in western Ecuador. We hope that both areas will be viewed primarily as educational centers rather than as a source of forest products. The local school at Jauneche is strategically situated at the entrance to the reserve, a perfect place for environmental education.

The biological station could also be promoted as a research site for scientists from other national and international institutions in addition to the University of Guayaquil; this would create a greater constituency for

the facility and would increase the likelihood that it will be maintained. Collaboration with the University of Guayaquil faculty and short-term courses by visiting scientists would greatly benefit the mission of the station and the university. This sort of activity should be supported by visitors' fees for researchers in residence as is the practice at present.

The reserve is an ideal natural laboratory where extinction phenomena could be studied. A comprehensive survey of the natural vegetation and fauna in surrounding areas should be undertaken so that a variety of natural processes could be studied over time (i.e., gene flow to and from areas with modified vegetation, forest succession, use of surrounding areas by forest-dwelling vertebrates such as rodents, primates, and birds). The reserve offers the great advantage of having a well-known flora (Dodson et al. 1985), it is relatively small, and it has comfortable accommodations.

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8 Manta Real. This magnificent and biologically rich forest apparently lies within or just north of the much larger (28,000 ha) Bosque Protector Cordillera de Molleturo, which extends from the Río Chacayacu south to the Río Jagua, and encompasses an elevational range of 200 to 2,000 m (García et al. 1989). Despite rapid encroachment from above and below, large areas of tall forest remain on steep slopes from the base of the mountains (ca. 300 m) up to about 1,500 m. In addition to having an almost intact and diverse flora, the forest at Manta Real still supports populations of the largest mammals, including jaguar (*Panthera onca*), puma (*Felis concolor*), white-lipped peccary (*Tayassu pecari*), and mantled howler monkey (*Alouatta palliata*), and birds (*Tinamus major*, *Penelope* spp.). About 10 percent of the avifauna is endemic to western Ecuador/NW Peru. The parakeet *Pyrrhura orcesi* is restricted to a small area of lower montane forest between Manta Real and Piñas (Ridgely and Robbins 1988), and numerous other poorly known taxa of plants and small vertebrates may share this distribution.

Apart from their biological value, we have seldom seen forested watersheds that are so clearly crucial to the economy of a region or a nation. The banana and cacao industries generate a large percentage of the GNP of the country, and adequate supplies of water are crucial to their continued productivity. The fog forests on the lower slopes of the Andes adjacent to the densely cultivated coastal lands trap and recycle huge quantities of moisture from clouds that roll in off the ocean, even during the driest times of year. The destruction of the remaining forests in southwest Ecuador will — without any doubt — have a strongly adverse effect on the regional economy. This potentially huge problem should be viewed as a threat to the national security of the country. Regional climatic changes (e.g., the trend toward frequent and prolonged droughts) are almost certainly caused in large part by widespread deforestation. Lesser but still significant problems such as the destruction of highway bridges all along the Pacific coast are a consequence of increased runoff due to the removal of forest cover.

Urgent and radical new measures are desperately needed if any of the Bosque Protector de Molleturo is to survive beyond the year 2000. Much of the forest above Manta Real and in the forested drainage of the upper Río Balao has been invaded by cooperatives that have already marked off large sections on even the steepest slopes to be cleared in the near future. Members of long-established cooperatives along the base of these mountains say that they are powerless to stop this intrusion, and most are fearful of the impact such activities will have on the lands below. Almost everyone we spoke with pointed out that government agencies such as IERAC still actively promote deforestation through land-tenure

...we have seldom seen forested watersheds that are so clearly crucial to the economy of a region or a nation.

policies that require owners to clear forest from a large portion of any property in order to maintain rights to it.

The destruction of the Bosque Protector de Molleturo is further hastened by the new road being constructed between Naranjal and Cuenca ("the Molleturo road"), which bisects the reserve. In addition to the environmental damage caused by the construction activity (e.g., unusually massive landslides and the destruction of hundreds of hectares of adjacent forest), this is an important new avenue for colonists who have already cleared all land within sight of the road surface above ca. 1,500 m. It is difficult to understand why the development agency(s) that funded this project did not take into consideration the effects that such a road would have on the Bosque Protector. Lateral colonization away from the roadway will ultimately lead to the destruction of a large percentage of the reserve. At the very least, steps could have been taken to control this colonization, such as the placement of guardposts at the base of the mountain and up around 1,500 m. The costs of maintaining a highway in such steep, erosion-prone terrain will probably be astronomical.

We suggest that conservation organizations seek to forge new alliances with the military, government agencies,…local cooperatives, and large agribusinesses.

We suggest that conservation organizations seek to forge new alliances with the military, government agencies (such as the Ministry of Agriculture and IERAC), local cooperatives, and large agribusinesses (especially the banana-growers), in order to avert the total destruction of the Bosque Protector de Molleturo. The support of the military in this process is essential to its success, for there is little time to implement strategies (environmental education, support for fundamental changes in local economic activities) that might work well in sparsely settled areas east of the Andes. The forests of western Ecuador are gravely threatened.

9 Reserva Militar de Arenillas. Included in this military reserve of ca. 20,000 ha is the largest area of intact dry forest and thornscrub in southwest Ecuador. Although nearly all of the tall dry forest has been selectively logged, the reserve remains an important reservoir (seed bank) for a variety of economically valuable tree species, especially ébano (*Zizyphus thyrsiflora*), guayacán (*Tabebuia chrysantha*), and charan blanco (*Pithecellobium* sp.). The extensive mangrove forest that lies along the coast between Arenillas and Huaquillas represents one of the largest surviving examples of this important ecosystem within the country. Much of this habitat to the north and south has been destroyed for the aquaculture of shrimp. Ironically, the widespread degradation and outright destruction of the coastal estuarine habitats threaten the long-term survival of this important economic resource. We were relieved to see that the military is protecting the natural spawning grounds of shrimp in this area.

Military authorities in Machala and at base headquarters in the reserve expressed great interest in finding ways to protect the integrity of the Arenillas dry forests. They have already begun a reforestation project in collaboration with the Ministry of Agriculture. Thousands of seedlings of three native tree species — ébano (*Zizyphus thyrsiflora*), guachapelí (*Albizia guachapele*), and algarrobo (*Prosopis* sp.) — are being raised at a tree nursery in Arenillas and replanted along forest edges in the interior of the military reserve. Initial results are discouraging, due in large part to a prolonged drought. We hope that the project will not be abandoned, but rather that military and ministry officials will seek outside technical and financial assistance that would result in success, and ultimately, more widespread acceptance and use of such projects.

10 **Reserva Ecológica Cotacachi-Cayapas and Reserva Etnica y Forestal Awa.** Although we did not visit these reserves, primarily because the region has been the focus of numerous biological inventories in recent years (Albuja, pers. comm.), we feel that we should comment on the growing threats to the forests lying along the reserve boundaries (e.g., those just north of the Río Guayllabamba). As the largest block (at ca. 280,000 ha) of tropical forest left in western Ecuador, these two reserves harbor the largest Ecuadorian populations of many plant and animal species restricted to the Chocó region of endemism. It is sad to see the lines of logging trucks (all stacked with massive tree trunks) laboring up the mountain roads from Esmeraldas province into the highlands — and to know that in the very near future most of the economically valuable hardwoods will have been cut out — leaving ragged forests comprised of numerous "useless" species that will also be felled to make way for more viable (but often short-term) economic activities. As in the Bosque Protector de Molleturo, the watershed importance of rain-drenched forests in the lowlands and foothills of the extreme northwest has apparently not been taken into account by government planners, to say little of the lack of value placed on preserving populations of economically valuable species, including even those that generate local income (e.g., Phytelephas aequatorialis, "tagua" palm nuts). Now that national governments worldwide are beginning to address the biodiversity issue, and to seek ways to protect their threatened ecosystems and to use their natural resources on a sustainable basis, it is hoped that the Ecuadorian government will realize the national and global importance of its Pacific forests, take steps in the immediate future to secure the boundaries of existing reserves, and protect — in some way — whatever else remains of this biologically rich region. We hope that all of the attention focussed on Amazonia does not distract national and international conservation organizations from the more immediate need to implement forest conservation strategies in the Pacific lowlands and on the lower slopes of the Andes in western Ecuador and Colombia.

Technical Report

INTRODUCTION TO THE SITES

The technical portion of this report consists of a series of accounts organized by site. Each account follows the same general format with the information organized into sections; the section topics fall in the order: site description and vegetation, birds, mammals, herpetofauna. All sites do not have an account containing all sections, and some accounts cover additional topics. The sites are organized geographically from north to south for the six sites within the Cordillera de la Costa, followed by the three other sites in order from north to south. Maps of the entire region and individual sites appear in Figs. 1-10. An itinerary for the trips appears in Appendix 1, followed by 18 other appendices detailing preliminary inventories of the flora and fauna of the sites.

CERRO MUTILES (MOIST FOREST)

Site Description and Vegetation (R. Foster)

Cerro Mutiles is a high hill (between 200 – 300 m) in back of the Jardín Tropical of the Universidad Técnica "Luis Vargas Torres" of Esmeraldas, a few kilometers southeast of the city of Esmeraldas (Fig. 2). The forest covering part of its southern slope is maintained by the Jardín and is contiguous with it. Located at 0° 54' N, 79° 37' W, it is part of a range of low ridges parallel to the coast that is bisected by the Río Esmeraldas. This is the northern extension of the Cordillera de la Costa, which becomes considerably reduced north of the Río Esmeraldas until it is represented by only a few low hills in the basin of the Río Santiago-Cayapas.

As with many other ridges near the coast, the forest appears to be a fog forest at the top (but a relatively dry one) and a dry forest at the bottom, but the differences are not extreme. Although it probably is drier at the base, the dry deciduous appearance is largely due to tree cutting that has left a high proportion of deciduous second-growth species. Most of the slope appears to be covered with a fairly typical semideciduous moist forest. The soil appears to be fairly rich and non-acidic, with 960 ppm K, 15.8 ppm P and 6770 ppm N, and a pH of 7.1-7.2 (data from Gentry).

The most common canopy trees are *Pseudolmedia rigida*, *Brosimum alicastrum* (Moraceae); *Pouteria reticulata* (Sapotaceae); *Trichilia* cf. *pleeana* (Meliaceae); and *Virola riedii* (Myristicaceae). On the lower slope, fast-growing trees such as *Triplaris cumingiana* (Polygonaceae), *Erythrina poeppigii* (Leguminosae), *Castilla elastica* (Moraceae), *Cupania* cf. *latifolia* (Sapindaceae), and *Spondias mombin* (Anacardiaceae) are all common. There are several species each of *Ficus* (Moraceae) and *Inga* (Leguminosae).

Common smaller trees are *Swartzia haughtii* (Leguminosae), *Sorocea sarcocarpa* (Moraceae), and *Trichilia pallida* (Meliaceae). The most common shrubs include *Psychotria horizontalis* (Rubiaceae); *Annona* sp. (Annonaceae); *Acalypha* sp., *Cleidion* sp. (Euphorbiaceae); *Piper laevigatum* (Piperaceae); *Picramnia latifolia* (Simaroubaceae); *Eugenia galalonensis* (Myrtaceae); and a stout *Dieffenbachia* (Araceae). Lianas are frequent, including many Bignoniaceae.

Despite the small size of the protected area we were able to visit, this was by far the most species-rich moist forest we saw in western Ecuador (Appendix 13). It included many more species in common with Central American and Amazonian moist forests than any of the similar forests to the south. This may be because it is less isolated from the Andes than the strip of moist forest along the coastal side of the Cordillera de la Costa that is south of Esmeraldas. Also, it is quite likely that a much larger area of moist forest previously existed in the hills and ridges south of Portoviejo — if I am interpreting the remnant scrub vegetation correctly. Finally, the terrain at Cerro Mutiles with its ridges and ravines is much more heterogeneous than that of the flat basin north of Guayaquil.

The lower half or two thirds of the slope appears to have been subject to much selective tree-cutting over the last 50 years, but there is progressively less disturbance with increasing altitude. The upper third appears to be nearly intact very old forest (200 + years). We were dismayed to see that within the last two years there has been a renewal of tree-cutting within the reserve. Chain saws were active while we were there, and there were freshly cut logs of several large old *Pouteria reticulata* trees (among other species) right along the main trail to the top. Apparently, this logging is occurring with the approval and even at the behest of the university administration.

Results of Plant Transect and General Observations (A. Gentry)

The Cerro Mutiles forest, which unfortunately appears to have been much modified by foresters who have cleared the understory in many areas, has few hemiepiphytes and an unusual prevalence of lianas, especially Bignoniaceae. In parts it is similar to Jauneche, one of the most liana-dense forests known in the world (Dodson et al. 1985, Gentry 1988).

The Cerro Mutiles forest is typical of western Ecuador moist forest in its relatively low diversity and the relative dominance of Moraceae. Coastal Ecuador is one of the few areas of lowland Latin America where Leguminosae is not the most diverse family. Not only was Moraceae the second most speciose family in the transect at Cerro Mutiles (after the dominant liana family Bignoniaceae), with nine sampled species, but it included 54 sampled individuals as compared to 17 individuals of Leguminosae, which was the third most species-rich family. Four of the six most common trees >10 cm dbh are Moraceae, including the most common, *Pseudolmedia rigida*, with eight individuals >10 cm diameter. Similarly, three of the seven most common large tree (>20 cm dbh) species are Moraceae, including the most prevalent large tree, *Brosimum guianense*. The most abundant understory species are

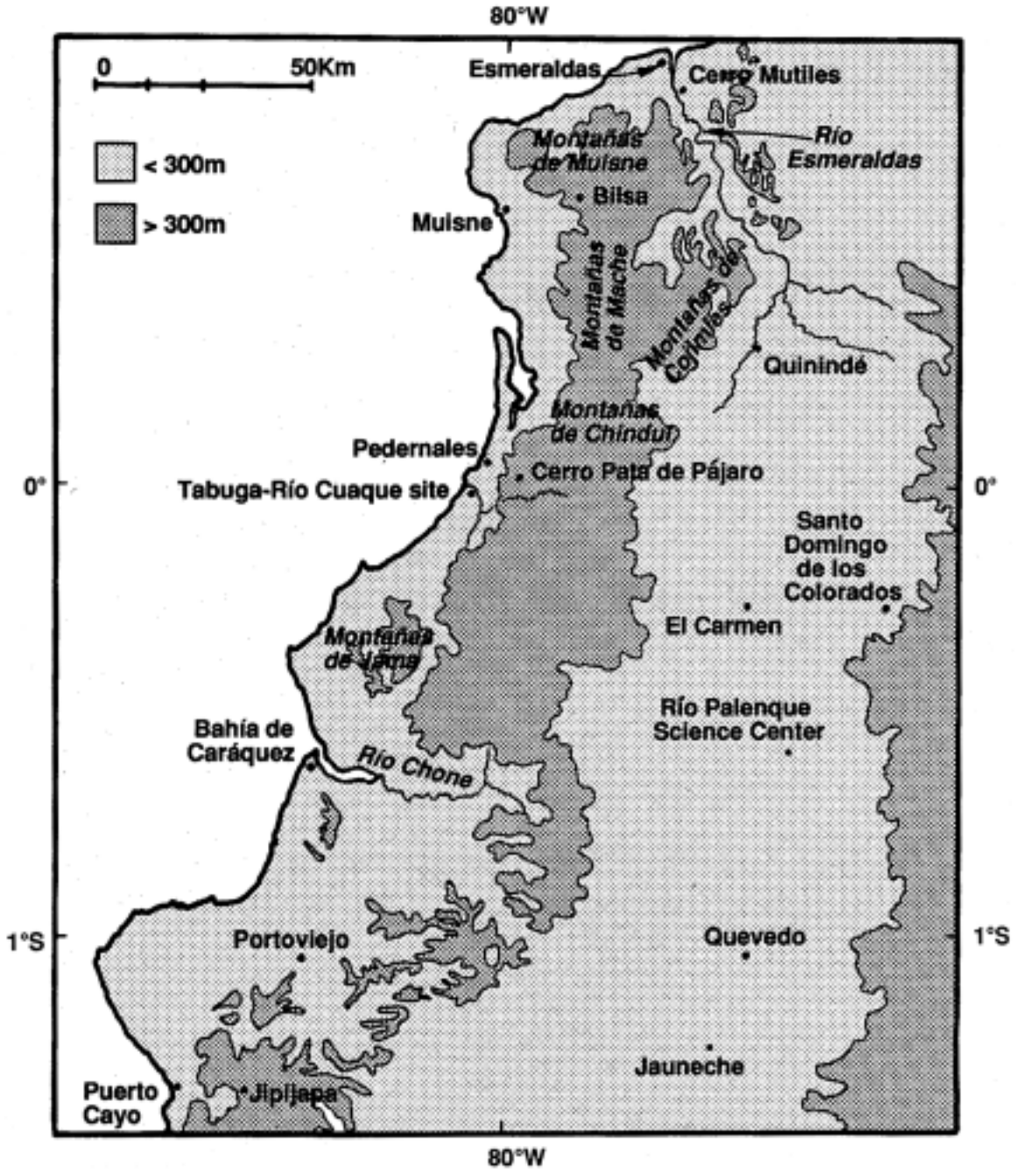

Figure 2. *Map of the northern portion of the Pacific coastal region of western Ecuador showing towns, cities, and geographic features. Note that various portions of the Cordillera de la Costa are known by regional names.*

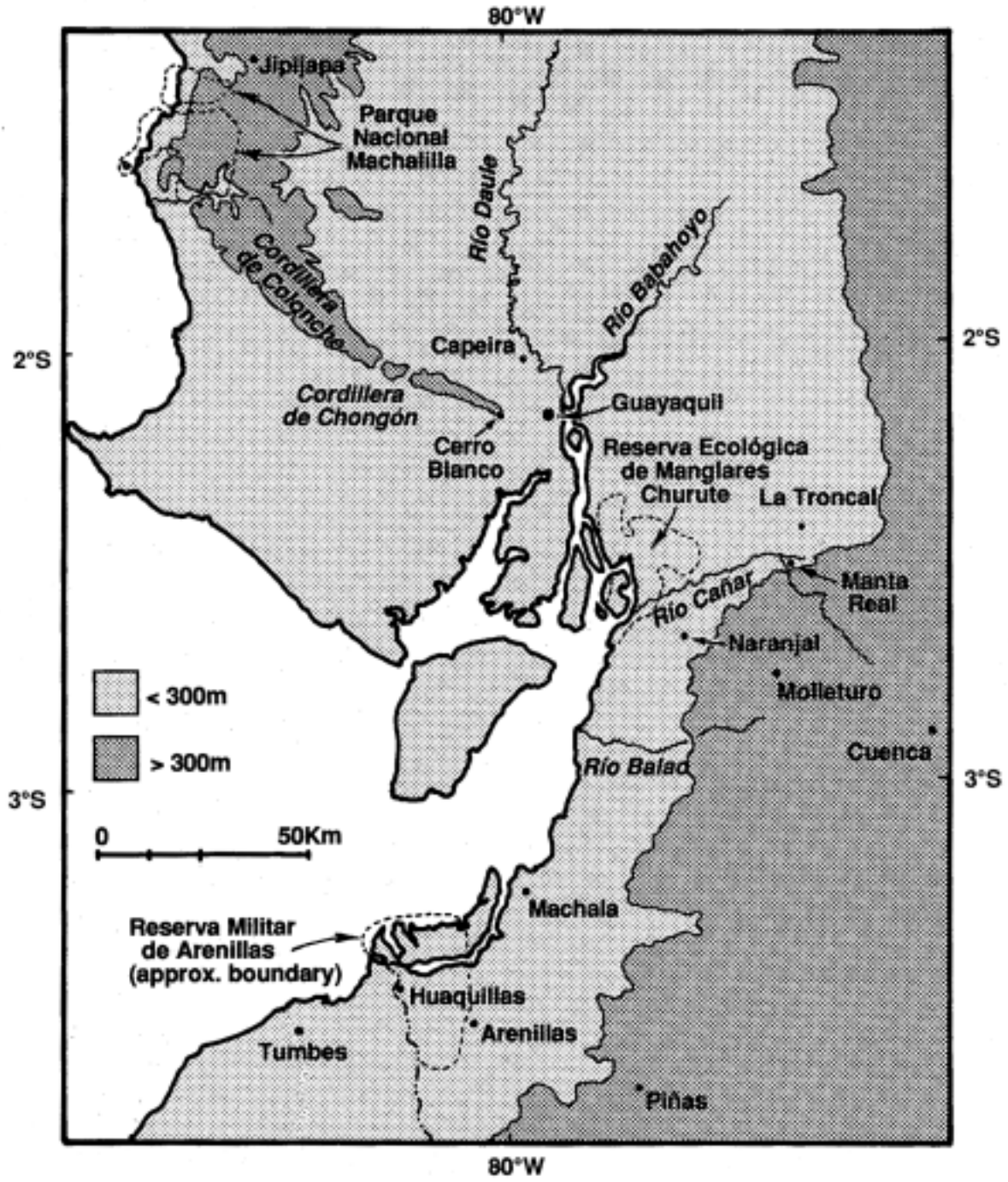

Figure 3. *Map of the southern portion of the Pacific coastal region of western Ecuador.*

Faramea occidentalis and *Trichilia pallida*, with 35 and 25 individuals respectively >2.5 cm dbh. These two species, along with *Pseudolmedia rigida*, constitute fully one quarter of all the sampled individuals in the transect.

Our discovery of a large *Ampelocera* (a genus new to western Ecuador) and *Lecointea* (a genus new to Ecuador and to the entire trans-Andean region of South America) in this forest illustrate how little we know of western Ecuadorian forests.

Birds of Cerro Mutiles (T. Parker)

This small reserve harbors an interesting moist forest avifauna more similar to those of Machalilla and Jauneche than to that of the closer wet forest at Bilsa. Among the ca. 140 forest species identified (see Appendix 8) were numerous taxa not found or rare at Bilsa (e.g., *Campylorhamphus trochilirostris*, *Sittasomus griseicapillus*, *Dysithamnus mentalis*, and *Tolmomyias sulphurescens*) that were common in this drier forest north of the Río Esmeraldas. This forest type may have once covered the now denuded slopes between Bilsa and the coast, but only scattered, small patches now remain in the region. There was also a distinct (though small) wet forest element in the avifauna at this site, including one species, the Blue Cotinga (*Cotinga nattererii*), not found at any locality to the south.

Among other interesting discoveries made at Cerro Mutiles was a surprisingly large population of Rufous-headed Chachalaca (*Ortalis erythroptera*), up to eight pairs or families of which were heard counter-calling within a small area of ca. 2 km^2. Gray-backed Hawks (*Leucopternis occidentalis*) were also observed in the taller ridgetop forest. We were surprised to find both of these threatened species so far north and so close to the city of Esmeraldas. These and other large birds (such as the extant Great Tinamou, *Tinamus major*) cannot possibly survive in this area if illegal hunting and tree-cutting are not curtailed in the near future.

A potentially important wintering population of Acadian Flycatchers (*Empidonax virescens*) was studied at this site. At least six territorial individuals were located within ca. 10 ha of disturbed forest with an abundance of vines at mid-height, and others were noted ca. 2 km away in similar habitat. The vine-rich forests of western Ecuador may be (or may have been) an important non-breeding habitat for this species. Summer Tanagers (*Piranga rubra*) were also common at Cerro Mutiles.

Mammals of Cerro Mutiles (L. Emmons and L. Albuja)

During part of a day walking along trails, we saw few signs of mammals (Appendix 9). Large species such as monkeys and deer appear to have been exterminated. Both the remaining large mammals and many of the plants seem to be under intense exploitation. Because of the small size of the forest and apparent state of its fauna, we think it unlikely that the majority of mammal species would recover even if protected. Nevertheless, immediate conservation action could prevent total extinction of the remaining species.

CABECERAS DE BILSA (WET FOREST)

Site Description and Vegetation (R. Foster)

The Montañas de Muisne is a complex system of ridges south of the city of Esmeraldas and primarily east of Muisne (Fig. 2). This ridge system gradually increases in altitude and steepness farther from the coast. The Cabeceras de Bilsa forest site is on a ridge in the middle and upper end of this gradient east of the small community of San José de Bilsa, near the headwaters of the Río Bilsa (0° 37'N,

79° 51'W)(Fig. 4). Perhaps because the extension of low mountains out into the ocean to the northwest serves to funnel the clouds into the southeast, and because the highest parts of these ridges form a barrier 600 to 800 m high, this forest appears to be extremely wet, equal if not surpassing the wetness of forest on the lower Andean slopes. This was especially surprising because vegetation maps of Ecuador had never indicated that such a habitat (and such an extensive one) even existed in the Cordillera de la Costa, and conservation groups had failed to take note of it. As in the Andes, the precipitation is apparently in the form of much heavy rainfall as well as cloud condensation on the trees. The soil is an extremely sticky red to yellow clay with obviously great water retention capability. It is acidic (pH 4.9-5.3) and especially low in potassium (>1-177 ppm) and phosphorous (1.1/3.1 ppm) (data from Gentry).

There is no evidence of human disturbance to this area prior to the very recent colonization and logging. The presence of large trees of *Caryodaphnopsis theobromifolia* (Lauraceae), an endemic species virtually exterminated throughout the rest of western Ecuador, is an indication of the "pristine" character of the forest. The forested area around Bilsa is now dotted with widely separated "claim stake" clearings of a few hectares each and a network of trails connecting them. Frequently, establishing these clearings involves cutting all the trees except the ones that are most valuable, such as the *Carapa guianensis*. Thus one encounters with surprise the exact reverse of normal selective removal of trees. However, with the advance of the logging roads, all the remaining large trees are taken out, though occasionally juveniles of valuable species are left behind in a welcome if half-hearted gesture at sustainable-yield forestry.

The high moisture environment is reflected in the heavy load of trunk climbers and stem epiphytes on all the trees, something

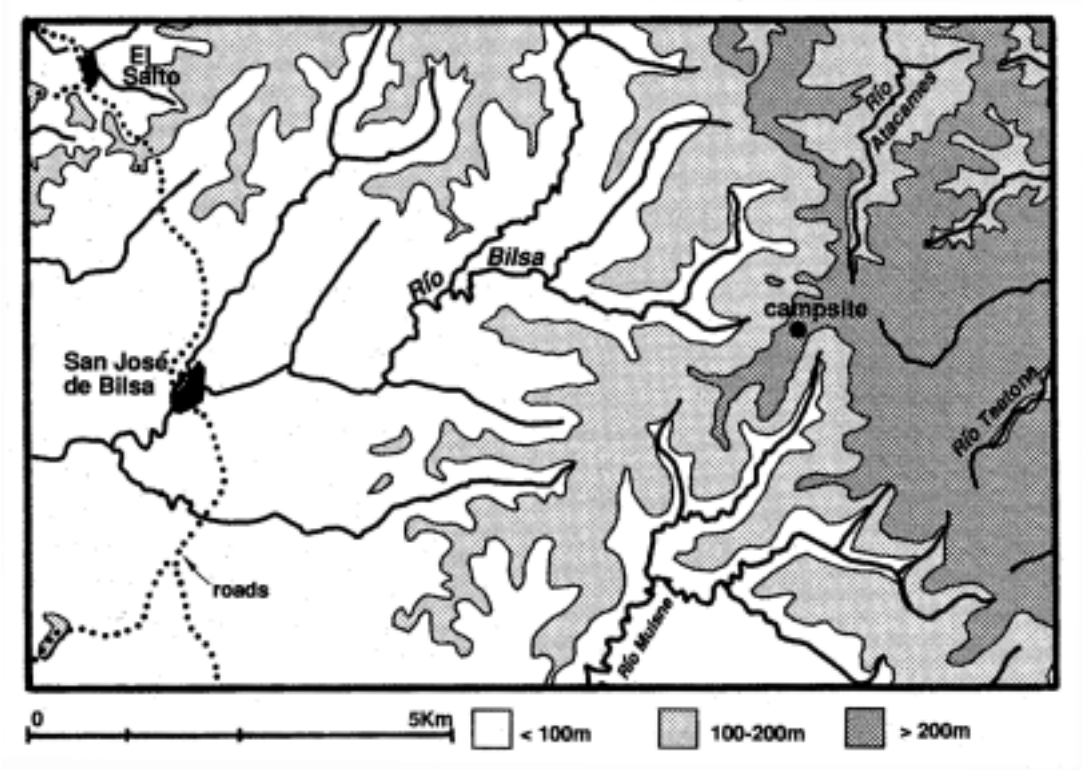

Figure 4. *Map of the Cabeceras de Bilsa area.*

usually not seen at this altitude. The forest canopy is mostly 30-40 m tall with a distinctive physiognomy caused by large numbers of trees with small monopodial crowns (i.e., like a Christmas tree; e.g., *Virola*, *Quararibea*, and *Symphonia*) in contrast to the large, branched, spreading crowns common in the canopy of other mature, lowland wet and moist forests. Even the few *Ceiba pentandra* (Bombacaceae) trees growing here had tight, constricted crowns rather than their normal, massive, spreading, umbrella shape. There are few very big trees and these are mostly *Coussapoa eggersii* (*villosa*) (Moraceae), the common strangler tree of western Ecuador.

The diversity of freestanding woody plants here seems to be equal to or greater than on the wet slopes of the Andes east of Guayaquil…

To explain this vegetation structure requires some speculation. In temperate regions, monopodial trees are much more vulnerable to death or damage by lightning strikes, and the same may be true in the tropics. While one could suppose that an absence of lightning in this area (for whatever reason) allows the monopodial trees to outcompete their sympodial neighbors, it is more likely to have something to do with the clay soil and the conducting system of the trees.

Other unusual aspects of this forest are the extreme paucity of plants with wind-dispersed seeds, the low numbers of Leguminosae, Bignoniaceae (except the hemiepiphytic, bird-dispersed *Schlegelia*), Violaceae, and *Ficus*. These missing groups are most commonly associated with soils relatively rich in nutrients or cation-exchange-capacity, and some groups usually associated with poor soils, such as *Eschweilera* and *Pourouma*, are abundant here. The conclusion that these soils are very poor or acidic is not supported by the rest of the flora with its abundance of *Heliconia*, *Calathea*, *Piper*, *Poulsenia*, *Sloanea*, *Quararibea*, etc. In other words, it is an odd mix of taxonomic groups.

The year-round moisture tends to eliminate the formation of separate communities on ridgetops, slopes, and ravine bottoms, a separation that is pronounced in moist and dry forest. Most species can be found from top to bottom of this gradient and in similar abundance whether they are terrestrial gesneriads, ferns, or canopy trees. One exception to this rule is a species of *Aspidosperma* tree which seemed to occur only along steep ridgetops. Also, landslides are mostly associated with the lower slopes of these valleys and the successional species that grow up on such areas are restricted as a consequence and rarely encountered on the ridges.

The diversity of freestanding woody plants here seems to be equal to or greater than on the wet slopes of the Andes east of Guayaquil, though perhaps not quite as great as on the Andean slopes east of Esmeraldas (Appendix 14). The trunk climbers and other hemiepiphytic or epiphytic species are certainly very diverse and probably the equal of any forest on the western slopes of the Andes.

The most common canopy trees in the area are *Virola dixonii*, *Otoba* sp. (Myristicaceae); *Quararibea soegenii*, *Quararibea* sp. (Bombacaceae); *Eschweilera* sp. (Lecythidaceae); *Cecropia* sp., *Coussapoa eggersii/villosa*, *Pourouma bicolor* (Moraceae); *Astronium* sp. (Anacardiaceae); *Ocotea* cf. *whitei* (Lauraceae); *Protium* sp. (Burseraceae); *Sapium* sp. (Euphorbiaceae); *Sloanea* sp. (Eleocarpaceae); and *Symphonia globulifera* (Guttiferae).

The common understory trees and shrubs are *Catoblastus* sp. (Palmae); *Calyptranthes* sp. (Myrtaceae); *Cephaelis* sp., *Coussarea* sp., *Pentagonia* cf. *macrophylla*, *Psychotria* sp. 2 (Rubiaceae); *Miconia* sp. (Melastomataceae); *Perebea* cf. *angustifolia* (*humilis*) (Moraceae); *Piper augustum*, *Piper* sp. 2 (Piperaceae); and *Tovomita* sp. (Guttiferae).

Terrestrial herbs and subshrubs that are frequent include *Calathea* sp. (Marantaceae), *Costus* sp. (Zingiberaceae), *Cyclanthus bipartitus* (Cyclanthaceae), *Danaea* cf.

moritziana (Marattiaceae), *Dieffenbachia* sp. (Araceae), *Episcia* sp. (Gesneriaceae), *Geonoma* sp. (Palmae), *Heliconia* cf. *longa* (Musaceae), *Triolena barbeyana* (Melastomataceae), and *Selaginella* sp. (Selaginellaceae). The fern *Neurolena lobata* is a common, tall weed along the logging roads.

Trunk climbers and epiphytes that are frequent include *Rhodospatha* (2 spp.), *Anthurium dolichostachyum*, numerous additional species of *Anthurium* and *Philodendron* (Araceae), *Coussapoa* sp. (Moraceae), *Columnea* sp. and numerous other Gesneriaceae, a climbing *Piper* sp. (Piperaceae), and two *Schlegelia* spp. (Bignoniaceae). Normal lianas are rare.

Results of Plant Transects and General Observations (A. Gentry)

At Bilsa, several unusual features of the vegetation, such as lack of wind-dispersed species and prevalence of hemiepiphytic climbers rather than free-climbing lianas, are shared with the Chocó flora (see Gentry 1986b), even though floristically the area seems distinctive at the species level. One unusual floristic feature at Bilsa is the sparse representation of Leguminosae (in transects), which are replaced by Rubiaceae (11-12 spp.) and Moraceae (8 spp.) as the most speciose families in the 0.1 ha sample. Similarly, hemiepiphytic climbers in the families Araceae, Guttiferae, and Piperaceae largely replace the standard bignon and legume lianas. Even the few bignons that are present mostly belong to the hemiepiphytic genus *Schlegelia*.

The most common species in the transects is an *Otoba* (Myristicaceae) and the second most numerous is *Perebea* cf. *angustifolia* (*humilis*)(Moraceae). The prevalence of *Otoba* (17 trees or treelets in 0.1 ha) and numerous Moraceae is usually an indication of rich soils.

At Bilsa, two palms tie as the eighth most common species, the same *Catoblastus* as at Río Palenque Science Center and a *Prestoea*. Indeed, this forest very nearly reproduces the otherwise highly distinctive Río Palenque forest (two thirds of the species in my sample are also at Río Palenque), a quite unexpected result.

Most of the species at Bilsa apparently constitute new records for Esmeraldas Province and a number of others, such as *Schlegelia dressleri* and a *Moutabea* sp., are taxa new to Ecuador. Especially intriguing is a genus new to science (described as *Exarata*; Gentry 1992) that is a large, locally common tree well known to the local people (indeed we even ate our meals while sitting on sections of its trunk). A *Rauvolfia* tentatively identified as a species known only from the Panamanian type and several species previously known only from the Río Palenque Science Center (e.g., *Caryodaphnopsis theobromifolia* and *Daphnopsis occulta*) are also indicative of how little we know of this flora.

Especially intriguing is a genus new to science that is a large, locally common tree well known to local people.

Birds of the Bilsa Area (T. Parker)

This fairly pristine wet forest had the richest bird community of the eight sites surveyed (Appendix 2). Most of the 158 species found at Bilsa (along a ca. 2 km by 100 m transect through mature forest) occur widely in lowland forests of the Neotropics, but 16 (10 percent) are Chocó endemics, and a smaller component (e.g., *Leucopternis occidentalis*, *Ortalis erythroptera*, and *Attila torridus*) is confined primarily to moist forests farther south. The Bilsa avifauna is very like that of the best-known Ecuadorian wet forest site at the Río Palenque Science Center, ca. 150 km to the southeast. As in most other Neotropical evergreen forests, the most speciose families at Bilsa were Formicariidae (16 species), Tyrannidae (27 species), and Thraupinae (22 species). Other typical features include the presence of numerous understory mixed-spe-

cies flocks (with *Dysithamnus puncticeps*, three *Myrmotherula* spp., *Microrhopias quixensis*, *Xenops minutus*, *Thryothorus thoracicus* and many others), and large canopy flocks dominated by tanagers, especially *Tangara* (5 spp.) and two species of *Tachyphonus*. Large frugivores, including pigeons (5 spp.), parrots (5 spp.), trogons (5 spp.), and toucans (3 spp.), seemed to be unusually abundant.

Of conservation importance were large populations of several Chocó endemics, including Rose-faced Parrot (*Pionopsitta pulchra*), Dusky Pigeon (*Columba goodsoni*), and Chocó Toucan (*Ramphastos brevis*). Black-tipped Cotinga (*Carpodectes hopkei*) was noted in small numbers, and Long-wattled Umbrellabird (*Cephalopterus penduliger*) was seen twice. The latter species was unexpected so far west of the Andean foothills and lower montane forest. Other Chocó endemics observed at Bilsa include *Trogon comptus*, *Sipia nigricauda*, *Tangara palmeri*, and *Heterospingus xanthopygius*.

As expected, wintering passerines from North America were more numerous here than at southerly sites. There was a small population of territorial Acadian Flycatchers (*Empidonax virescens*) in the viny middlestory of the Bilsa forest. Unexpected was an Olive-sided Flycatcher (*Contopus borealis*) and a male Blackburnian Warbler (*Dendroica fusca*) — both rare away from the Andes — and at least two singing Bay-breasted Warblers (*Dendroica castanea*); the latter species was known in Ecuador from fewer than five records (P. Greenfield, pers. comm.).

Mammals of the Bilsa Area (L. Emmons and L. Albuja)

Bad weather and moonlight prevented us from adequately sampling this site and further work is needed, but we can make preliminary comments (Appendix 9). Mantled howler monkeys (*Alouatta palliata*), listed as endangered on CITES Appendix 1, had a dense and healthy population at Bilsa, as shown by the many groups seen and heard calling. The monkeys were completely tame, evidence that they are not hunted locally for meat. Although few were caught, bats included some species typical only of undisturbed forest (*Rhinophylla alethina*, *Mimon crenulatum*). Small mammal trapping was unsuccessful, and we saw few signs of terrestrial mammals, but we cannot yet say whether this is a temporary or permanent condition of this forest. People frequently travelled through the area while we were there and hunting pressure may have reduced some populations of large mammals. The local mammals listed by informants included species said to be absent at Machalilla, such as *Bradypus variegatus*, *Cabassous centralis*, and *Marmosa* spp. (see Appendix 9). We expect that the mammal fauna at Bilsa will include more species than forests farther south, such as Machalilla.

Herpetofauna of the Bilsa Area (A. Almendáriz and J. Carr)

At this site in the Muisne mountains, herpetofaunal sampling was successful due largely to a week of heavy rainfall that began the day we arrived. The conditions were particularly favorable for anurans, of which 17 species were found.

The specimens obtained indicate that the herpetofauna of the site is typical of the Chocó lowlands of northwestern South America (Appendix 11). The environmental conditions permitted us to obtain various species of hylids (e.g., *Smilisca phaeota*), leptodactylids (*Eleutherodactylus* spp.), and

dendrobatids (*Colostethus* spp.) that were initiating their reproductive cycle. Most anuran specimens were taken during nocturnal excursions.

Among the interesting finds at this site was the collection of a specimen of *Epipedobates erythromos*, apparently the first since its description (Vigle and Miyata 1980), and only the second known locality for the species. We also obtained a caecilian, *Oscaecilia equatorialis*, which was previously known only from the type locality east of Santo Domingo de los Colorados (Frost 1985).

Two species of *Tantilla* were collected, both represented by a single specimen. *Tantilla equatoriana* was previously known only from the type specimens collected near San Lorenzo in extreme northwestern Ecuador (Wilson 1987), and *T. supracincta* was previously known from only two other west Ecuadorian localities (Wilson et al. 1977; Wilson 1987), although there are many other collection localities known in lower Central America.

With so many interesting finds in such a short period, we feel that additional collections are needed from this region, including at higher altitudes in the same area.

CERRO PATA DE PÁJARO (FOG/CLOUD FOREST, WET FOREST)

Site Description and Vegetation (R. Foster)

The small (nearly 800 m) but conspicuous mountain of Cerro Pata de Pájaro stands by itself not far from the coast near the equator between Bahía de Caráquez and Muisne, just east of Pedernales (00°02' N, 79°58' W)(Fig. 5). It is apparently the highest mountain of the northern coastal range between Portoviejo and Esmeraldas. Most of the other ridgetops in this range do not top 400-500 m, and rarely pass 600 m.

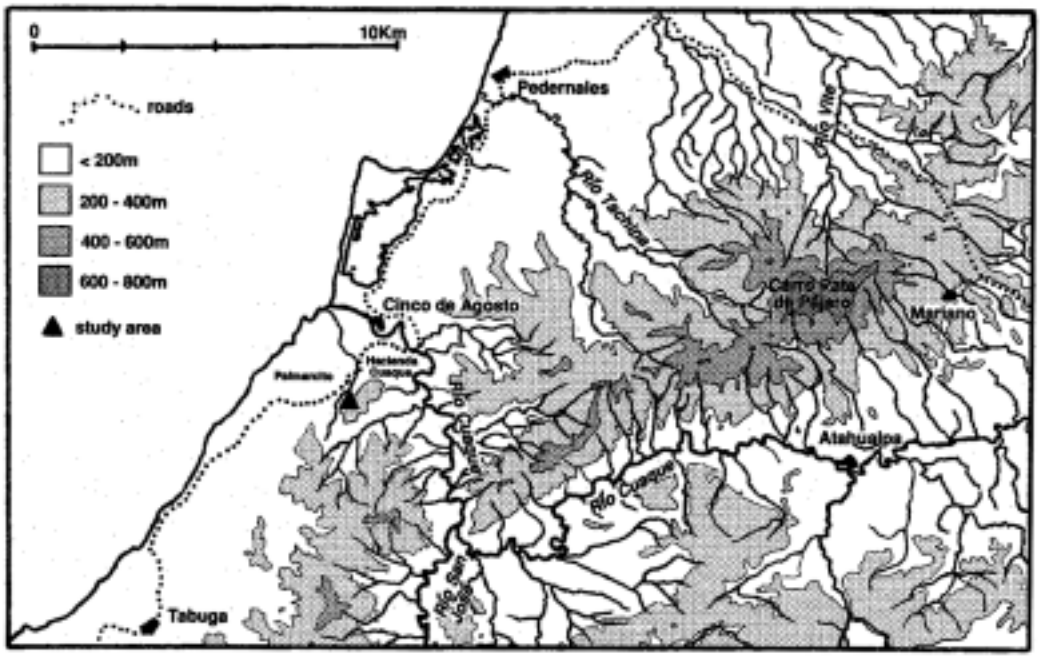

Figure 5. *Map of the area around Cerro Pata de Pájaro, including the Tabuga-Río Cuaque study site.*

The new road from Pedernales to El Carmen passes over the north shoulder of this mountain, and the small village of Mariano on the northeastern flank is a convenient base of operations for obtaining guides and hiking up. The last third of the climb from 550 m to 750 m is very steep and slippery, prohibitive to mules and requiring the use of all four human limbs. The trail all along the crest of the semi-circular mountain is better defined, and ranges from the eastern peak at 730 m down to a saddle at 650 m and up to the western peak at 800 m. There are several other access trails leading up from other sides of the mountain.

Cerro Pato de Pájaro is enveloped in clouds most of the year, even through the dry season. The cloud layer usually hits the mountain at between 650 and 700 m and above. Precipitation is probably from fog condensation in the dry season and mixed with rainfall in the wet season. This results in a "cloud forest" 20-30 m tall at higher elevations, heavily laden with moss, epiphytes, and hemi-epiphytes. Below the cloud layer the 30 m tall forest has fewer epiphytes and less moss, but nonetheless appears very wet, whether from rainfall, or the year-round combination of rainfall and high soil water-content draining from above as a result of the frequent low cloud cover.

Cloud Forest

An estimated 95 percent of the canopy trees in the cloud forest are of two species: *Carapa guianensis* (Meliaceae, "tangar" or "figueroa") and an *Eschweilera* sp. (Lecythidaceae). *Carapa* is the larger tree and makes up most of the basal area and biomass. It is extraordinary to see such a large population of large trees of this valuable species, probably the largest — if not the only — stand remaining in the Cordillera de la Costa. At each site we visited in this mountain range, even if the rest of the forest remained intact, the mature trees of *Carapa* have been removed by axe or chain saw — though juveniles have sensibly been left standing. The same is true on the wet western slopes of the Andes from Pichincha to Azuay and in the hills of the Río Santiago-Cayapas area of Esmeraldas. Possibly the only other area in western Ecuador where large stands of adults of *Carapa* still exist is in the Reserva Ecológica Cotacachi-Cayapas in Esmeraldas (L. Albuja, pers. comm.).

The dominance by these two species does not mean that many other canopy tree species do not occur here, only that others are all locally rare. For whatever reason, the westernmost peak and ridge of the mountain had more diversity and abundance of other canopy species than the eastern ridge. The largest tree seen was a *Sloanea* (Elaeocarpaceae) with a trunk diameter of about 1 m.

The understory trees and tall shrubs are more diverse than those of the canopy, but with the possible exception of melastomes (2 species) and treeferns (probably all one species), most of these species had relatively small populations. Among the low shrubs and terrestrial herbs the most common are species of *Peperomia* (Piperaceae), *Pseuderanthemum* (Acanthaceae), *Psychotria* (Rubiaceae), *Tournefortia* (Boraginaceae), *Spigelia* (Loganiaceae), *Triolena* (Melastomataceae), *Adiantum* and *Selaginella* (Pteridophyta), and *Rhynchospora* (Cyperaceae).

Trunk climbers and trunk epiphytes occur in profusion. Among the most common are *Polybotrya* cf. and *Elaphoglossum* sp. (Pteridophyta); *Columnea* (3 spp., Gesneriaceae); *Asplundia* cf. (Cyclanthaceae); *Macleania* sp. (Ericaceae); *Anthurium* (8 spp.), *Philodendron* (5 spp.), and *Stenospermation* sp. (Araceae); *Guzmania* spp. (Bromeliaceae); and *Schefflera* (2 spp., Araliaceae).

Palms are an occasional but not particularly conspicuous part of the vegetation. All of the species in the cloud forest appear to be more abundant in the wet forest farther down.

Most abundant are an *Aiphanes* sp., *Geonoma interrupta*, and *Catoblastus* cf. *velutinus.* Occasional are *Chamaedorea* cf. *polyclada*, *Geonoma cuneata*, *Bactris* sp. 1 (tall but thin, clumped species common throughout western Ecuador), *Bactris* sp. 2 (small), and *Jessenia bataua*.

At the top of the eastern ridge, a small clearing (ca. 20 by 10 m) was made some years ago, presumably for surveying purposes, and contains cement markers dated 1963 and 1982. Around this clearing are "gap" species rarely found in other parts of the forest such as a *Bocconia* sp. (Papaveraceae, disjunct from the west-Andean cloud forests); *Inga* (2 spp., Leguminosae); *Ladenbergia pavonii*, *Rondeletia* sp. and *Posoqueria* sp. (Rubiaceae).

The cloud forest flora does not show any particular affinities to one region. Rather, it has a mixture of species known from the fog forests of the Chongón-Colonche mountains to the south, the wet forests of the Muisne mountains farther north, the low cloud forests of the western Andes, and a number of species we have not yet noted anywhere else (Appendix 15).

Wet Forest

Between 550 and 650 m on the side slopes and ridges of the mountain, the forest is considerably more diverse in all but its epiphytes. Although this forest was very little explored on this trip, it appeared to have a flora with considerable affinity to that of the lower western slopes of the Andes including the Río Palenque Science Center (Appendix 15). It contained such species as *Calatola costaricensis*, *Brownea disepala*, *Heliconia curtispatha*, *Socratea excorrhiza*, and a *Syagrus* sp. An unusual new species of *Bauhinia* with large, bright red flowers coming out of the trunk, was found in a small, monospecific grove on the ridge here, and nowhere else. Other species of *Bauhinia* with these characteristics are known only from Africa (R. Fortunato, pers. comm.). A one hectare clearing made within the next few years would wipe out the known population. Further investigation of the flora on these slopes is urgently needed.

Disturbance

Except for the tiny clearing on the eastern peak and an old boundary line cut on the western ridge, there is no indication of any tree-cutting in the cloud forest that covers the top of the mountain. We were informed that it is illegal to cut this forest, by order of the "ministry," but further details were not available. However, it is not clear that the law would be enforced or respected, and it may be just a matter of time before the colonists on the lower slopes work their way up. On the side of Atahualpa, the clearings already extend up to 600-650 m along the trail, only a few hundred meters distance from the ridge crest at that point. We saw no evidence of logging activity, just clearings for bananas, coffee, cacao, and cattle.

We did see or pass through several large patches of forest on the upper mountain flanks. Though interrupted by a few clearings, they represent a sizeable area of wet forest around the mountain top. By combining these wet forests with the approximately 2 km^2 of cloud forest, the total area for a reserve of intact forest could be as much as 8 km^2.

Disturbance in the forest other than tree-cutting was also in evidence. As the guides insisted on carrying guns, it is likely that they have already shot out most of the larger game animals and are reduced to picking off squirrels. Apparently, colonists on the south side of the mountain have recently taken to driving their domestic pigs up into the forest at some times of year, probably to feed on all the large *Carapa* and *Eschweilera* nuts. This is causing damage to the ground vegetation and

An unusual new species of* Bauhinia *with large, bright red flowers coming out of the trunk, was found… on the ridge here…

increased erosion in these areas. Before hunting, this mountain would probably have been home to many wild mammals that feed on large nuts due to the dominance of these two tree species. A dog seen by itself on the ridgetop trail is an additional indication of domesticated animals in this forest.

Birds of Cerro Pata de Pájaro (T. Parker)

Although we did not survey birds at this site, this potentially interesting forest may well support some of the montane species found on the Cerros de Colonche to the south (see Appendix 8), as well as wet forest species at the southern limit of their ranges. Chapman (1926) reported southerly records of the antbirds *Myrmeciza berlepschi* and *Dysithamnus puncticeps* from this mountain, which suggests that a very unusual mixture of Chocó and Tumbesan endemics occurs together here. A bird survey is urgently needed, especially as it would eventually prove to be of great value as a test of species loss in a small forest island.

Mammals of Cerro Pata de Pájaro (L. Albuja)

The mammal fauna of the upper elevations of this mountain is typical of wet forests of the tropical zone in northwestern Ecuador, while the fauna at the base of the mountain has dry forest affinities. Our brief visit to the mountain did not allow for a mammal survey in the lower elevation forest.

Twenty species of mammals were recorded in this area; of these, seven (35 percent) were non-flying species (Appendix 10). Two species of primates (*Alouatta palliata* and *Cebus albifrons*) were found on the forested lower slopes of the mountain at 550 - 650 m, none in the cloud forest. The howler monkeys were regularly heard from the mountaintop. The absence of both monkey species in the ridgetop forest is probably due to a lack or scarcity of important food plants, such as *Ficus* spp.

Thirteen species of bats were found at this site (65 percent of the total list), which is a large number for only one night of mist-netting. The species are typical of humid tropical forest; most are frugivores of the family Phyllostomidae (*Artibeus jamaicencis*, *Vampyrops* cf. *infuscatus*, *Rhinophylla alethina*, and *Carollia perspicillata*). Along the trails at the top of the mountain, we noted numerous tracks of peccaries, deer, agoutis, and armadillos. Only one species of squirrel (*Sciurus granatensis*) was found in the area.

Herpetofauna of Cerro Pata de Pájaro (A. Almendáriz and J. Carr)

Although we did not get to visit this site, three other party members obtained a few specimens (Appendix 12). The most interesting of these was a toad, *Bufo caeruleostictus*, that is considered restricted in distribution to the western Andean slopes (Hoogmoed, 1989). This is but one indication of a relationship between the herpetofauna of the coastal cordillera and the Andean slopes. The other species from this site are more widespread in western Ecuador and occur in a fairly wide altitudinal range.

TABUGA - RÍO CUAQUE (MOIST FOREST)

Site Description and Vegetation (R. Foster)

Just south of Pedernales on the coast, the Río Cuaque and its tributary the Río San José form the north and eastern boundary of a series of ridges 200 to 600 m in altitude and covered with moist semideciduous forest. From the western boundary of this area — the main road up the coast between Tabuga and Cinco de Agosto on the Río Cuaque (Fig. 5) — one can see that much of this forest, on the

ridgetops at least, is still mostly intact but going fast.

South of the crossing of the Río Cuaque, the road angles toward the coast and crosses a small saddle shown on maps as Palmarcito. To the east of Palmarcito (00° 01' S, 80° 05' W) lies a ravine and 320 m ridge covered with good-looking 20-30 m moist forest (Fig. 5). The ridgetop can be reached by a gradual trail from the Hacienda Cuaque at the north end near the river, or by bushwhacking straight up from the seasonally dry stream in the ravine below Palmarcito.

The stream edge is characterized by the tree *Brownea angustiflora* (Leguminosae) with its small bunches of slim red flowers, but the remainder of the flora mixed with it appears to be a random assemblage of "weedy" trees and shrubs. The habitat seems highly unstable with frequent bank slides. Common colonists are *Muntingia calabura* (Elaeocarpaceae); *Ochroma pyramidale* (Bombacaceae); *Guazuma pubescens* (Sterculiaceae); *Cochlospermum vitifolium* (Bixaceae); *Spondias mombin* (Anacardiaceae); *Inga* spp., *Centrolobium ochroxylum* (Leguminosae); *Malvaviscus* sp. (Malvaceae); and *Ruellia* aff. *graecizans* (Acanthaceae).

The slopes are dominated by large trees of *Brosimum alicastrum* (Moraceae), *Alseis eggersii* (Rubiaceae), *Attalea colenda* (Palmae), *Pouteria* sp. (Sapotaceae), *Lonchocarpus* sp. (Leguminosae), and occasional large individuals of *Ficus trigonata* and two other figs (Moraceae). Infrequent are *Ampelocera* sp., *Celtis schippii* (Ulmaceae); *Clarisia racemosa*, *Coussapoa eggersii* (Moraceae); *Genipa americana* (Rubiaceae); *Pochota trinitensis*, *Pseudobombax millei*, *Quararibea asterolepis* (Bombacaceae); and a couple of other unidentified trees. We did not see any *Virola reidii* (Myristicaceae), perhaps because this site is too dry for them or because they have already been cut out.

There is a great diversity of shrubs and small trees on the slopes. The common ones are *Morisonia* sp. (Capparidaceae); *Adelia triloba* (Euphorbiaceae); *Aiphanes* sp., *Clavija eggersii* (Theophrastaceae); *Faramea occidentalis*, *Guettarda* sp., *Randia* sp., *Rudgea* sp. (Rubiaceae); *Gustavia pubescens* (Lecythidaceae); *Eugenia galalonensis*, *Eugenia* sp. (Myrtaceae); *Erythroxylum patens* (Erythroxylaceae); *Trichilia elegans* (Meliaceae); *Rhipidocladum* sp. (Gramineae); and *Zamia lindenii* (Zamiaceae). The apparent absence of *Capparis ecuadorica* is surprising.

Common terrestrial herbs include a variety of ferns (*Cyclopeltis semicordata*, *Tectaria incisa*, *Adiantum* sp.) and the grass *Streptochaeta* sp. Common vines and lianas are *Lycoseris trinervis* (Compositae), *Malvaviscus* sp. (Malvaceae), *Acacia* cf. *polystachya* (Leguminosae), and *Pisonia aculeata* (Nyctaginaceae). Trunk epiphytes are rare but a giant 'bird-nest' *Anthurium* is conspicuous.

The top of the ridge seemed to be a slightly moister habitat. Numerous species not seen on the slopes are encountered here, but only a few of these are really abundant — for example, a *Rinorea* sp. (Violaceae) and *Psychotria horizontalis* (Rubiaceae).

The flora as a whole is roughly intermediate between those of the moist forests at Cerro Mutiles and Jauneche, which is appropriate given the geographic position of this site, but the flora of course has its own peculiarities (Appendix 16).

Fauna (R. Foster)

Howler monkeys (*Alouatta palliata)* can frequently be heard from the road. In addition to the three troops of *Alouatta* encountered in fruiting *Ficus* and *Brosimum*, there were abundant feces and trails of small deer.

During an earlier, brief stop along the highway in semideciduous forest just south of the Río Cuaque crossing, Parker saw or heard *Brotogeris pyrrhopterus*, *Lathrotriccus gri-*

seipectus, and *Basileuterus fraseri*, three dry forest endemic bird species not previously known north of the Río Chone. The forests of the Río Cuaque drainage may well be the northern limit for these and other endemics of this forest type. Farther south towards Bahía de Caráquez there were only a few small patches of good dry forest within sight of the road.

PARQUE NACIONAL MACHALILLA (FOG FOREST, DRY FOREST, COASTAL SCRUB)

Site Description and Vegetation (R. Foster)

Parque Nacional Machalilla is about 55,000 ha in size. It includes three separate parcels,

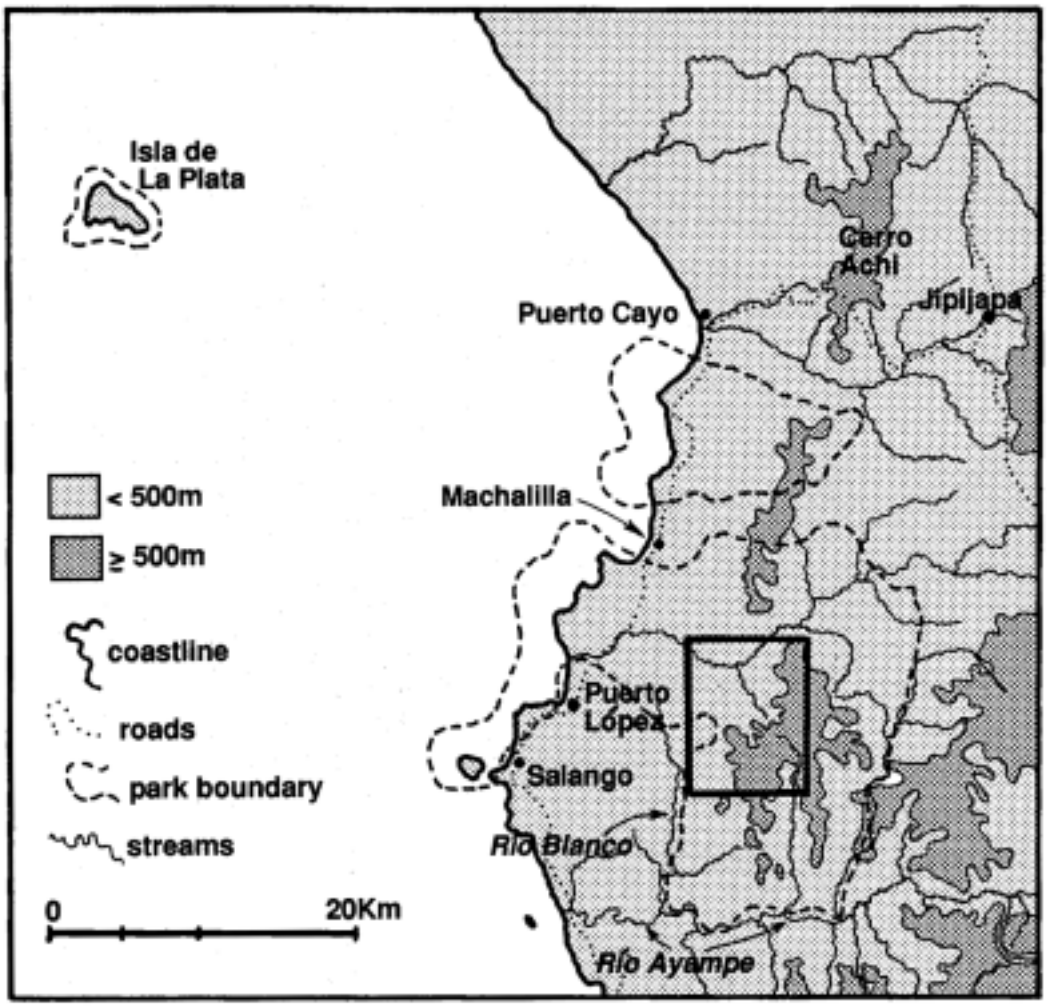

Figure 6. *Map of coastal Ecuador showing the three units of Parque Nacional Machalilla. The area of the rectangle is enlarged in Figure 7.*

two on the mainland and the offshore island of Isla de la Plata (Fig. 6). The mainland portions of the park extend from the coast into the highest ridges of the Cordillera de la Costa near the middle of the range between Guayaquil and Bahía de Caráquez. The larger towns (i.e., Puerto López, Machalilla) are excluded from the park boundaries, but smaller settlements are included.

Along parts of this coast, fog forest (or remnants of it) occurs on the hills right near the ocean. This type of fog forest is found just south of the park below the Río Ayampe in an area that should be immediately considered for inclusion in the park. In Machalilla, however, the more typical pattern of dry conditions on the hills near the coast exists, and fog forest is only found on the highest hills several kilometers inland. These different distributions probably reflect the patterns of airflow from the ocean onto land in response to different configurations of ridges, coastline, and

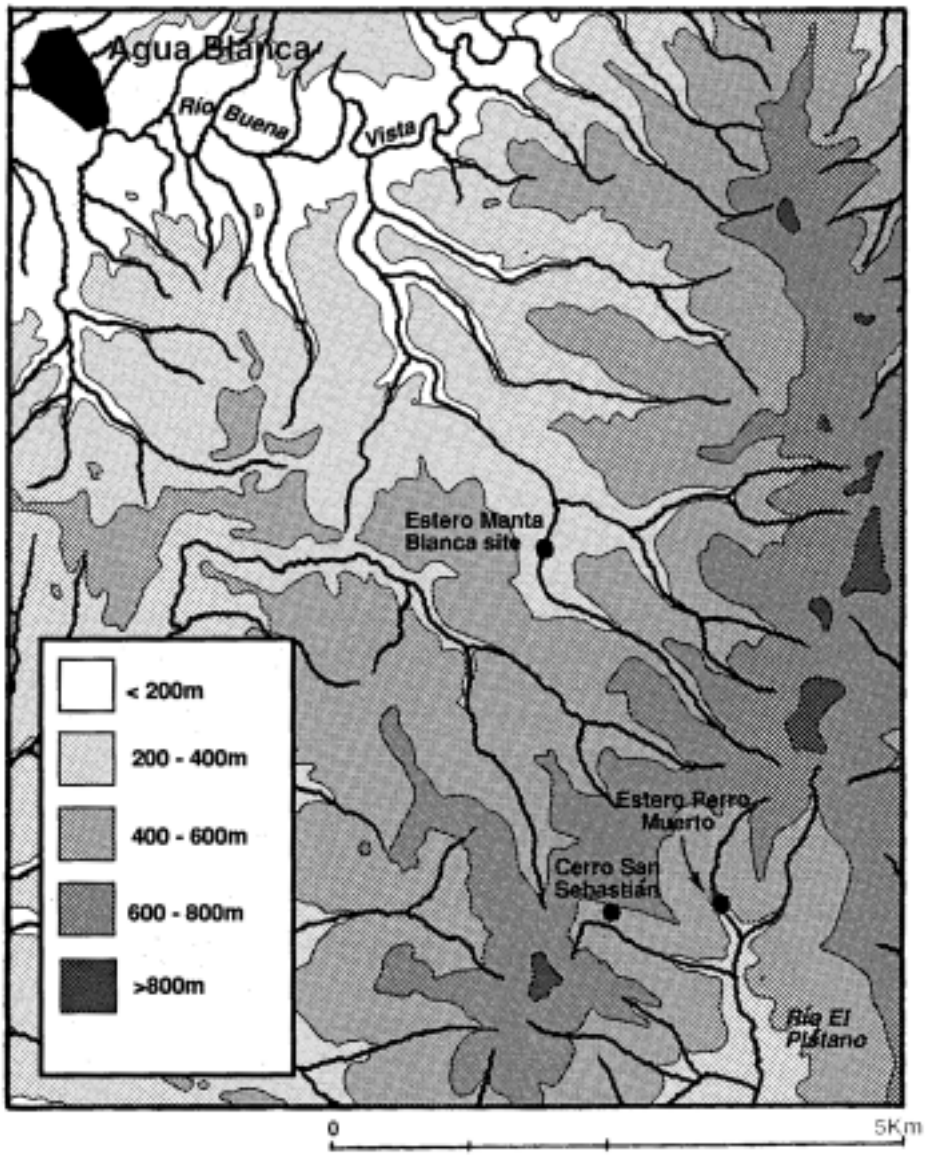

Figure 7. *Enlargement of a central portion of Parque Nacional Machalilla showing our campsite on Cerro San Sebastián and two dry forest transect sites.*

offshore islands. The cloud layer may be trapped low on the coast at times, but in most of the coastal area it gradually rises to where it skims only the tops of the high ridges.

There are abrupt changes between different plant communities at Machalilla more than at any other sites we visited (Appendix 17). Here the fog forest of the ridgetops rapidly turns into dry forest on the middle and lower slopes, separated by only a very narrow band of transitional moist forest. Gentry's San Sebastián transect was made where the fog forest grades into the moist forest.

There are abrupt changes between different plant communities at Machalilla more than at any other sites we visited...

Fog Forest

With every passing cloud that comes up against the ridge, this forest starts dripping heavily, very much as if it were raining. Stepping out into a clearing, however, one immediately finds that there is no rain at all. The tree stems are loaded with trunk climbers, vascular epiphytes, and bryophytes.

The most common trees of the fog forest on Cerro San Sebastián (Fig. 7) and adjacent ridges varied considerably according to the extent of disturbance. The following species stand out, even if they are not abundant in all places: *Grias peruviana* (Lecythidaceae); *Poulsenia armata*, *Ficus maxima*, *Ficus trigonata* (Moraceae); *Quararibea grandiflora* (Bombacaceae); *Sapium* sp. (Euphorbiaceae); *Tapirira* sp. (Anacardiaceae); *Triplaris cumiingiana* (Polygonaceae); *Cordia* sp. (Boraginaceae); *Turpinia occidentalis* (Staphyleaceae); *Matayba* sp. (Sapindaceae); *Aspidosperma* sp. (Apocynaceae); *Borojoa* sp. (Rubiaceae); *Cecropia* sp. (Cecropiaceae); *Chrysophyllum* sp. (Sapotaceae); *Heliocarpus americana* (Tiliaceae); *Ocotea* sp. (Lauraceae); *Tabebuia chrysantha* (Bignoniaceae); *Vitex gigantea* (Verbenaceae); *Dussia* sp. and several species of *Inga* (Leguminoseae).

Important shrubs are *Acalypha diversifolia* (Euphorbiaceae); *Ardisia* (2 spp., Myrsinaceae); *Bauhinia* sp. (Leguminosae); *Clavija* sp. (Theophrastaceae), *Chamaedorea* sp., *Geonoma* sp. (Palmae); *Cornutia* sp. (Verbenaceae); *Palicourea* sp., *Pentagonia* sp. (Rubiaceae); *Petiveria alliacea* (Phytolaccaceae); *Rauvolfia* sp. (Apocynaceae); *Siparuna* sp. (Monimiaceae); *Talisia* sp. (Sapindaceae); *Trichilia pallida* (Meliaceae); and *Witheringia* sp. (Solanaceae).

Common herbs include *Calathea insignis*, *Maranta gibba* (Marantaceae); *Heliconia latispatha*, *Heliconia* sp. (Musaceae); *Dieffenbachia* sp., *Xanthosoma* sp. (Araceae); *Ossaea* sp. (Melastomataceae); *Begonia glabra*, *Begonia* sp. (Begoniaceae); *Burmeistra* sp. (Campanulaceae); *Asplundia* sp. (Cyclanthaceae); *Hoffmannia* sp. (Rubiaceae); and *Selaginella* sp. (Selaginellaceae).

Common epiphytes are *Oncidium* cf. *obryzatum*, *Pleurothallis* sp., *Sobralia* sp., *Stelis* sp. (Orchidaceae); *Anthurium* sp., *Philodendron* sp. (Araceae); *Sphearospermum* sp. (Ericaceae); *Blakea* sp. (Melastomataceae); *Columnea* spp. (Gesneriaceae); *Nephrolepis* sp. (Davalliaceae); *Microgramma* sp., *Polypodium* sp. (Polypodiaceae); *Tillandsia usneoides*, *T. narthecoides*, and *Tillandsia* (3 spp., Bromeliaceae).

Additional Botanical Observations and Transect Data (A. Gentry)

To our knowledge, the flora of the moist (i.e., fog) forest patches above 550 m in Parque Nacional Machalilla has not previously been studied (Appendix 17). This flora, now isolated, is so remarkably similar to that of Río Palenque Science Center (with two thirds of the species in my sample in common) as to indicate a former direct connection. A good example of a shared species with an otherwise very restricted distribution is *Erythrina megistophylla*, which is common at both localities. It is especially noteworthy that the flora is closer to that of Río Palenque than to

that of geographically closer Jauneche, which probably has a more similar rainfall regime as well. Apparently, cloud-cover effects (shared by Cerro San Sebastián and Río Palenque) take precedence over absolute precipitation as a determinant of the vegetation. Physiognomically, this is reflected in the prevalence of hemiepiphytic climbers, which constitute a third of the scandent species in the sample.

A few noteworthy species from the Machalilla moist forest that are not at Río Palenque include a large tree (*Phytolacca* sp.) not previously reported from western Ecuador (but which I collected once before in the vicinity of Río Palenque); this might be an amazing disjunction of the Argentinian *P. dioica* (of which there is one old record as a native plant from Peru — without locality). Another unusually interesting large tree is apparently a species of Simaroubaceae (because of its pinnately compound leaves and apocarpous indehiscent fruits) that is generically quite unknown to me. Especially intriguing is the fact that there is another recent collection of this same genus (whatever it may be) from the Cauca Valley of Colombia. Nor are these two collections conspecific. Several other species at San Sebastián that I had never seen before might be new, including a pendant *Heliconia* with yellowish-green, pubescent bracts, and several of the more than a dozen species of Bromeliaceae that we collected. The common *Dieffenbachia* is undescribed, as is at least one *Anthurium* (G72592).

In the plant transects in mature forest at San Sebastián, palms were especially dominant, with *Chamaedorea polyclada* being the most common woody species (31 trees/0.1 ha). The endemic species *Phytelephas aequatorialis* was the most common tree (10 trees >10 cm dbh in 0.1 ha).

Floristically, the sampled forest is unusual for lowland western Ecuador in the prevalence of Lauraceae, which tie with Leguminosae as the most speciose family in our sample (six spp. each) and included three of the most common large tree (>20 cm dbh) species. Prevalence of Lauraceae is a common cloud forest phenomenon and may reflect the site's cloud forest nature. As usual in lowland western Ecuador, Moraceae is also well represented, with *Poulsenia armata* the most common species and the third most common species >10 cm dbh. The second most common understory species (after *Chamaedorea polyclada*) is a *Palicourea*. Also noteworthy in the sampled plot were *Quararibaea grandifolia*, the third most common species (and second most common (8 individuals) species >10 cm dbh), *Aegiphila alba* the fourth most common species, and the hemiepiphytic *Philodendron purpureoviride*, the most common climber (16 individuals).

Habitat Disturbance on Cerro San Sebastián (R. Foster)

All of the fog (= moist) forest we visited had been disturbed to some degree. In the best cases, this habitat has only suffered removal of one or a few valuable tree species such as *Carapa guianensis*. At worst, it has been completely cleared to form pastures or to cultivate platanos. On average the forest has either suffered from severe cattle-grazing activity in the understory or has had most of the trees of any large size cut out for common use.

Where the cutting has been most intense, there are usually dense stands of bamboo or large populations of young ivory nut palms, *Phytelephas aequatorialis*. These species rapidly take advantage of the high-light environment created by the tree-cutting. Normally these species would only be colonizing fresh landslides — not a frequent occurrence here. The palm regeneration is perhaps also encouraged for its useful leaves and fruits.

There is a conservation advantage here to the colonization by bamboo: The thorny

and dense stems keep cattle out of the understory (though probably not goats). To the extent that juvenile plants have survived after harvesting of adult trees, they remain protected until the bamboo finally flowers and dies, at which point the other plants are hopefully large enough to avoid herbivory and trampling by the cattle. For herb species this may be only a very short-term protection. Many of the plant species we found in the fog forest were only found under these bamboo thickets. How well these thickets trap cloud moisture compared to the normal forest is not clear.

Clearing of fog forest, in addition to eliminating species populations outright, immediately dries out the ground except for what little superficial moisture is trapped by the low herbs. This has far-reaching consequences, not only in altering the soil structure in a way that makes recolonization or reforestation difficult, but also in greatly reducing the ground water available to all the forests on the slopes and along the increasingly dry streams in the valley below.

Clearing of fog forest …has far-reaching consequences …in greatly reducing the ground water available to all the forests on the slopes and…in the valley below.

Dry Forest (A. Gentry)

The Machalilla dry forest hardly exists as "forest" anymore. Worse, many important plant species are virtually extinct locally and perhaps generally in western Ecuador. Examples include a *Simira* sp., perhaps now occurring on only one hill near Estero Perro Muerto (where it was the third most common species in our transect). Similarly, the few large individuals and scattered saplings of *Myroxylon balsamifera* at Estero Manta Blanca may represent the only extant population in the country. We saw no trees of *Cedrela*, an important timber tree and the dominant species in the less-disturbed but otherwise equivalent dry forest near Tumbes, Peru, and suspect that it once occurred at Machalilla but now may be locally extinct or nearly so.

It is noteworthy that the species composition of the dry forest apparently varies greatly from place to place within Parque Nacional Machalilla. For example, 59 percent of the species in my (incomplete) Estero Manta Blanca sample were not represented in the equivalent sample from Estero Perro Muerto. In contrast, 75 percent of the species in my Cerro Amotape transect from northwestern Peru were observed at Machalilla, and 50 percent of them occurred in the Machalilla dry forest transects. One extremely interesting disjunct from the Amotape area of Peru that occurred in the Manta Blanca sample is *Delostoma gracile*, previously known only from the type from 900 m elevation in Tumbes. Not only is this the second collection ever of this rare species, but also by far the lowest altitude record for the entire genus, which otherwise occurs only in Andean forests.

Although there are some local peculiarities, the dominant families in our dry forest sample from Estero Perro Muerto are Leguminosae and Bignoniaceae (7 spp. each), just as they are in essentially all Neotropical dry forests. A noteworthy family in this region is Capparidaceae, which mostly occurs in the very driest forests and may be more dominant here than anywhere else in the Neotropics. One striking *Capparis* (of which we found only a single tree) at Estero Manta Blanca is a large tree ca. 25 m tall, among the largest for this genus. Another interesting *Capparis* discovery is that the sometimes confused *C. heterophylla* and *C. ecuadorica* show strong ecological differentiation in areas where they are sympatric. I have not previously seen the large-leaved *Capparis* with edible banana-sized, striped fruits that we found at Machalilla and it may be an undescribed species.

An endemic plant genus of the western Ecuadorian dry forests, *Macranthisiphon* (Bignoniaceae), is the most common species along disturbed parts of the trail to Estero Manta

Blanca in Machalilla National Park. A distinctive distributional pattern for plants (and to a lesser extent for birds), is the disjunct occurrence of dry forest taxa in dry areas of western Ecuador/northwest Peru and across the Andes in Bolivia; a plant example is *Cydista decora*.

Coastal Scrub (R. Foster)

The predominant vegetation along the coast is a thorny scrub forest or shrubland. However, there are obvious radical differences from place to place in the appearance and composition of this scrub. Some areas are dominated by columnar cacti, others by *Jacquinia* shrubs and small trees. *Capparis* trees and shrubs are especially prominent.

From archeological excavations, we know that the coastal area of the park has a long history of human occupation. It is very likely that prior to human occupation, some kind of "normal" much taller dry forest covered the region. It is not clear now if the striking differences in plant communities in this coastal zone reflect differences in human land use — such as the differences now seen where goats are kept in or out — or differences in the underlying rock that assume a greater importance to the plants once the buffering effects of a soil layer has been stripped away by erosion and overgrazing. Gentry suggests that small, but critical differences in rainfall between different sites may be responsible for these plant community differences.

Birds of Machalilla (T. Parker)

Our six days of fieldwork in the park revealed the presence of 214 species of landbirds, 37 (17 percent) of which are endemic to western Ecuador and adjacent northwest Peru (Appendix 3). The richest bird community in the park (with ca. 140 spp.) is that of evergreen forests on the upper slopes and ridgecrests of mountains such as Cerro San Sebastián. Many of the most numerous species in these forests (e.g., *Sittasomus griseicapillus*, *Lathrotriccus griseipectus*, *Thryothorus paucimaculatus*, and *Basileuterus fraseri*) are characteristic of moist forests farther south, but others occur mainly in wetter areas to the north. Deciduous (= dry) forests, where 64 resident species were found, occur from the lowlands up to ca. 500 m. A few species, such as *Grallaria watkinsi*, were found only in a narrow transitional zone (at 500-600 m) between almost leafless deciduous forest and more humid evergreen forest, but extensive logging and trampling of the undergrowth by cattle have severely altered this type of forest.

In the uppermost evergreen (= fog) forest at 600-800 m on Cerro San Sebastián, we were surprised to discover 17 montane bird species not previously known in Ecuador away from the Andes, including seemingly small, vulnerable populations of *Anabacerthia variegaticeps*, *Grallaria guatimalensis*, *Mecocerculus calopterus*, *Troglodytes solstitialis*, *Catharus dryas*, and *Amaurospiza concolor*. We estimate that there are fewer than 500 individuals of most of these species in the park, and continued slash-and-burn agriculture and trampling of the undergrowth by cattle clearly threaten their long-term survival. Individuals of the Mountain Wren (*Troglodytes solstitialis*) appeared to be unusually gray and may represent an undescribed subspecies endemic to the coastal mountains. The degree to which all montane species of the coastal cordillera have differentiated from Andean populations should be investigated.

Also of zoogeographic interest was our discovery of *Hylocryptus erythrocephalus* and *Grallaria watkinsi* on Cerro San Sebastián; these species were previously known only from a small area of semideciduous forest in the Andes ca. 200 km to the southeast. Other potentially threatened dry and moist forest endemics found on Cerro San Sebastián in-

clude *Crypturellus transfasciatus*, *Leucopternis occidentalis*, *Ortalis erythroptera*, *Leptotila ochraceiventris*, *Aratinga erythrogenys*, *Acestrura bombus*, *Campephilus gayaquilensis*, *Pyriglena pacifica*, *Lathrotriccus griseipectus*, *Attila torridus*, *Onychorhynchus occidentalis*, and *Carduelis siemiradzkii*. Another (but smaller) component of the moist forest avifauna in the park consists of wet forest species at or near the southern limits of their distribution; these include *Lurocalis semitorquatus*, *Malacoptila panamensis*, *Dendrocincla fuliginosa*, *Formicarius nigricapillus*, *Microcerculus marginatus*, and *Dacnis lineata*.

Of ecological interest was the apparent importance to nectarivorous birds of numerous flowering individuals of the small endemic tree *Erythrina megistophylla*. These trees were visited constantly by large numbers of hummingbirds, especially *Thalurania colombica*, *Amazilia tzacatl*, and *Adelomyia melanogenys*. These species (and *Phaethornis superciliosus*) were also frequently seen at flowers of *Heliconia latispatha*. Few other hummingbird flowers were conspicuous, except for those of several unidentified canopy vines.

Despite continued hunting pressure and deforestation within the national park, a large population of Rufous-headed Chachalacas (*Ortalis erythroptera*) survives in the evergreen forests of Machalilla above 500 m. Based on counts of counter-calling pairs/families, we estimate the Cerro San Sebastián population to be ca. 25 individuals/km^2. In contrast, the Machalilla population of Crested Guans (*Penelope purpurascens*) is very small — probably less than 200 individuals — and may be extirpated within a few years if steps are not taken to protect them. Perhaps also needing protection are several species of large raptors, such as Ornate Hawk-Eagle (*Spizaetus ornatus*) and Black Hawk-Eagle (*Spizaetus tyrannus*), that also occur in the more densely forested parts of the park.

Small numbers of the following Nearctic migrants were apparently "wintering" in the evergreen forests above 500 m: *Contopus (sordidulus)*, *Empidonax virescens*, *Catharus ustulatus*, *Seiurus noveboracensis* (along streams), *Setophaga ruticilla*, and *Piranga rubra*. All of these were near the southern limits of their non-breeding ranges west of the Andes.

The lowland and foothill scrub avifauna of Machalilla is diverse (Appendix 3) and apparently resilient in the face of constant, severe overgrazing by goats and cattle. Populations of some bird (and mammal) species would no doubt increase dramatically if the impact of domestic livestock was lessened.

During a short visit to the stunted evergreen forest on Cerro Achi (600 m), a ridge crossed by the Puerto Cayo-Jipijapa highway, we found a number of the montane bird species observed on the higher ridges in Parque Nacional Machalilla, including *Adelomyia melanogenys*, *Cranioleuca erythrops*, and *Henicorhina leucophrys* (see Appendix 8). Although this isolated patch of forest was small (<100 ha), it also supported at least one pair of Gray-backed Hawks (*Leucopternis occidentalis*) and at least two groups of Rufous-headed Chachalacas (*Ortalis erythroptera*). Watkins' Antpitta was found at this site in March 1991 (P. Koopmans, pers. comm.). How long these species will persist in such (small) forest islands is unknown.

Mammals of Machalilla (L. Emmons and L. Albuja)

Thirty-three species of mammals were identified in the park. Our own data were supplemented by skins and skeletal remains found in the museum at Salango, the Centro de Interpretación Ambiental and Oficina del Parque, and in a house of residents in the park. The list is incomplete and more species of small mammals can be expected to occur here.

Densities of native mammals were very low. Among larger species, only kinkajous (*Potos flavus*) and agoutis (*Dasyprocta punctata*) seemed to have good populations in the better forest fragments above 600 m on Cerro San Sebastián. The two monkey species (*Alouatta palliata*, *Cebus albifrons*) in the park are tame and apparently are not hunted for meat by park residents. Nonetheless, only a few groups of howler monkeys (ca. 3-4 of *Alouatta palliata* on Cerro San Sebastián and adjacent ridges) and *Cebus* seem to survive — all in the better fragments of higher elevation forest. Forest destruction is probably the direct cause of low primate numbers. Rodent and marsupial numbers were so low as to be virtually nonexistent at the time of our visit. This may have been a temporary situation caused by regional drought, and requires further study.

The severe degradation of the forest understory by cattle is also likely to have negative effects on small mammal diversity. Bat populations were good on the higher, wetter ridges above 700 m, but the species were largely typical of disturbed forest (e.g., *Artibeus* spp. and *Carollia* spp.). At the foot of the mountain by the Río El Plátano, only a single vampire bat was caught, and there was a striking absence of bats seen flying about. Thirteen years ago, when the forest was in better condition, Albuja made a brief trip to Río Blanco and collected six species of bats near Río El Plátano. Habitat alteration since that time may have restricted the mammal fauna to the more humid mountaintops.

Park rangers and residents of Machalilla state categorically that there are three species of deer in the park, White-tailed Deer (*Odocoileus virginianus*, *cola blanca*) in the drier lowlands, and two sympatric brocket deer in the wetter highlands, a large blackish form (*encerrado*) and a smaller pale brown form (*colorado*). In 1987, Albuja observed skins and skulls of both forms in the possession of a local hunter. A skin and a skull of an *encerrado* are in the collections of the Escuela Politécnica Nacional. The blackish form may correspond to *Mazama fuscata* Allen 1915, and the smaller to *Mazama americana*. In recent years mammalogists have considered these forms to be conspecific and have recognized but one species of brocket deer in lowland Ecuador and Colombia. This question merits immediate attention to establish whether there are two species, what they are, and what their distributions are. There may be a species of deer endemic to western Ecuador that has recently been overlooked by science. It is likely to be highly endangered or threatened.

Hunting and severe forest degradation have reduced the native mammals of Machalilla to small and fragmentary populations, but because many species still persist, the fauna would recover if forest vegetation was totally protected and allowed to regenerate.

Hunting and severe forest degradation have reduced the native mammals of Machalilla to small and fragmentary populations...

Herpetofauna of Machalilla
(A. Almendáriz and J. Carr)

Following a brief visit along the Río Ayampe (at 70 m), we conducted more extensive fieldwork in the San Sebastián sector, near the highest and wettest part of the park. The primary study area was on Cerro San Sebastián, ca. 8.5 km southeast of Agua Blanca, and trips were made to the surrounding area, including the sites called La Pacharaca and Bola de Oro. Some material from lower elevation dry forest was obtained by Al Gentry and Carmen Josse in the course of their botanical collecting. Additional information was taken from the material located in the Interpretive Center of the park headquarters and in the Museo de Salango (Appendix 11).

The very dry conditions at the sites sampled within the park were not favorable for collecting amphibians. We found anurans

primarily near small springs and pools in a streambed and in the highest, wettest part of the forest (around 750 m). Only anurans of the genera *Colostethus* and *Eleutherodactylus* were collected. It is worth noting that in the microhabitats where it was possible to find anurans, they were relatively abundant. Snakes and lizards were scarce; the two species of snakes caught were very near two pools where anurans were common. One of them, *Leptodeira septentrionalis*, feeds primarily on frogs. Lizards of the genera *Ameiva* and *Ophryoessoides* were found primarily near disturbed sites, such as pastures and cultivated fields.

The *Colostethus* within the park provide an indication of altitudinal variation in the herpetofauna coincident with the marked vegetation and precipitation gradients. One species was collected on a muddy, drying backwater pool of the Río Ayampe at about 70-80 m altitude, and the other was collected near the campsite along permanent pools at 550 m. The lowland species was later collected in July at Jauneche (see Appendix 12), another lowland site (50-70 m).

One of the unidentified *Eleutherodactylus* species from Cerro San Sebastián is tentatively allied with *E. phoxocephalus*, a species known only from the western slopes of the Andes above 2,000 m (Frost, 1985). This is another indication of a relationship between the Cordillera de la Costa herpetofauna and that of the western Andean slopes.

CERRO BLANCO (MOIST LIMESTONE FOREST)

Site Description and Vegetation (R. Foster)

On the outskirts of Guayaquil, Cerro Blanco (2° 10' S, 80° 02' W) is near the southeastern end of the Cordillera de la Costa (Figs. 3,8). Cerro Blanco is the part of this narrowing ridge system with a great exposure of white limestone rock. This limestone is used to produce the cement with which most of Guayaquil is now being built, hence there is a large mining industry operating along the front wall of this ridge system. In recent years, the security needed to protect the mine has helped preserve the forest nearby, mainly on the ridges and small valleys directly in back of the mining operation.

This forest, in spite of its current protection, is not particularly old and much of it is very scrubby and not more than 5-10 m high. There are some fairly large patches of forest as much as 100 years old on sheltered slopes. The most common large tree in these patches is *Brosimum alicastrum*. The streambeds in the shallow ravines maintain pools of water throughout the dry season. The vegetation of this area reflects a moist forest climate over a porous limestone rock. As in other limestone areas, the lack of a high water table creates severe water-stress problems for plants in the dry season. This selects for deciduous plants with a very high tolerance for stress, or plants with roots capable of penetrating far enough down through the rock to reach water throughout the year.

Before human disturbance eroded the soil and accentuated the extremes of drought, there was probably considerably less deciduousness than now. Nevertheless, large conspicuous deciduous trees such as *Cavanillesia platanifolia* were probably as abundant then as now on the ridges. The front slope of the ridge where the mining for cement is underway seems to be much drier than the top and back ridges and slopes. The front slope is dominated (visually) by *Ceiba trichistandra* and the back ridges by *Cavanillesia platanifolia*. From an overflight it is apparent that *Cavanillesia* dominates the entire eastern side of the Cerro Azul ridges for many kilometers to the northwest, and almost never overlaps with *Ceiba trichistandra*, which intermittently

dominates many other dry habitats all the way north to near Pedernales. It is not clear whether this is strictly the result of a difference in soils and their water-holding capacity, their chemistry, or some very specific local climatic difference.

A nearly evergreen forest is maintained along the streambeds, but in the one ravine studied in detail, Quebrada Canoa, the dominant species were large figs (mostly stranglers) and other fast-growing species of no current commercial value. It appears that all trees of even modest value had already been cut out and it was virtually impossible to reconstruct the composition of the original forest. Most likely it was a more typical moist forest community such as found at Jauneche.

This does not mean that the forest is of no botanical interest; it is apparently the only protected limestone flora in western Ecuador and has a great diversity of species still present whose populations can recover with time (Appendix 18). Elsewhere, because limestone soils are productive for seasonal crops, the species restricted to this substrate will probably disappear.

According to Gentry, the flora includes a prospective new species of *Salacia*, several other species he has only recently described from Ecuador, and a species of *Rinorea* (the only one from dry forest in the world) that was previously known only from the type collected in 1844.

[Note: there is a recent overview of the phytosociology and plant resources of the Cordillera de Chongón-Colonche (Valverde 1991).]

Birds of Cerro Blanco (T. Parker)

During two brief visits to this recently established dry forest reserve of 2,000 ha, we found 143 bird species in tall, semideciduous forest in Quebrada Canoa and on adjacent ridges (Appendix 4). Thirty-seven (28 percent) of these species are endemic to southwest Ecuador and adjacent northwest Peru. The Cerro Blanco avifauna is very similar to that of a

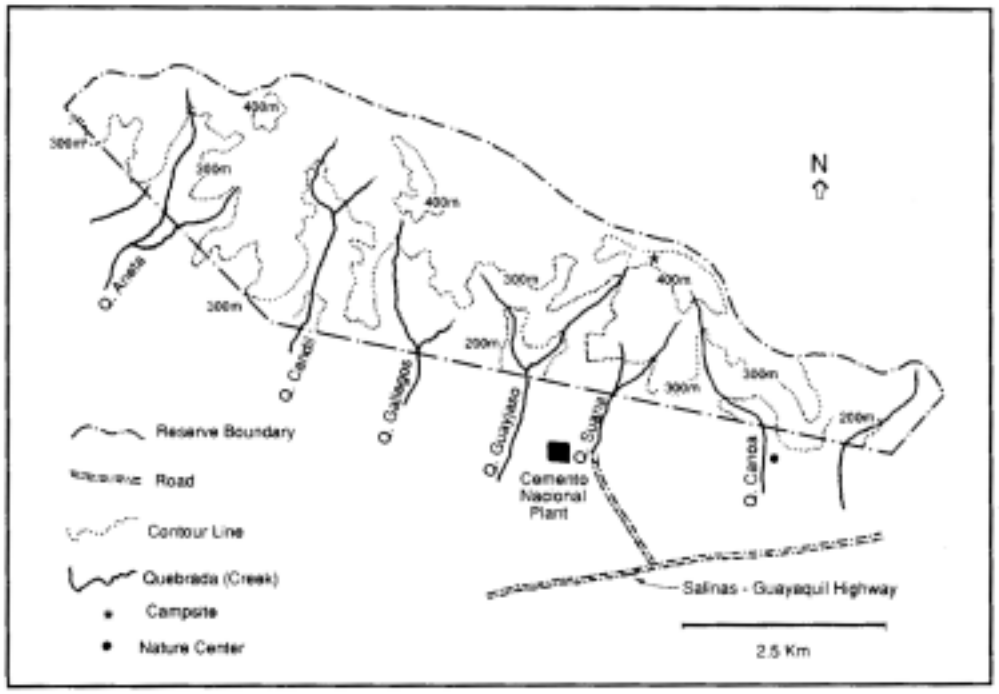

Figure 8. *Map of the Bosque Protector Cerro Blanco (map based on original from Fundación Natura).*

more pristine dry forest in the Bosque Nacional de Tumbes in northwest Peru, where ca. 90 resident species were found by Wiedenfeld et al. (1985; pers. obs.).

Among the Cerro Blanco dry forest endemics were three poorly known species not previously reported from the area: Ochre-bellied Dove (*Leptotila ochraceiventris*), Blackish-headed Spinetail (*Synallaxis tithys*), and Gray-breasted Flycatcher (*Lathrotriccus griseipectus*). At least three male *Leptotila ochraceiventris* called persistently from viny thickets in the undergrowth of Quebrada Canoa during our January visit, and a male was seen displaying before a female. Our local guide said that this rare dove occurs here only during the wet season (December-April), but the nondescript flycatcher may have been previously overlooked. Other species of interest due to their restricted distributions include Pale-browed Tinamou (*Crypturellus transfasciatus*), several of which were heard in January, a pair of Gray-backed Hawks (*Leucopternis occidentalis*) which were probably nesting in tall trees in Quebrada Canoa (in January), and large numbers of the potentially threatened Gray-cheeked Parakeet (*Brotogeris pyrrhopterus*) were observed in the tops of tall *Ficus* trees in the quebrada (ravine) bottom. Several groups of Saffron Siskins (*Carduelis siemiradzkii*), known from only a few localities in an area of ca. 10,000 km^2 in southwest Ecuador and adjacent Tumbes, Peru, were also found in Quebrada Canoa.

Interesting features of the reserve include the presence of an unusual diversity of raptors, including 15 species of hawks and kites, and 6 species of Falconidae. As in other Neotropical forests, the most speciose family is Tyrannidae with 23 species. Very southerly records of three Nearctic migrants were obtained in January: Northern Waterthrush (*Seiurus noveboracensis*), American Redstart (*Setophaga ruticilla*), and Summer Tanager (*Piranga rubra*).

Our guide also informed us that he continues to observe a small group of Great Green Macaws (*Ara ambigua*), a remnant population that barely survives here and in the Cordillera de Colonche to the northwest (R. Jones, R. Ridgely, pers. comms.). The guide also mentioned that Crested Guans (*Penelope purpurascens*) have been locally extinct for more than 20 years (although E. Aspiazu reports having seen a pair within the past year).

The presence of a diverse dry forest bird community so close to the city of Guayaquil is quite surprising. The Cerro Blanco reserve is one of only a few large tracts of dry forest left in western Ecuador, others lying within or near Parque Nacional Machalilla, the Reserva Militar de Arenillas, and the hills around and north of Bahía de Caráquez.

[Note: a preliminary bird list for the reserve has also been prepared by Ralph Jones (MS), who accompanied Parker on his second visit to the area.]

…fieldwork confirmed our initial impression that mammal populations in the reserve remain in relatively good condition.

Mammals of Cerro Blanco (L. Albuja)

Following a very brief visit to this reserve in January 1991 (Appendix 9), the RAP team returned in July and spent more than 30 hours over a period of four days obtaining additional information on mammals through direct observation, the trapping of smaller species such as rodents and bats, and examination of tracks and droppings of larger species (Appendix 10). This fieldwork confirmed our initial impression that mammal populations in the reserve remain in relatively good condition.

The mammal fauna of the area is typical of dry tropical forest. Representative species include the Mantled Howler Monkey (*Alouatta palliata*) and White-fronted Capuchin (*Cebus albifrons*), both of which prefer denser forest adjacent to the humid quebradas, two species of deer (*Mazama americana* and

Odocoileus virginianus), peccaries (*Tayassu pecari* and *T. tajacu*), small cats (*Felis pardalis*, *F. yagouaroundi*), kinkajous (*Potos flavus*), coatimundis (*Nasua narica*), and crab-eating racoons (*Procyon cancrivorus*).

Two species of squirrels were recorded in the reserve, *Sciurus granatensis* and *S. stramineus*; other common rodents include spiny rats (*Proechimys decumanus*) and porcupines (*Coendu rothschildi*). This suggests the presence of a rich rodent fauna in the reserve. Data obtained during visits in January and July indicate that pools of water that form during the dry season (August-November) in the middle and lower parts of quebradas are important to many species of mammals and other animals, especially those that frequent the quebradas in search of water and food; bats are particularly common in these areas.

A great quantity of large mammal bones was found in the quebradas, including those of deer and peccaries; this indicates that jaguars (*Panthera onca*) still inhabit the area. Along the Ecuadorian coast this rare species occurs primarily in the southwest.

During all walks in the forest made by the author and other members of the RAP team, a variety of mammal species was easily recorded. This shows that the area is a refuge for large numbers of mammals and that their protection is effective.

Considering the conservation status of dry tropical forest remnants in western Ecuador, and taking into account the relatively large size of the Bosque Protector Cerro Blanco, we feel strongly that it is necessary to support all efforts by the Empresa Cemento Nacional and Fundación Natura to maintain or improve the condition of this forest.

Herpetofauna of Cerro Blanco (A. Almendáriz and J. Carr)

Following a brief reconnaissance of the reserve in January, most of our field effort in July was concentrated in the upper part of Quebrada Canoa and near the trails at the lower end of the quebrada. As a result of dry conditions during both visits, the few anurans found were encountered near pools of water in the quebrada or on adjacent vegetation in areas where the forest canopy closed over the streambed.

Colostethus infraguttatus was abundant near the pools in the streambed, and tadpoles near transformation were found in July. This species has been considered to have a Pacific Andean slope distribution between 500-1000 m (Frost, 1985). The Cerro Blanco record is the first from the Cordillera de la Costa, and at an elevation of only 100-200 m, although the species has previously been reported from Río Palenque Science Center at a similar altitude (Vigle and Miyata, 1980).

Lizards of the genus *Ameiva* were very common on the forest floor in January but were much less obvious in July, although several blue-tailed juveniles were seen. The iguanid *Ophryoessoides iridescens* was also common on the forest floor and near clearings in both months, although in July most specimens seen were small juveniles.

JAUNECHE (MOIST FOREST)

Site Description and Vegetation (R. Foster)

The Jauneche forest — a biological station and forest reserve of the Universidad de Guayaquil known formally as the Estación Científica Pedro Franco Dávila — is the subject of a book on its flora (Dodson et al. 1985), and a management plan that includes much of what is known of its biology (Valverde et al. 1991)(Fig. 9). There is little point in repeating all of the botanical and ecological description here, except to summarize and add any different points of view and new observations.

Jauneche (1° 20' S, 79° 35' W) is part of a flat but dissected plain north of Guayaquil in the center of the great, flat valley between the Cordillera de la Costa and the western slopes of the Andes. Most of the terrain is only slightly undulating but there are significant erosion slopes near the main drainage channels. The rainfall of 1,855 mm per year is strongly seasonal, but the tree canopy is largely evergreen except for many "successional" species. Gentry considers the mature forest to be much more deciduous.

It is difficult to interpret the highly disturbed forest near the station and margins of the plot, which makes up perhaps half of the area. It is a jumble of vine tangles, second-growth trees, occasional relict old-forest trees, palms, and patches of old-forest understory.

The terrain breaks up into a series of ridges and ravines closer to the Estero Peñafiel, which is the main drainage channel. The ridges and slopes differ somewhat in their floral composition — mostly a matter of relative abundance of species rather than really different communities — the ridges probably having more of the drought-tolerant species. The most abundant understory woody plants appear to be *Duguetia peruviana* (Annonaceae), *Capparis ecuadorica* (Capparidaceae), *Faramea occidentalis* (Rubiaceae), and *Erythroxylum patens* (Erythroxylaceae). The unbranched stems and tight whorls of large leaves of *Talisia setigera* (Sapindaceae) and *Gustavia angustifolia* (Lecythidaceae) are conspicuous in the understory, and there are several species of *Psychotria* (Rubiaceae).

It is not clear that any of the forest is in a "virgin" state. Most of the forest that has not been subject to recent intensive cutting is nevertheless dominated by large *Coussapoa eggersii* (*villosa*) (Moraceae), large strangler figs (*Ficus*), and other large species that are usually left behind and thrive when the more useful species are selectively cut. A large, valuable tree of the region, *Anacardium*

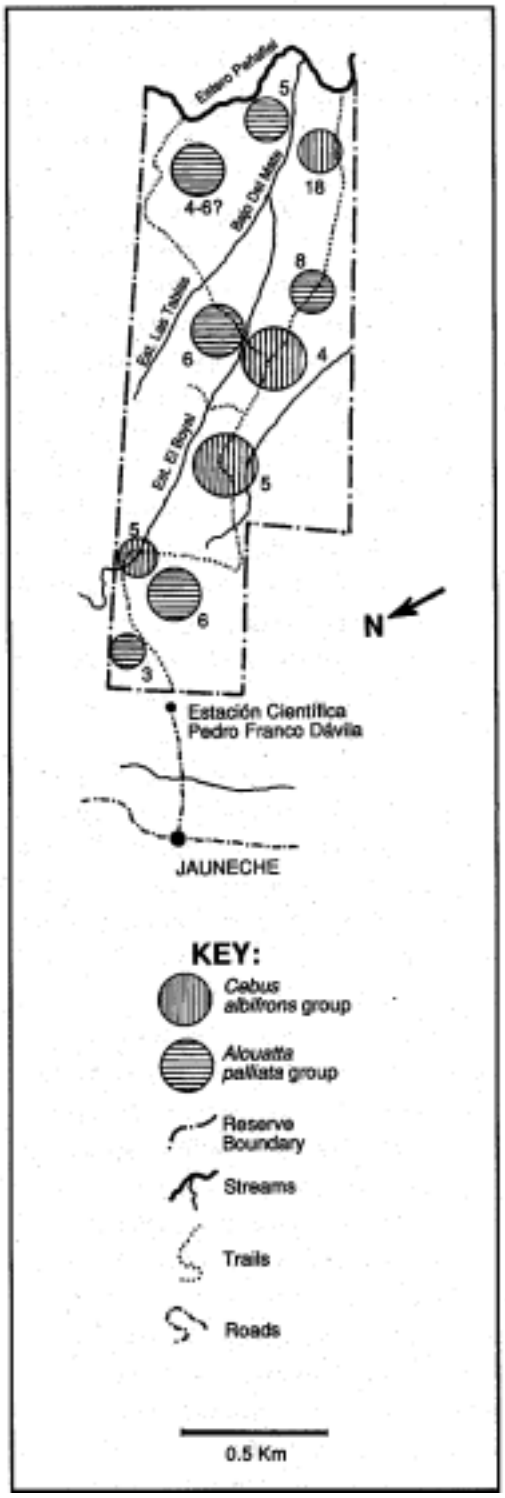

Figure 9. *Map of Juaneche reserve, formally know as the Estación Científica y Reserva "Pedro Franco Dávila," with an emphasis on the location of primate groups within the reserve (map based on original from Valverde et al. 1991).*

excelsum (Anacardiaceae), has not been found in this piece of forest and was very likely cut out. Slopes of the deepest ravines have several fairly large *Virola reidii* (Myristicaceae) that may represent an older intact forest, but one that is subject to natural disturbance from landslides. However, the forest does not appear to have been cleared for agriculture for a very long time. This is important in terms of maintaining diversity because many plant species can hang on as juveniles for a long timein spite of tree-cutting, whereas clearing for agriculture is much more likely to eliminate them locally. Many of the "old forest" tree species in this forest seem to be represented only by juveniles, or by juveniles and a very few misshapen adults.

The ravine bottoms are mostly open areas covered with large herbs and shrubs tolerant of poor drainage. It is not immediately obvious why there are not more trees growing in these strips along the minor drainage channels.

The flooded forest, subject to long periods of complete inundation by the slow-moving estero, has a very limited but distinct flora and may indeed be the most threatened community of plants as Dodson et al. (1985) have suggested. The most common tree is a *Pouteria* sp. (Sapotaceae); the most common shrub is *Turnera hindsiana* (Turneraceae).

The collections of Yanez and Foster on this two-day visit turned up several species not listed in the published flora of this forest (Dodson et al. 1985). This is not at all surprising. Virtually all tropical floras are incomplete. Until every growing stem in a forest is checked, there will never be a complete flora. Most of the species in a forest are rare or uncommon and new species will continue to turn up as long as people keep looking.

Birds of Jauneche (T. Parker)

The avifauna of this small (138 ha) but interesting reserve allows us a glimpse of what once occurred in the formerly extensive moist forests of southwestern Ecuador. Of 118 forest species found during our visit, 27 are endemic to the "Tumbesan" center of endemism (Appendix 5). Seventy-three species were reported from the reserve by Valverde et. al (1991); this total included six species not found by us.

As pointed out by Dodson et al. (1985) for plants, the forest bird community is quite different from that of the wet forest at the Río Palenque Science Center, only 70 km to the north. Many of the most common species at Jauneche are either rare or absent at Río Palenque, including such endemics as *Lathrotriccus griseipectus*, *Thryothorus paucimaculatus*, and *Basileuterus fraseri*. Differences in forest structure or floristics no doubt account for most of the lack of bird similarity between the two sites. The Jauneche forest, for example, is characterized by an abundance of large, woody vines which are scarce at Río Palenque (Dodson et al. 1985); a number of moist forest species, such as *Cercomacra nigricans* and *Thryothorus paucimaculatus*, are confined to vine tangles. In terms of community composition, the Jauneche avifauna is more like that of Cerro San Sebastián in Parque Nacional Machalilla, or even of Cerro Mutiles far to the north.

Although the Jauneche reserve supports the most intact moist forest avifauna surviving in southwest Ecuador, at least four species (*Tinamus major*, *Penelope purpurascens*, *Odontophorus erythrops*, and *Ara ambigua*) disappeared prior to 1970 (*fide* local residents), presumably as a result of over-hunting. Additional species, especially some of the larger raptors, may soon follow. Even the most numerous species in the reserve (e.g., *Manacus manacus*, *Basileuterus fraseri*) are probably represented by fewer than 500 individuals, and as many as 20 species (24 percent of the avifauna) are barely surviving — i.e.,

…the forest bird community is quite different from that of the wet forest at the Río Palenque Science Center, only 70 km to the north.

there are fewer than 20 individuals — examples include *Leucopternis occidentalis* and *L. plumbea*, *Spizaetus tyrannus*, *Ortalis erythroptera*, *Amazona autumnalis*, *Amazona farinosa*, *Ciccaba virgata*, *Campephilus gayaquilensis*, *Herpsilochmus rufimarginatus*, and *Cnipodectes subbrunneus*. Due to the small size and isolation of the reserve, many of these species will ultimately disappear regardless of steps taken to protect them. The Jauneche reserve is a natural laboratory where the extinction process can be well documented. It will be instructive to determine how long the small but important populations of globally threatened taxa such as *Ortalis erythroptera*, *Onychorhynchus occidentalis*, and *Lathrotriccus griseipectus* can persist here.

The Jauneche reserve is a natural laboratory where the extinction process can be well documented.

At Jauneche we found the highest densities yet reported for two endemic bird species, the vine-dwelling flycatcher *Lathrotriccus griseipectus* (up to 3 pairs/ha) and *Onychorhynchus occidentalis* (up to 5 individuals noted/day). These are probably the best indicator species of "good" moist forest in SW Ecuador/NW Peru.

Among our other noteworthy bird observations at Jauneche was a sighting — by Parker at Estero Peñafiel — of a Spotted Rail (*Pardirallus maculatus*), apparently the second record of this species for Ecuador. Also of interest was our discovery of a small population of Brownish Flycatcher (*Cnipodectes subbrunneus*) in the understory of tall forest in the reserve. Although widespread east of the Andes, this species is known from only a few widely scattered localities in western Ecuador, and there are few records during the past 100 years (R. Ridgely, pers. comm.).

Mammals of Jauneche (L. Albuja)

In four days of fieldwork at Jauneche we recorded 21 species of mammals. Of these, 67 percent were non-flying species and 33 percent were bats (Appendix 10).

The most characteristic mammals of the area are two primates, *Alouatta palliata* and *Cebus albifrons*, known by the common names "aullador" and "mico," respectively. Observations by the author and other RAP members indicate that the area is inhabited by five or six groups of *Alouatta*, with a total population of 28-30 individuals (Fig. 9).

Four groups of *Cebus albifrons* comprising a total of 37 individuals were found in the reserve; group size ranged from 5-18 individuals. The estimated density is 0.27 individuals/ha for this species, and 0.21 ind/ha for *Alouatta palliata*. Populations of these primates are apparently high, especially considering the small size of the reserve (138 ha). A comparison of population data obtained at the reserve in 1986 with those of the present study reveals that the population of primates has remained stable over the past five years. This is because these animals have not been persecuted by hunters in the area.

The mammal fauna of Jauneche is typical of seasonal tropical forest. Like the two species of primates, also common are two species of squirrels (*Sciurus granatensis* and *S. stramineus*), kinkajous (*Potos flavus*), tamanduas (*Tamandua mexicana*), pacas (*Agouti paca*), and agoutis (*Dasyprocta punctata*). Peccaries (*Tayassu* spp.) are apparently rare. Small cats (*Felis pardalis*, *F. wiedii*) still survive, although populations are reduced. The larger cats (*Felis concolor* and *Panthera onca*) have been extirpated.

The reserve is inhabited by two species of deer, the "encerrado" (*Mazama americana*) and the "colorado" (*Odocoileus virginianus*). Along Estero Peñafiel, in the lowest and easternmost area of the reserve, and in the sector Bajo del Mate, there were abundant tracks of large mammals.

The area is an island of forest that serves as a refuge to a variety of mammals and other groups of vertebrates. We do not have information on the prior conservation status of

other mammal groups that would allow for comparisons with our own data. Nevertheless, many animal species — particularly those that are not preferred by hunters — are still in good condition, although some residents of Jauneche and nearby areas still enter the reserve to hunt pacas, agoutis, deer, and peccaries, as noted during our survey of the area.

Herpetofauna of Jauneche (A. Almendáriz and J. Carr)

Collections were made along established trails within the forest and along the esteros Boyal and Peñafiel. During our stay conditions were very dry and unfavorable for collecting; furthermore, the forest is greatly disturbed and some areas are in the process of regeneration. We also noted species for which records existed in the station office and examined a small collection of preserved snakes there as well (see Appendix 12).

Two species of *Colostethus* were collected along the esteros, one the aforementioned *C. infraguttatus* found at Cerro Blanco, the other an undescribed species also found at Machalilla (Appendix 11, sp. 1). Four hylids were collected from vegetation at night, primarily in the vicinity of Estero El Boyal in areas with standing water or a moist streambed. Of particular interest was the capture of a specimen of *Phrynohyas venulosa*, a species for which there is only one published record from trans-Andean forests in South America (in El Oro Province; Duellman 1971).

A species of *Ameiva* was common in open areas and near clearings in the forest, but we do not believe it is *Ameiva ameiva* as reported by Valverde et al. (1991:104). Two other lizard species that we recorded, *Ophryoessoides iridescens* and *Iguana iguana*, were also noted by Valverde et al. (1991).

MANTA REAL (CLOUD FOREST AND WET FOREST)

Site Description and Vegetation (R. Foster)

At the base of the Andes southeast of Guayaquil, Manta Real (2° 34' S, 79° 21' W) is a small village in the province of Cañar (Fig. 10) whose name refers to the great abundance of small bloodsucking flies. At 250 m, it is just above the zone of extensive banana plantations. The mountains rise steeply behind the town up into a nearly perpetual cloud bank at 600 m. We spent several days camped on the steep slopes at 650 m, and also worked out of the village on the lower slopes.

The forest is far from pristine and most disturbed at the base. Horse trails lead up to isolated clearings at the higher elevations. These openings are created mainly to stake claim to the land under the current property laws, rather than to seriously engage in agriculture. Nevertheless, there is considerable forest remaining here and along the slopes to the north and south, and in spite of the logging, most of the plant diversity still remains even if the dynamics of the forest has been altered.

Cloud Forest

The average lower limit of clouds we observed on the slopes is approximately 550-600 m. Between this level and the peak (Cerro San José Chico) at 1,240 m, the forest is obviously extremely wet year-round, apparently combining fog and fog drip with considerable rain. The trees are covered with moss and trunk epiphytes.

The most common canopy trees are an as yet unidentified Euphorbiaceae; *Huertea glandulosa* (Staphyleaceae); *Landenbergia pavonii* (Rubiaceae); *Otoba* cf. *gordoniaefolia* (Myristicaceae); *Sapium* sp. (Euphorbiaceae); *Tetragastris panamensis* (Burseraceae); two

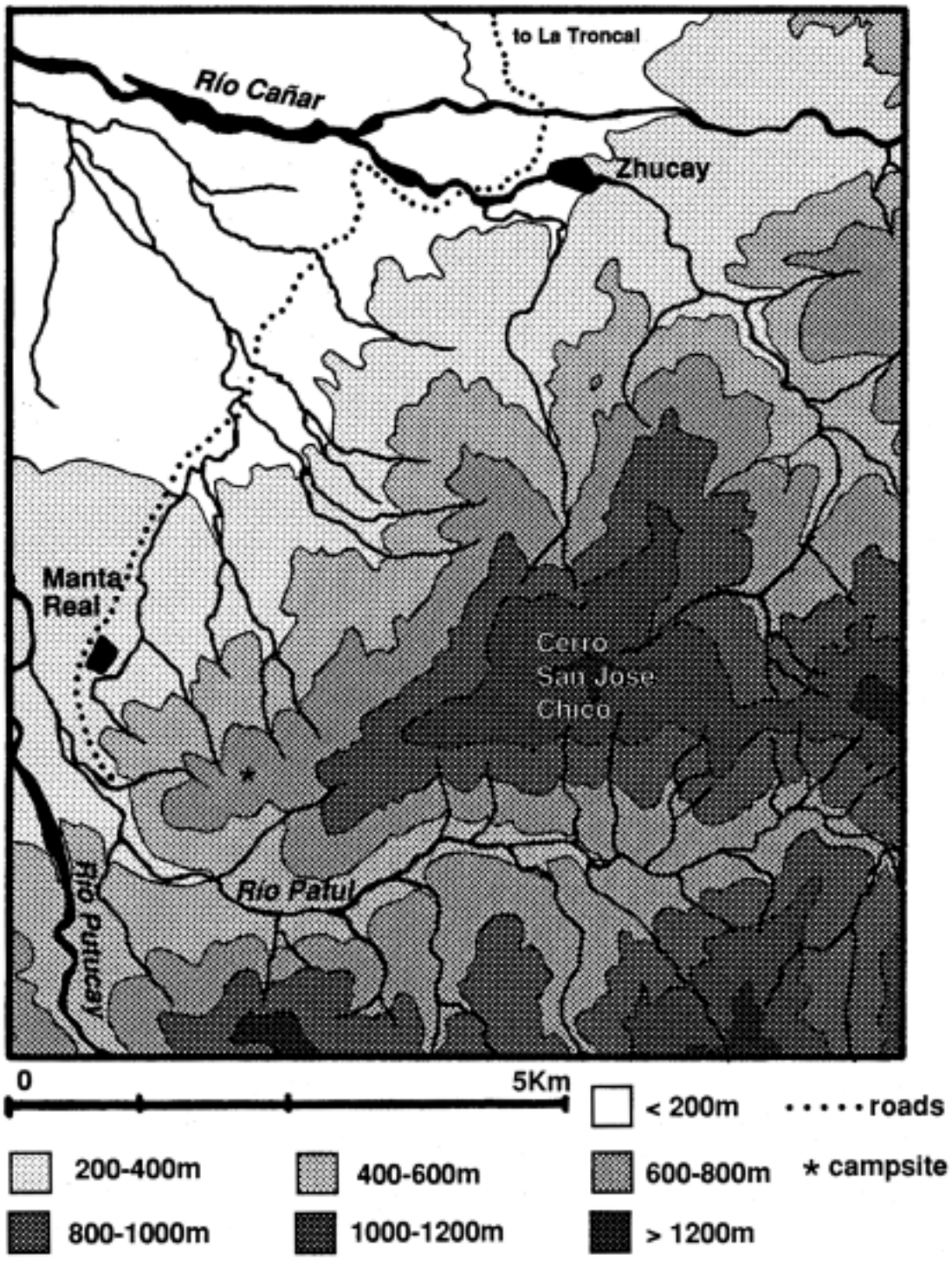

Figure 10. *Map of the Manta Real area.*

Lauraceae; one Melastomataceae; *Cecropia* sp. and *Ficus* sp. (Moraceae). The area has been selectively cut and most of the large *Carapa guianensis* trees (Meliaceae) have apparently been removed, although the occasional juvenile was noted.

The most abundant smaller trees are *Turpinia occidentalis* (Staphyleaceae), *Erythrina* cf. *smithii* (Leguminosae), *Ficus tonduzii* (Moraceae), *Piper imperiale* (Piperaceae), and species of *Allophylus* (Sapindaceae), *Conostegia* (Melastomataceae), *Faramea* (Rubiaceae), and *Hedyosmum* (Chloranthaceae), treeferns, and a couple of unknowns.

The only palm that ranks as a canopy tree is the frequent *Catoblastus* cf. *velutinus.* In the understory, *Pholidostachys dactyloides* and the tall, clumped *Bactris* (found in all western Ecuador forests we visited) are common, but smaller palms are virtually missing.

The shrubs in this forest are striking in their fragility. With the exception of the chusquioid slender bamboo which occurs in occasional thick, arching clumps, they all seem to be semisucculents with very juicy stems. This includes the most common small tree, a species of *Hedyosmum*. The weakest swing of a machete clears a broad swath in the understory. The most important species were members of the Rubiaceae (*Psychotria*, *Hoffmannia*); Melastomataceae (*Leandra*, *Miconia*, *Ossaea*); Gesneriaceae (*Besleria*); Piperaceae (*Piper*); one pachycaul Myrsinaceae; and the large herb *Heliconia curtispatha*. The distinction between shrubs and herbs is almost meaningless unless it is by size alone. Common plants under 1 m tall are *Alloplectus dodsonii*, *Monopyle* cf. *sodirona* (Gesneriaceae), *Selaginella* sp. (Selaginellaceae), *Peperomia* (several spp., Piperaceae), *Pilea* (three spp, Urticaceae), *Tectaria nicotianifolia* (Aspleniaceae), and *Triolena pustulata* (Melastomataceae). Many trunk climbers are also found as herbs (see below).

Large woody epiphytes noted are a few *Clusia* including the atypical *Clusia venusta* (Guttiferae), *Schefflera* spp. (Araliaceae), and large-leaved *Blakea* (Melastomataceae). Orchids and ferns were diverse on the upper branches of the few fallen trees. Trunk climbers and trunk epiphytes are very dense and diverse. The most important appear to be *Pitcairnea* (two spp.) and *Guzmania* of the Bromeliaceae; *Asplundia* and other Cyclanthaceae; anthuriums, philodendrons, and *Stenospermation* of the Araceae; *Peperomias* and a large *Piper* of the Piperaceae; *Macleania* cf. (Ericaceae); *Columnea* (Gesneriaceae); *Clusia descussata* (Guttiferae) and numerous ferns. Many of these species are quite flexible in their growth habit and also can be found as herbs on the ground, presumably either getting their start from fallen logs and branches, or by germinating on the ground and making their way up trees if opportunity permits. In most instances, species could be found in fertile condition in either micro-habitat.

Lianas are not common; the most frequently encountered are the climbing fern *Salpichlaena volubilis* and a species of *Mikania* (Compositae).

In spite of this being "cloud forest," the only truly montane Andean genera noted were *Hedyosmum* (Chloranthaceae), *Macleania* cf. (Ericaceae), *Monnina* (Polygalaceae), and *Castilleja* (Scrophulariaceae). The latter two were found only on human clearings, but might occur naturally on landslides in the area. Perhaps the relatively warm temperatures at this low elevation create a soil environment that only lowland genera are likely to tolerate. An alternative explanation is that there is little seed source for mid-to-upper montane genera in this area because clouds (at least in the dry season) and forest vegetation at the higher elevations are virtually missing on the southwestern slopes of the Andes in Ecuador. This is not true of the northwestern slopes.

The forested slopes above [Manta Real] support an unusually rich avifauna of more than 200 species.

Wet Forest

From 550 m (that is, below the clouds) down to the bottom of the slopes at 300 m, the forest still appears wet, but not heavily laden with epiphytes, and it has more lianas. The forest on these lower slopes is more cut up and interrupted with cacao, coffee, and small pastures, but the remnants give a fair idea of its original composition.

There is a remarkable difference in the flora and community composition (see Appendix 19). Several species occur commonly in both habitats, but most species are either not shared, or if common in one habitat, are very rare in the other. The great exception to this pattern is the cloud forest flora that follows the small streams down the deeper damp ravines to the base of the mountains.

Remarkably, the two most common trees observed in this elevational range did not seem to overlap. Between 400 and 500 m, the most abundant tree, though not a large one, is *Metteniusa nucifera* (Icacinaceae), a rarely collected genus and a species apparently unknown from western Ecuador. Below 400 m, the forest is dominated by a large (possibly new) species of *Browneopsis* (Leguminosae-Caesalp.) with extraordinary, hanging inflorescences 2 m long bearing very large pink and white flowers (bat-pollination probable). Neither of these species was seen in the cloud forest. However, all other species seemed to be evenly mixed throughout, and it could be that these two represent isolated dense patches of species which are not usually so abundant.

Other common and characteristic large trees of this zone are an *Endlicheria* with huge leaves (Lauraceae); *Quararibea coloradorum* (Bombacaceae); *Otoba* cf. *noovogranatensis*, *Virola dixonii* (Myristicaceae); *Calophyllum brasiliense* (Guttiferae); *Cecropia insignis*, *Ficus* sp., *Poulsenia armata*, *Pourouma bicolor* (Moraceae); and the large palm *Jessenia bataua*.

Common understory trees are *Gloeospermum falcatum* (Violaceae); *Macquira* sp., *Coussapoa* cf. *herthae* (Moraceae); *Coussarea* sp., *Guettarda* sp. (Rubiaceae); *Guarea pterorhachis* (Meliaceae); *Hirtella* cf. *triandra* (Chrysobalanaceae); and *Pleuranthodendron lindenii* (Flacourtiaceae). The common shrubs are *Cyphomandra* sp. (Solanaceae); *Faramaea* sp., *Psychotria marginata* (Rubiaceae); *Podandrogyne* sp. (Capparidaceae); *Urera baccifera* (Urticaceae); *Bactris* sp. (Palmae); and treeferns.

The most common herbs are *Selaginella* cf. *haematodes* (Selaginellaceae), *Triolena barbeyana* (Melastomataceae), *Calathea inocephala*, *Pleiostachya morlei* (Marantaceae), *Gasteranthus onconogastrus* (Gesneriaceae), *Didymochlaena truncatula* (Aspleniaceae), and *Cyclanthus bipartitus* (Cyclanthaceae).

Common epiphytes and trunk climbers are *Tillandsia anceps*, *Guzmania melinonis* (Bromeliaceae); *Heteropsis* sp. (Araceae); and *Asplundia* sp. (Cyclanthaceae). Lianas are diverse, but two common species were *Pisonia* sp. (Nyctaginaceae) and *Schlegelia* sp. (Bignoniaceae).

Species that are shared by the cloud forest and the wet forest — and frequent in both — are *Coussapoa herthae*, a *Guarea* sp. (with huge leaves), a *Bactris* sp. (occurs in large clumps), *Psychotria* sp. (with giant leaves), *Palicourea* sp. (with large leaves), most aroids, *Solanum* sp. (spiny liana), *Pholidostachys dactyloides*, *Cecropia* sp. (many deep lobes not hairy), *Sapium* sp. (large tree), many *Piper* spp., many *Psychotria* spp., *Tectaria nicotianifolia*, *Turpinia occidentalis*, *Grias peruviana*, and *Ficus tonduzii*.

Birds of Manta Real (T. Parker)

The forested slopes above this village support an unusually rich avifauna of more than 200 species (Appendix 6). This diversity reflects

the mixing of three distinct avifaunas, those of moist, wet, and lower montane (pluvial?) forests along an elevational transect of only 600 m (from ca. 350-950 m). Moist forest bird species (*Lathrotriccus griseipectus*, *Onychorhynchus occidentalis*, and *Basileuterus fraseri*) are now confined to the degraded lower 100 meters of this forest — just above the cacao plantations and village. A rather rich, wet forest avifauna (ca. 130 spp.), quite like that of Río Palenque Science Center (Appendix 8), occurs in tall forest up to ca. 600 m, above which numerous montane species begin to appear (Appendix 6). The montane forest avifauna above 600 m is comprised of more than 110 species. At least (170) forest-dwelling species occur within a rectangular area of ca. 200 ha bordering the main trail above the village from 350-900 m. This single site richness is unexpected at such a southerly latitude west of the Andes, especially considering the fact that (35%) of this avifauna is not known from northwest Peru only 150 km to the south.

Most of the local endemics (15+ spp. and numerous ssp.) are moist forest species that occur in small numbers along the lower edge of the forest. The endemic parrot *Pyrrhura orcesi* was noted once in montane forest at 650 m. The relatively pristine condition of the Manta Real forest is reflected by the presence of numerous large species long gone from smaller forest remnants in western Ecuador (e.g., *Tinamus major*, *Penelope* spp., *Odontophorus erythrops*, *Ara severa*).

[Note: Appendix 6 is offered to complement the unpublished bird lists for the area compiled by Juan Carlos Matheus and by R. S. Ridgely et al.]

Mammals of Manta Real (L. Albuja)

In Ecuador, the lower slopes of the Cordillera Occidental of the Andes are among the least known regions from a biological viewpoint and the mammal fauna has been largely ignored. For this reason, among others, the RAP team undertook a preliminary study of this site. During the four days spent on the slopes above Manta Real in the sectors of Manglar and Tres Marías (600 - 850 m), 27 species of mammals were recorded, of which 14 or 52 percent were non-flying species, and 13 or 48 percent were bats (Appendix 10). The brevity of the study impeded the compilation of a larger species list; however, results suggest that a great diversity of species occurs in the area — diversity comparable to that of the northwestern portion of the country (Appendix 10, list B). The species of terrestrial mammals, as well as the bats recorded at Manta Real, indicate that the fauna of this area is related to that of northwest Ecuador, and pertains to the "Chocó Association."

Our fieldwork revealed the presence of large numbers of brocket deer (*Mazama americana*), peccaries (*Tayassu pecari*), pacas (*Agouti paca*), agoutis (*Dasyprocta punctata*), and armadillos (*Dasypus novemcinctus*). Tracks of small cats were noted, as were tracks of jaguar (*Panthera onca*), which confirms our observation that other large mammals — i.e., prey of the latter — were numerous. Only one species of primate is common in the area, *Alouatta palliata*; settlers who know the area well affirm that *Cebus albifrons* does not occur here. Among the flying mammals are the common frugivorous bats *Artibeus jamaicencis* and *Vampyrops* aff. *infuscus*, and the nectarivores *Glossophaga soricina* and *Lonchophylla robusta*.

In remote areas — as at higher elevations — the influence of man is reduced and mammal populations are in better condition. But the pressure from residents of the nearby communities is rapidly causing changes in the vegetation, as well as declines of numerous mammal species.

…the lower slopes of the Cordillera Occidental of the Andes are among the least known regions from a biological viewpoint…

Herpetofauna of Manta Real (A. Almendáriz and J. Carr)

We made numerous excursions into the forest above and below the base camp at 650 m, and we explored several hundred meters of the streambed and surrounding vegetation along the quebrada below the campsite. The temperature was cool, with an abundance of fog during our stay in the forest above Manta Real. We also spent shorter periods exploring the shoreline of the Río Patul where it breaks out of the mountainside and into the flats, and farther upstream along a trail in the canyon on the north side of the river. Our records of the herpetofauna are listed in Appendix 12.

We were able to collect nine species of anurans, including five species of *Eleutherodactylus*, two species of which were fairly common on the forest floor. Only a single hylid species was recorded, *Gastrotheca cornuta*, a substantial extension of its known range to the south of other known Ecuadorian localities in Pichincha Province (Duellman 1983). One other anuran of interest that was collected in the forest in the canyon of the Río Patul was a specimen of *Atelopus balios*. This species was described based on museum material collected along the Río Pescado in Guayas Province in the 1920s (Peters 1973). We have not found any published records of the species since its description.

RESERVA MILITAR DE ARENILLAS (DRY FOREST)

Vegetation (T. Parker and A. Luna)

Included in this military reserve of 20,000 ha is the largest area of intact dry forest and thornscrub in southwest Ecuador. Although nearly all of this forest has been selectively logged, many young trees of even the most valuable species remain, and most of the many endemic plant and animal species of the region undoubtedly survive here as well.

The extensive forest on level land near the coast, and especially along both sides of the Panamerican Highway between Arenillas and Huaquillas, is dominated visually by tall *Ceiba trichistandra*. The higher hills in the western part of the reserve are covered with impressive stands of *Cavanillesia platanifolia* and smaller numbers of other large trees such as a *Ficus* sp. The branches of many of the biggest trees in this zone are covered with *Tillandsia* epiphytes. The rest of this forest — especially near sea-level — is comprised of smaller trees including numerous *Cochlospermum vitifolium*, an *Erythrina* sp., and species of *Capparis*, *Acacia*, *Caesalpinia*, *Geoffroea*, *Guazuma*, *Jacquinia*, *Loxopterygium*, *Morisonia* and *Zizyphus*. Conspicuous shrubs included *Cordia lutea*, *Carica parviflora*, and *Ipomoea carnea*. Numerous small individuals of the valuable guayacán (*Tabebuia chrysantha*) were noted, especially in slightly hilly terrain a few kilometers east of the main highway. The vegetation becomes progressively shorter closer to the coast, and there are large areas of thornscrub 2-3 m tall bordering the mangroves. The extensive mangrove habitat along the coast is relatively inaccessible, and was visited only briefly by us.

An intensive botanical inventory of this biologically important reserve is urgently needed.

Fauna of the Reserva Militar de Arenillas (T. Parker and A. Luna)

During our two-day visit to the area we recorded 123 bird species (Appendix 7). Of these, 32 (45 percent) are endemic to the dry forest and thornscrub of SW Ecuador/NW Peru. Included in this total are six species considered to be globally at risk or endangered by the I.C.B.P.: *Crypturellus trans-*

fasciatus, *Ortalis erythroptera*, *Aratinga erythrogenys*, *Brotogeris pyrrhopterus*, *Synallaxis tithys*, and *Grallaria watkinsi*.

The mangroves support large populations of wading birds, including nine species of herons and the White Ibis (*Eudocimus albus*). Smaller numbers of American Wood Stork (*Mycteria americana*) and Roseate Spoonbill (*Platalea ajaja*) also occur here, as do at least five mangrove habitat specialists: *Buteogallus subtilis*, *Rallus longirostris*, *Aramides axillaris*, *Quiscalus mexicanus*, and *Dendroica aestiva erithacorides*.

Several species of large mammals are common in the reserve according to soldiers who showed us around the area. White-tailed Deer (*Odocoileus virginianus*) are said to be especially common, as are foxes (*Duscicyon sechurae*), anteaters (*Tamandua mexicana*), and squirrels (*Sciurus stramineus*). Other large species reported from the area include armadillos (*Dasypus novemcinctus*), jaguaroundi (*Felis yagouaroundi*), crab-eating raccoon (*Procyon cancrivorus*), and tayra (*Eira barbara*). A survey of the smaller mammal species in the reserve, such as bats and rodents, is badly needed.

Biogeographic Overviews

PHYTOGEOGRAPHY (A. GENTRY)

Coastal Ecuador is of conservation significance for its high plant endemism. Twenty percent of the plant species in wet forest at the Río Palenque Science Center are endemic to western Ecuador, and 26 percent are known only from western Ecuador and adjacent southwestern Colombia. The coastal moist forest has less endemism; for example, 15 percent of the Jauneche flora is known only from western Ecuador (some of these range into extreme northwest Peru), but this value is still high when compared with the floras of other areas (e.g., 12 percent of the Barro Colorado Island flora is endemic to Panama). For lowland western Ecuador (below 900 m) as a whole, we have estimated that there are 6,300 species of vascular plants, of which 1,200 (20 percent) may be endemic (Dodson and Gentry 1991).

What has not been appreciated previously is that the unusually high endemism of western Ecuadorian moist and wet forests is associated with relatively species-poor forests. Four sampled coastal lowland wet forests average only 125 species (plants >2.5 cm in 0.1 ha), and three sampled moist forests average only 96 species, as compared to the Neotropical moist/wet forest average of 152 species in equivalent samples of lowland forest elsewhere in the Neotropics (Gentry 1986a, 1988). The local speciation (and resultant endemism) that characterizes the flora of western Ecuador is probably facilitated by the relatively less diverse and thus ecologically "unsaturated" local forests; the low diversity values may have positive conservation significance, providing a situation favorable to local speciation akin to that of islands.

The Ecuadorian dry forest, like all dry forests, is less diverse in species than are wetter forests. However, contrary to the situation in wet and moist forests, the Ecuadorian dry forest has normal species richness (60 and 52 species >2.5 cm dbh in 0.1 ha at Capeira and Estero Perro Muerto (= Machalilla dry forest), respectively, as compared to the Neotropical average of 60 species). Despite the relatively low species diversity in dry forest, the coastal dry forest of Ecuador is phytogeographically exceptionally interesting in its high endemism: 20 percent of the Capeira species are endemic to western Ecuador and adjacent northwest Peru. This is especially noteworthy in view of the typically low endemism and widespread distribution that characterize most other dry forest areas.

Despite the tremendous local variation in species composition

from place to place within a given dry forest area (e.g., within Machalilla), as a region, the dry forest that once stretched from Esmeraldas to south of Tumbes in Peru may have been a single remarkably homogeneous floristic unit. In summary, the Ecuadorian dry forest, though surprisingly poorly known (see below), would seem to qualify as one of the most interesting and floristically distinctive dry forests in the world. Because of the inter-site variability in species composition, this forest type cannot be effectively conserved in a single small patch like that of Capeira; however, because the overall flora seems widespread throughout the zone, a single large park (such as Machalilla, if it were better protected) could effectively preserve most of its species.

The tendency among botanists has been to write off western Ecuador (except dry forest) as already destroyed except for a few minuscule reserves like Río Palenque and Jauneche (Dodson and Gentry 1978, Dodson et al. 1985). According to the estimates of Dodson and Gentry (1991), ca. 1 percent of the dry forest, <4 percent of the moist forest, and 0.8 percent of the wet forest (but 25 percent of the pluvial forest) below 900 m was left as of 1988. Thus our discovery that there is still a large patch of wet forest near Bilsa is of great conservation significance, as well as being phytogeographically important. Indeed, this forest very nearly reproduces the otherwise highly distinctive Río Palenque Science Center flora (2/3 of the species in my sample are also at Río Palenque), a quite unexpected result. Moreover, a different subset of the Río Palenque species occurs in the moist forest patches above 550 m elevation in Parque Nacional Machalilla (also 2/3 of the species in my sample shared with Río Palenque as contrasted to only 40 percent shared with Jauneche and 1/4 shared with Bilsa). While these areas seem to have little or no local endemism of their own (although any endemism would be most likely manifested in epiphytes and forest floor herbs, many of which I cannot identify without herbarium comparison), the pattern that results is a new and interesting one that focuses on western Ecuador (i.e., south of the town of Esmeraldas) as a unique and distinctive floristic region for wet and moist forest as well as for dry forest vegetation, rather than as the tail-end of the Chocó flora as I had previously interpreted it (e.g., Gentry 1982, 1986b). The similarities between the coastal and Andean foothill wet forest floras are so great as to suggest that they must have constituted originally part of the same uninterrupted block of forest. Similarly, a close relationship of the surviving moist forest near Esmeraldas north of the Río Esmeraldas with that of Jauneche is indicated (75 percent of the species in my transect are shared with Jauneche vs. only 41 percent with the geographically closer, but wet forest, Río Palenque). Curiously, the species diversity of the 0.1 ha sample at Esmeraldas is also exactly the same as at Jauneche (96 species at each!). The close similarity suggests continuity of the former coastal moist forest, which perhaps crossed the formerly east-west continuous wet forest from north to south via patches in drier sites through the Quinindé-Esmeraldas region. Why the Chocó flora that reaches northern Esmeraldas does not extend farther south is an unsolved (and previously unraised) question.

From a conservation perspective, we have been granted a short reprieve: Equivalents of the destroyed moist and wet forests of west-central Ecuador still exist in the coastal area where significant blocks might be saved, but only in the next couple of years judging from current rates of deforestation. This forest is characterized by low species diversity of trees (but high diversity of epiphytes), high endemism, a predominance of hemiepiphytic climbers (also typical of the Chocó), unusually low levels of such characteristic taxa as Bignoniaceae and Leguminosae, and high levels of Araceae, Piperaceae (the 5-6 species

…our discovery that there is still a large patch of wet forest near Bilsa is of great conservation significance…

included in the Bilsa sample is a world record for my transects), Moraceae, and Cucurbitaceae (also a world record). For the uniquely endemic (and still poorly known) dry forest, conservation efforts may already be too late.

The data on the structure and floristic composition of the area are instructive. Even though specific identifications in the species-rich genera that are the most likely to include new species must await the arrival of 800 documentary collections in St. Louis, some preliminary generalizations are safe. For example, the forests of western Ecuador have been suggested to be unusually rich in Bombacaceae (Gentry 1986b), with *Cavanillesia*, two *Ceiba* species, *Eriotheca*, *Pochota* (*Bombacopsis*), and *Pseudobombax* all prevalent in the dry forest, and *Quararibea* especially frequent in wetter forests. While we encountered all these taxa, they seem somewhat less important ecologically than in most of the sites previously studied. Another characteristic of the western Ecuadorian wet forests is the prevalence of palms, a standard feature of trans-Andean forests.

Based on data from Jauneche and the Río Palenque Science Center, Moraceae are especially important ecologically in western Ecuador (Gentry 1986b), being the second-most speciose family in the samples at both Cerro San Sebastián and Cerro Mutiles, as well as at Bilsa. Because the presence of Moraceae is usually an indicator of rich soils, it may be that the soils at Bilsa, as at Río Palenque and perhaps in much of western Ecuador, are relatively fertile ones, unlike those in much of the heavily leached high-rainfall Chocó. Only now can this possibility even be considered, since nothing was previously known of this type of vegetation on these soils.

VEGETATION (R. FOSTER)

In western Ecuador, there appear to be two salient determinants of vegetation distribution: clouds and geological substrate. For neither of these do we have the information needed to make a perfectly clear picture of why and where different plant communities are found, either now, or before the devastation left by recent clearing. But, from our quick survey, several patterns are apparent, which if pursued further will be useful for conservation planning.

Clouds

Northwestern Ecuador has two layers of clouds, southwestern Ecuador has one. I have not read of this crude generalization anywhere, but it is derived from empirical observation from plane flights (between Quito and the coast, and other coastal flights between Panama and Bolivia) in different seasons, and from observation of the clouds and vegetation on the mountains. The source of this pattern is presumably the changes in regional air flow with respect to the ocean currents off the coast near the equator. It is an overly simple model and changes with seasons and local topography. It explains why from the Quito-Santo Domingo road down the Andes and north into Colombia there is dense cloud forest in the vicinity of 3,000 m, and another area in between is "wet" mountain forest down to the vicinity of 1,000 m where cloud forest-like conditions again prevail, albeit with different species. To the south, the upper layer of cloud forest disappears such that transects from Cuenca to the coast have cloud forest only from 600 to 1,500 m.

To the north, moisture on the ground is derived from both cloud layers as either rainfall from the upper layer, or condensation from where either layer of clouds directly hits vegetation. The south derives its moisture from vegetation contact with the lower cloud layer or occasional straying south of the upper cloud layer, such as with the southern oscilla-

tion of the warm Pacific countercurrent. Perhaps there is sometimes enough "pressure" in the lower cloud layer when it hits the Andes to cause significant rainfall throughout the southern region. The point here is that the sources of moisture in the southern region are tenuous, and year-round moisture is available only in extremely limited areas. This explains the much greater contrasts in vegetation over short distances in the south and the more uniform appearing vegetation in the north except right along the coast. The effects would be more extreme if it was not for the ameliorating effect of the low cloud layer keeping the temperature down and humidity up for most of the year.

We visited only three fog forests on the mountain tops of the coastal range (Machalilla, Cerro Achi, Cerro Pata de Pájaro), but there is an archipelago of these, many still mostly intact, though disappearing fast. We have seen that each has a unique plant composition. Each represents an opportunity to save a portion of the plant species in danger of extinction, even if they are each insufficient to protect the larger animal species. Plants are usually long-lived and the species often can survive hundreds or even thousands of years even if their dispersal agents or pollinators finally disappear.

A conservation program to protect the remaining fog forests is urgently needed for both plant species conservation and protection of water supplies for the communities below. Similarly, the low fog forests and wet forests on the southern slopes of the Andes in western Ecuador are much more vulnerable than the slopes to the north and are in desperate need of conservation attention especially for their plants and the water they provide to the crops in the valleys below.

Substrate

In the Cerro Blanco reserve we see the general effects of limestone in producing drought-susceptible soils and a distinct vegetation similar in many ways to typical dry forest and with many unusual plants as well. Two distinctive trees in the Bombacaceae — *Ceiba trichistandra* and *Cavanillesia platanifolia* — seem to separate two different kinds of alkaline soils. This separation is obvious not only at Cerro Blanco but also in the dry forest of the Reserva Militar de Arenillas to the southeast, and much of the Cordillera de Chongón-Colonche further northwest. This deserves much further study to map the distribution of these conspicuous trees, determine the other flora and fauna associated with them, and their relationship to the soils or underlying rock.

In the wet forests, there is an easily visible difference within the mountains from Portoviejo to Esmeraldas between ridges covered with large *Iriartea deltoidea* palms and others completely without, such as the Bilsa area. The underlying cause is presumably the soil, but once again a survey is needed to compare these areas and determine if more than just this large palm is involved.

A more extensive survey of western Ecuador than our quick visits will probably reveal other significant differences in communities of plants associated with substrate. Recognition of such differences is important for conservation efforts to insure that whole groups of species do not disappear from Ecuador or the world because we are limited to overly simplistic categories such as dry forest, moist forest, and wet forest.

A conservation program to protect the remaining fog forests is urgently needed for both plant species conservation and protection of water supplies for the communities below.

BIRD FAUNA (T. PARKER)

Lowland western Ecuador encompasses two important areas of bird endemism recognized by Chapman (1926). The "Arid Equatorial Fauna" of deciduous forest and desert scrub habitats that extend from Manabí, Ecuador, south to coastal Cajamarca, Peru, and the

…the proximity of several distinct forest types and elevational zones, in addition to moderate to high levels of endemism at the species level, combine to make western Ecuador a very important region in terms of bird conservation.

"Colombian Pacific Fauna" of humid evergreen forests that once formed an unbroken expanse from eastern Darién, Panama, south along the Pacific coast of Colombia to Los Ríos, Ecuador. More than 40 species and 140 well-marked subspecies of birds are restricted to the dry forests and scrub habitats of SW Ecuador and NW Peru (Cracraft 1985, Parker et al., MS), and at least 30 species (and far more subspecies) are confined to the humid coastal and foothill ("Chocó") forests of Pacific Colombia and northwestern Ecuador. The majority of these endemic bird taxa are now threatened by massive deforestation, and presumably by genetic problems associated with small, isolated populations. Fifteen bird species that occur primarily in western Ecuador are considered to be threatened with extinction by the International Council for Bird Preservation (Collar and Andrew 1988).

Considering the relative accessibility of coastal forests in Ecuador, surprisingly few intensive ornithological surveys have been undertaken to date. Chapman (1926) reported on small bird collections obtained in the Pacific lowlands and coastal mountains prior to 1925, and recent efforts by Ecuadorian and North American ornithologists working for the Academy of Natural Sciences (Philadelphia) and the Western Foundation of Vertebrate Zoology (Los Angeles) have clarified the status and distribution of numerous poorly known species. Despite a recent increase in ornithological fieldwork, only the small (100 ha) wet forest at the Río Palenque Science Center has been studied in detail (P. Greenfield, unpubl. list).

With this in mind, we surveyed birds at eight localities in the coastal hills, low mountains, and lowlands between Esmeraldas and Arenillas, near the Peruvian border (Appendices 2-8). Although our efforts in each area varied from a few hours to six days, our results are similar to those obtained during more intensive surveys of similar forest types in western Ecuador (Robbins and Ridgely 1990), northwest Peru (Wiedenfeld et al. 1985, Parker et al., MS), and eastern Panama (Robbins et al. 1985).

Comparison of locality lists obtained in this study reveals several interesting patterns. The most diverse bird communities in lowland western Ecuador occur in wet forests such as those at Bilsa, where ca. 160 resident species were found in an area of less than 500 ha. The moist forest sites at Cerro Mutiles (ca. 100 ha) and Jauneche (138 ha) support 140 and 118 species, respectively. In dry forests at Cerro Blanco (100 ha surveyed) and in the Reserva Militar de Arenillas (ca. 200 ha) we found 86 and 70 resident species. Although bird species richness declines from north to south (reflecting the dramatic decline in rainfall from ca. 3,000 to 500 mm per year), endemism increases dramatically. Nearly 40 percent of the dry forest and thornscrub species in the Reserva Militar de Arenillas are restricted to those habitats in SW Ecuador/ NW Peru. In contrast, only 10 percent of the avifauna in the wet forest at Bilsa is endemic (to W Colombia/ NW Ecuador), the majority occurring north into Middle America and east of the Andes in Amazonia. As previously mentioned with respect to plants, the richest bird communities in western Ecuador are depauperate in comparison with those of upper Amazonian sites — which typically have 190-230 spp. (Haffer and Parker, in press). Nevertheless, the proximity of several distinct forest types and elevational zones, in addition to moderate to high levels of endemism at the species level, combine to make western Ecuador a very important region in terms of bird conservation.

MAMMAL FAUNA (L. EMMONS AND L. ALBUJA)

The mammal fauna of lowland western Ecuador is typical of that of the rain forest region

from Veracruz, Mexico, to northwestern Peru, and is distinct from that of the Amazon Basin. Although a few species are characteristic of dry forest, savanna, or grassland habitats (e.g., *Sciurus stramineus*, *Sigmodon hispidus*, *Odocoileus virginianus*), there is no significant mammal fauna restricted to these habitat types. Drier habitats support species with broad habitat tolerance from rain forest to savanna. In contrast to birds and plants, therefore, the dry forests of western Ecuador do not have a large fauna distinct from that of its wet forests.

Of the 324 mammal species known from all of Ecuador, 54, or 17 percent, are found only in the western lowlands. Fifteen of these are endemic to the Pacific coasts of Colombia, Ecuador, and northern Peru. Regional endemism is highest among bats, with approximately 24 percent of Ecuador's total bat fauna of 125 species found only in the western lowlands. Because the forests of Mesoamerica and coastal South America are smaller in extent and much more severely reduced by deforestation than those of Amazonia, a much larger percentage of the western Ecuador mammal fauna is officially listed as globally endangered or threatened than that of Amazonian Ecuador.

Knowledge of the mammal fauna of western Ecuador is still largely incomplete, and many regions have never been explored or inventoried. The discovery by Albuja of four new species of bats in the northwest between 1984 and 1988 shows how poorly explored the region has been in the past. An example of our lack of knowledge is that there is evidence of the existence of two large mammals in the region that are currently unrecognized by science. Park rangers and residents of Parque Nacional Machalilla believe that there are two sympatric brocket deer in the wetter highlands of the park. They describe a large, dark form that may pertain to *Mazama fuscata* Allen 1915. In recent years, mammalogists have considered this form to be conspecific with the smaller *Mazama americana* and have recognized but one species of brocket deer in the Pacific lowlands of Ecuador and Colombia. Thus, there may be a species of deer endemic to western Ecuador that has recently been overlooked by science. If so, it is likely to be highly endangered due to habitat destruction and over-hunting.

In the region around Quevedo, including parts of Los Ríos, Guayas and Pichincha, and perhaps to southeastern Manabí (including the Jauneche reserve in Los Ríos), there were formerly three sympatric species of monkeys, including howlers (*Alouatta palliata*), spider monkeys (*Ateles fusciceps*, now extinct there?) and white-fronted capuchins (*Cebus albifrons*), locally called *mono lanudo* – that according to Hershkovitz (1949) is an isolated subspecies (*C. albifrons aequatorialis*). Albuja previously saw it at Jauneche and Gentry at Río Palenque Science Center, where it is now extinct. Although we obtained additional records of this form at Jauneche, Machalilla, Cerro Blanco, and Cerro Pata de Pájaro, this subspecies is obviously severely threatened.

These previously known but unresolved problems of mammalogy in western Ecuador illustrate both the lack of knowledge and urgent need for further work. We feel that immediate attention should be given to clarifying the identity of both of these large mammals (i.e., *Mazama fuscata* and *Cebus albifrons aequatorialis*), lest possible endemics become extinct without recognition.

In conclusion, the mammal fauna of the lowland forests of western Ecuador includes many species found nowhere else in Ecuador. Most of these are restricted to forested habitats. The future of this fauna thus depends on the preservation of intact forests. Only a few patches of mature forest remain outside of the Reserva Ecológica Cotacachi-Cayapas and most of these have undergone degradation.

…despite hunting pressure, large mammals still persist in most of the remnant forests we visited. There is still time for effective conservation of most of the mammal fauna of western Ecuador.

However, despite hunting pressure, large mammals still persist in most of the remnant forests we visited. There is still time for effective conservation of most of the mammal fauna of western Ecuador. A number of mammal species of the region (e.g., *Amorphochilus schnablii*, *Artibeus fraterculus*, *Sciurus stramineus*, *Cebus albifrons*) do not occur as far north as Cotacachi-Cayapas. Their conservation will depend on preservation of several forests of different vegetation types, such as dry forest, south of the Río Esmeraldas.

HERPETOFAUNA (A. ALMENDÁRIZ AND J. CARR)

The majority of the herpetofauna of the western lowlands of Ecuador, and that which occupies the trans-Andean forests, is the southerly extension of the fauna characteristic of the humid forests of the Colombian Chocó. On the other hand, the herpetofauna of the Chocó is strongly related to that of the Caribbean lowlands of Central America (Lynch 1979). Albuja et al. (1980) referred to this zoogeographic area as the Tropical Northwestern Region. These authors further recognized a Tropical Southwestern Region, which encompasses the drier forests and desert scrub vegetation of the southwestern lowlands. The herpetofauna of this region has widespread species from the Central American - Chocoan region, and a component endemic to the dry forests of SW Ecuador and adjacent NW Peru.

In the tropical and subtropical zones of western Ecuador (up to 2000 m), 253 species of amphibians and reptiles have been recorded (Almendáriz, 1991). Amphibians, including frogs, salamanders, and caecilians, account for 49 percent of the total, lizards and amphisbaenians 19 percent, snakes 28 percent, and turtles and crocodilians only 3 percent. Approximately 60 percent of the species of frogs are endemic to western Ecuador, especially species of the family Centrolenidae, and genera such as *Eleutherodactylus* (Leptodactylidae) and *Colostethus* (Dendrobatidae). The percentage of endemism is much less for lizards and snakes. There are no endemic species of turtles or crocodilians.

Existing information on the herpetofauna of the Cordillera de la Costa of Ecuador was relatively poor, and thus our field collections were of value in increasing knowledge of the species composition of the fauna and its distribution. After reviewing the available comparative material and literature, it was still not possible to identify some frog species of the genera *Eleutherodactylus* and *Colostethus*, and some lizards of the genus *Anolis*. Some of these species are currently in the process of being described by other workers, based on previously known material from other locations. The remaining identifications will take additional analysis and it is probable that some of the specimens represent undescribed species.

Our collection of the herpetofauna of the Cordillera de la Costa and adjacent areas reflects the zoogeographic affinities of the west Ecuadorian herpetofauna in general, including three principal components to the herpetofauna:

1. Fifty percent of the species identified are part of the tropical wet forest fauna of the Chocoan region, and approximately 60 percent of this fauna is widely distributed north into Central America (including those widespread in the entire Neotropical Realm);

2. Forty-two percent of the species are endemic to western Ecuador (including the unidentified species as endemics). This percentage includes species that inhabit dry, moist and wet tropical forests;

3. Eight percent of the species are endemic to western Ecuador and the adjacent area of northwestern Peru. Principally, they are species associated with drier habitats.

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Appendices

Ecuador Trip Itineraries

APPENDIX 1

Trip I. January - February 1991	Dates	Coordinates	Elevational Range
CERRO BLANCO RESERVE	17 January		
Quebrada Canoa		2° 10' S, 80° 02' W	ca. 100-420 m
PARQUE NACIONAL MACHALILLA	18-24 January		
Cerro San Sebastián and vicinity		1° 36' S, 80° 42' W	500-800 m
Agua Blanca		1° 32' S, 80° 44' W	ca. 80 m
Estero Manta Blanca		1° 34' S, 80° 43' W	ca. 300 m
CERRO ACHI	23 January	1° 20' S, 80° 39' W	ca. 600 m
PORTOVIEJO-PEDERNALES-EL CARMEN-PORTOVIEJO (Reconnaisance by road)	24 January		
CABECERAS DE BILSA (7 km E of San José de Bilsa)	26 (PM), 27-31 January	0° 37' N, 79° 51' W	campsite ca. 225 m; 100-300 m
CERRO MUTILES (reserva forestal of the Universidad Técnica "Luis Vargas Torres")	2-4 February	0° 54' N, 79° 37' W	ca. 60-300 m

Trip II. July 1991	Dates	Coordinates	Elevation
JAUNECHE RESERVE	6-9 July	1° 20' S, 79° 35' W	70 m at the station; 50 m at Estero Peñafiel
MANTA REAL	10-17 July	2° 34' S, 79° 21' W	campsite at 650 m; ca. 250-1100 m
RESERVA MILITAR DE ARENILLAS	12-13 July	3° 33' S, 80° 03' W (for Arenillas)	sea level to ca. 300 m
CERRO BLANCO RESERVE	15-20 July		
Quebrada Canoa		2° 10' S, 80° 02' W	ca. 100-420 m; campsite at 420 m
TABUGA-RÍO CUAQUE	19 July		
site east of Palmarcito		0° 01' S, 80° 05' W	ca. 60-320 m
CERRO PATA DE PÁJARO	20-21 July	0° 02' N, 79° 58' W	650-800 m

Note: *Overlapping dates result from times when the travelling party was split into more than one group.*

Codes for Avian Data

Appendices 2-8

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous (dry) forest
Fm	Montane evergreen forest (lower cloud forest)
Fr	Riparian forest (in dry areas, along rivers)
Fe	Forest edges
Fsm	Forest stream margins
Mg	Mangroves
B	Bamboo thickets within evergreen forest
Sc	Desert-scrub
Sg	Second growth; low, shrubby vegetation (man-created)
P	Pasture
M	Marsh; permanently flooded areas filled with grasses and other water-adapted plants
S	Shores, sandbars
R	River; open water
Rm	River margins; vegetation overhanging riverbanks
Sm	Stream margins; vegetation overhanging or bordering streams
A	Aerial (letters in parentheses following this code refer to habitats in which the species is most apt to occur)
O	Ocean; coastal waters within a few km of land

Foraging Position	
T	Terrestrial
U	Undergrowth or understory (up to 5 m in tall forest)
M	Subcanopy or middlestory (mainly from 5 to 15 m in tall forest)
C	Canopy (primarily above 15 m in tall forest)
W	Water
A	Aerial

Sociality	
S	Solitary or in pairs
G	Gregarious; large groups of same species (more than 5 individuals)
M	Mixed-species flocks

Abundance	
C	Common; recorded daily in preferred habitat in moderate to large numbers (i.e., more than 10 individuals)
F	Fairly common; recorded every day in small numbers; less than 10 individuals
U	Uncommon; recorded every other day; occurs in small numbers
R	Rare; recorded only once during survey period
E	Extinct
X	Recorded, status uncertain
(M)	Migrant, origin unknown
(Mn)	Migrant from the north, primarily from North America, normally occurring only from mid-August to March
(Ms)	Migrant from south (April to October)
(V)	Vagrant; of very rare and irregular occurrence

Evidence	
t	Tape-recording obtained in area

Preliminary List of the Birds of Cabeceras de Bilsa

APPENDIX 2

T. A. Parker, III

	Habitats	Foraging	Sociality	Abundunce	Evidence
TINAMIDAE (2)					
Tinamus major	Fh	T	S	U	
Crypturellus soui	Fh	T	S	F	t
CATHARTIDAE (3)					
Coragyps atratus	Sg,Fe	T	S,G	U	
Cathartes aura	Sg,Fh	T	S	U	
Sarcoramphus papa	Fh	T	S	F	
ACCIPITRIDAE (7)					
Elanoides forficatus	Fh	A,C	S,G	U	
Harpagus bidentatus	Fh	M,C	S	U?	
Leucopternis occidentalis	Fh	C,T	S	U	
L. plumbea	Fh	M,T	S	R?	
Ictinia plumbea	Fh,Sg	A,C	S	F	
Buteogallus urubitinga	Fh	M,T	S	U	
Buteo magnirostris	Fe	T,C	S	F	t
FALCONIDAE (2)					
Herpetotheres cachinnans	Fe,Sg	T,C	S	F	t
Micrastur ruficollis	Fh	U,M	S	U	
CRACIDAE (2)					
Ortalis erythroptera	Fe,Sg	T,C	G	U	
Penelope sp.	Fh	T,C	S	U	
PHASIANIDAE (1)					
Odontophorus erythrops	Fh	T	G	U	
COLUMBIDAE (5)					
Columba speciosa	Fh	C	S	U	t
C. subvinacea	Fh	C	S	U?	
C. goodsoni	Fh	C	S	C	t
Leptotila pallida	Fe,Fh	T	S	C	t
Geotrygon montana	Fh	T	S	F	t
PSITTACIDAE (5)					
Pionopsitta pulchra	Fh	M,C	S,G	C	t
Pionus menstruus	Fh	C	S,G	C	t
P. chalcopterus	Fh	C	S,G	F	t
Amazona autumnalis	Fh	C	S,G	R?	t?
A. farinosa	Fh	C	S,G	C	t

Habitats	
Fh	Mature evergreen forest
Fe	Forest edges
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 2

	Habitats	Foraging	Sociality	Abundunce	Evidence
CUCULIDAE (3)					
Piaya cayana	Fh,Sg	C	S,M	U	t
P. minuta	Fe,Sg	U	S	R	
Crotophaga ani	Sg	T,U	G	F	t
STRIGIDAE (3)					
Lophostrix cristata	Fh	M,C	S	F	t
Pulsatrix perspicillata	Fh	M,T	S	U	
Ciccaba virgata	Fh	M,C	S	U	t
NYCTIBIIDAE (1)					
Nyctibius griseus	Fe,Sg	C,A	S	R?	
CAPRIMULGIDAE (1)					
Lurocalis semitorquatus	Fh	C,A	S	U	t
APODIDAE (1)					
Chaetura cinereiventris	Fh,Sg	A	S	F	t
TROCHILIDAE (14)					
Glaucis aenea	Fh,Fe	U	S	U	
Threnetes ruckeri	Fh	U	S	F	
Phaethornis yaruqui	Fh	U	S	C	t
P. superciliosus	Fh	U	S	X	
P. longuemareus	Fh	U	S	F	
Eutoxeres aquila	Fh	U	S	U	
Florisuga mellivora	Fh,Sg	C	S	F	
Popelairia conversii	Fh	C	S	X	
Thalurania colombica	Fh	U,C	S	F	
Damophila julie	Fh	M,C	S	X	
Amazilia tzacatl	Fh,Sg	U,C	S	U	
Chalybura buffoni	Fh	U,M	S	X	
Heliothryx barroti	Fh	M,C	S	U	
Heliodoxa jacula	Fh	U,M	S	F?	
TROGONIDAE (5)					
Trogon melanurus	Fh	M,C	S	U	t
T. comptus	Fh	M,C	S	?	t
T. viridis	Fh	C	S	C	t
T. collaris	Fh	M	S	C	t
T. rufus	Fh	M	S	U	t

APPENDIX 2

	Habitats	Foraging	Sociality	Abundunce	Evidence
MOMOTIDAE (1)					
Baryphthengus martii	Fh	M,C	S	F	
BUCCONIDAE (4)					
Notharchus macrorhynchos	Fh,Fe	C	S	F	t
Nystalus radiatus	Fh,Fe	C	S	F	t
Malacoptila panamensis	Fh	U	S	U	t?
Micromonacha lanceolata	Fh	C	S	R?	
CAPITONIDAE (1)					
Capito squamatus	Fh	C	S	F	t
RAMPHASTIDAE (3)					
Pteroglossus erythropygius	Fh	C	G	F	t
Ramphastos brevis	Fh	C	S,G	C	t
R. swainsonii	Fh	C	S,G	C	t
PICIDAE (7)					
Piculus rubiginosus	Fh,Sg	M,C	S,M	F	t
P. leucolaemus	Fh	M,C	M	F	t
Celeus loricatus	Fh	M,C	S,M	F	t
Dryocopus lineatus	Fh	M,C	S	U	t
Melanerpes pucherani	Fh,Fe	C	S,M	F	t
Veniliornis kirkii	Fh	C	M	F	t
Campephilus gayaquilensis	Fh	M,C	S	F	t
DENDROCOLAPTIDAE (5)					
Dendrocincla fuliginosa	Fh	U,M	S,M	C	t
Glyphorynchus spirurus	Fh	U,M	S,M	F	t
Dendrocolaptes certhia	Fh	U,M	S,M	U	
Xiphorhynchus lacrymosus	Fh	M,C	S,M	C	t
X. erythropygius	Fh	M,C	M,S	C	t
FURNARIIDAE (4)					
Synallaxis brachyura	Sg	T,M	S	F	t
Hyloctistes subulatus	Fh	M	M	F	t
Automolus ochrolaemus	Fh	U	M,S	X	
Xenops minutus	Fh	U,M	M	C	
FORMICARIIDAE (16)					
Cymbilaimus lineatus	Fh	M,C	S,M	F	t
Taraba major	Fe,Sg	U,M	S,M	U	

Habitats	
Fh	Mature evergreen forest
Fe	Forest edges
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 2

	Habitats	Foraging	Sociality	Abundunce	Evidence
Thamnophilus atrinucha	Fh	U,M	S,M	C	t
Thamnistes anabatinus	Fh	C	M	C	t
Dysithamnus puncticeps	Fh	M	M	C	t
Myrmotherula surinamensis	Fe,Sg	U,M	S,M	U	t
M. fulviventris	Fh	U,M	M	F	t
M. axillaris	Fh	U,M	M	C	t
M. schisticolor	Fh	U,M	M	R	
Microrhopias quixensis	Fh	M,U	M	C	t
Cercomacra tyrannina	Fe	U	S	U	
Myrmeciza berlepschi	Fh	U	S	F	t
Myrmeciza exsul	Fh	U	S	C	t
M. immaculata	Fh	U,T	S	U	t
Hylophylax naevioides	Fh	U	S	U	
Formicarius nigricapillus	Fh	T	S	U?	t
TYRANNIDAE (27)					
Phyllomyias griseiceps	Fe,Sg	C	S	F	t
Zimmerius viridiflavus	Fh,Fe	C	S,M	C	t
Ornithion brunneicapillum	Fh	C	S,M	F	t
Camptostoma obsoletum	Sg,Fe	C	S,M	F	t
Tyrannulus elatus	Fh	C	S	F	t
Myiopagis caniceps	Fh	C	M	U	t
Elaenia flavogaster	Sg	C	S	U	t
Mionectes olivaceus	Fh	U,M	S,M	U	
Myiornis ecaudatus	Fh	C	S	F	t
Lophotriccus pileatus	Fh	U,C	S,M	U	t
Rhynchocyclus brevirostris	Fh	M	M,S	X	
Platyrinchus coronatus	Fh	U,M	S	U	
Myiophobus fasciatus	Sg,Fe	U	S	F	
Contopus borealis	Fe	C,A	S	R	
Empidonax virescens	Fh,Fe	M	S	F	t
Attila torridus?	Fh	C	S,M	R	
A. spadiceus	Fh	C,M	S,M	U	t
Sirystes albogriseus	Fh	C	M	F	t
Myiarchus sp.	Fe,Sg	M,C	S	U	
Myiozetetes cayanensis	Sg,Fe	C	S	F	t

APPENDIX 2

	Habitats	Foraging	Sociality	Abundunce	Evidence
Conopias albovittatus	Fh	C	M,S	F	t
Tyrannus melancholicus	Fe,Sg	C,A	S	U	
Pachyramphus cinnamomeus	Fh,Fe	C	M,S	U	t
P. polychopterus	Fh,Fe	C	M	F	t
P. homochrous	Fh,Sg	C	S,M	F	t
Tityra semifasciata	Fh	C	S	F	t
T. inquisitor	Fh	C	S	F	
PIPRIDAE (3)					
Schiffornis turdinus	Fh	U	S	F	t
Manacus manacus	Fh,Fe	U	S	F	t
Pipra mentalis	Fh	U,M	S	X	
COTINGIDAE (3)					
Lipaugus unirufus	Fh	M,C	S	C	t
Carpodectes hopkei	Fh	C	S	F	
Cephalopterus penduliger	Fh	C,M	S	R	
HIRUNDINIDAE (2)					
Progne chalybea	Sg,Fh	A	G	U	
Stelgidopteryx ruficollis	Sg,Fe	A	S,G	F	
TROGLODYTIDAE (6)					
Campylorhynchus zonatus	Fe,Sg	C	S,M	U	
Thryothorus nigricapillus	Fe	U	S	C	t
T. thoracicus	Fh	M	M	C	t
Troglodytes aedon	Sg,Fe	U	S	C	t
Microcerculus marginatus	Fh	T,U	S	F	t
Cyphorhinus phaeocephalus	Fh	T,U	S	F	t
TURDIDAE (1)					
Turdus albicollis	Fh	T,M	S	F	t
SYLVIIDAE (1)					
Microbates cinereiventris	Fh	U,M	S,M	F	t
VIREONIDAE (2)					
Vireolanius leucotis	Fh	C	M,S	F	t
Hylophilus minor	Fh	M,C	M	C	t
EMBERIZIDAE					
ICTERINAE (3)					
Scaphidura oryzivora	Fe,Sg	T,C	S,G	U	

Habitats	
Fh	Mature evergreen forest
Fe	Forest edges
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 2

	Habitats	Foraging	Sociality	Abundunce	Evidence
Zarhynchus wagleri	Fh,Fe	C	S,M	F	t
Cacicus microrhynchus	Fh	C	G,M	F	t
PARULINAE (3)					
Dendroica fusca	Fh	C	M	R(Mn)	
D. castanea	Fh	C	M	R(Mn)	t
Setophaga ruticilla	Fh	M	M	R(Mn)	
COEREBINAE (1)					
Coereba flaveola	Fh,Sg	C	S	C	t
THRAUPINAE (22)					
Cyanerpes caeruleus	Fh	C	M	C	
Chlorophanes spiza	Fh	C	M	C	
Dacnis cayana	Fh	C	M	F	t
D. lineata	Fh	C	M	U	t
D. venusta	Fh	C	M	F	
Euphonia xanthogaster	Fh,Sg	U,C	M,S	C	t
E. fulvicrissa	Fh	C	M	U	
E. laniirostris	Fe,Sg	C	S,M	F	t
Tangara icterocephala	Fh	M,C	M,S	F	t
T. larvata	Fh	C	S,M	F	t
T. palmeri	Fh	C	M	U	t
T. gyrola	Fh	C	M	C	
T. florida	Fh	C	M	U	
Thraupis palmarum	Fh,Sg	C	S,M	F	t
T. episcopus	Sg,Fe	C	S,M	U	t
Ramphocelus icteronotus	Sg,Fe	U,C	G,M	C	t
Piranga rubra	Fh,Fe	C	M,S	R	t
Chlorothraupis stolzmanni	Fh	M,C	M,G	C	t
Tachyphonus luctuosus	Fh	M,C	M	F	t
T. delatrii	Fh	M,C	M	F	t
Heterospingus xanthopygius	Fh	C	M	F	t
Mitrospingus cassini	Fh	U,M	G,M	F	t
CARDINALINAE (4)					
Saltator maximus	Fh,Fe	M,C	S,M	F	t
Pitylus grossus	Fh	M,C	S	U	t

APPENDIX 2

	Habitats	Foraging	Sociality	Abundunce	Evidence
Pheucticus ludovicianus	Fh	C	M	R(Mn)	
Cyanocompsa cyanoides	Fh,Fe	U	S	U	t
EMBERIZINAE (1)					
Sporophila americana	Fe,Sg	U	S,G	X	

Habitats	
Fh	Mature evergreen forest
Fe	Forest edges
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 3

Preliminary List of the Landbirds of Parque Nacional Machalilla

T. A. Parker, III

	Habitats	Foraging	Sociality	Abundunce	Evidence
TINAMIDAE (2)					
Crypturellus soui	Fh	T	S	F	t
Crypturellus transfasciatus	Fd	T	S	F	t
ARDEIDAE (3)					
Egretta alba	Rm	W	S	U	
Egretta thula	Rm	W	S	F	
Butorides striatus	Rm	W	S	F	t
CATHARTIDAE (3)					
Sarcoramphus papa	Fh,Fd	T	S	U	
Coragyps atratus	Sc,Fd,Fh	T	G	F	
Cathartes aura	Sc,Fd,Fh	T	S	C	
ACCIPITRIDAE (10)					
Elanoides forficatus	Fh	A,C	S,G	U	
Leptodon cayanensis	Fh	M,C	S	R	t
Ictinia plumbea	Fh	A	S,G	R	
Geranospiza caerulescens	Fd,Sm	T,C	S	U	t
Leucopternis occidentalis	Fh,Fd	T,C	S	U	t
Buteogallus urubitinga	Rm,Fd,Fh	T,U	S	R	
Parabuteo unicinctus	Sc,Fd	T	S	U	
Buteo brachyurus	Fh	A,C	S	R	
Spizaetus ornatus	Fh	M,C	S	R	t
Spizaetus tyrannus	Fh	M,C	S	R	
PANDIONIDAE (1)					
Pandion haliaetus	R	W	S	U(Mn)	
FALCONIDAE (6)					
Herpetotheres cachinnans	Fh,Fd	T,C	S	U	t
Micrastur ruficollis	Fh	U,M	S	F	t
Polyborus plancus	Sc	T	S	F	
Falco peregrinus	Sc,Rm	A	S	R	
Falco rufigularis	Fh	A	S	R	
Falco sparverius	Sc	T	S	U	
CRACIDAE (2)					
Ortalis erythroptera	Fh,Fd	T,C	G	F	t
Penelope purpurascens	Fh	T,C	S	R	t

APPENDIX 3

	Habitats	Foraging	Sociality	Abundunce	Evidence
PHASIANIDAE (1)					
Odontophorus erythrops	Fh	T	G	R	
SCOLOPACIDAE (1)					
Actitis macularia	Rm	T,W	S	U(Mn)	
COLUMBIDAE (10)					
Columba speciosa	Fh	C	S	U	t
Columba cayennensis	Fr	C	S,G	U	t
Columba subvinacea	Fh	C	S	C	t
Zenaida auriculata	Sc	T	S,G	F	t
Zenaida asiatica	Sc	T,C	S,G	F	t
Columbina buckleyi	Sc,Fd	T	S,G	F/C	t
Columbina cruziana	Sc,Fd	T	S,G	C	
Claravis pretiosa	Fr	T	S,G	U	
Leptotila ochraceiventris	Fh,Fd?	T	S	R	
Leptotila verreauxi	Sc,Fd,Fh	T	S	C	t
PSITTACIDAE (4)					
Ara ambigua	Fh?	C	S,G	R	
Aratinga erythrogenys	Fd,Fr,Fh	C	G	F	t
Forpus coelestis	Sc,Fd	U,C	G	C	t
Pionus chalcopterus	Fh	C	S,G	U	t
CUCULIDAE (3)					
Piaya cayana	Fh,Fr	M,C	S,M	U	t
Crotophaga sulcirostris	Sc,Sg	T,U	G	C	t
Tapera naevia	Sg,Sc	T,U	S	U	t
TYTONIDAE (1)					
Tyto alba	Sc	T	S	U?	
STRIGIDAE (5)					
Otus roboratus	Sc,Fd	M,C	S	C	t
Pulsatrix perspicillata	Fh	T,M	S	U	t
Glaucidium (brasilianum)	Sc,Fd	U,C	S	C	t
Speotyto cunicularia	Sc	T	S	U	t
Ciccaba nigrolineata	Fh	M,C	S	F	t
NYCTIBIIDAE (1)					
Nyctibius griseus	Fh	C,A	S	F	t

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous forest
Fm	Montane evergreen forest
Fr	Riparian forest
B	Bamboo thickets
Sc	Desert-scrub
Sg	Second growth
R	River
Rm	River margins
Sm	Stream margins
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 3

	Habitats	Foraging	Sociality	Abundunce	Evidence
CAPRIMULGIDAE (2)					
Lurocalis semitorquatus	Fh	A	S	U	t
Nyctidromus albicollis	Fd,Sg	A	S	F	t
APODIDAE (3)					
Streptoprocne zonaris	Fh,Fd	A	G	U/R	
Chaetura cinereiventris	Fh	A	S,G	C	t
Chaetura brachyura	Fh,Fd	A	S,G	U	
TROCHILIDAE (8)					
Phaethornis superciliosus	Fh	U	S	C	t
Thalurania colombica	Fh	U,C	S	F	
Damophila julie	Fh	M,C	S	U	
Amazilia amazilia	Sc,Fd	U,C	S	F	t
Amazilia tzacatl	Fh	U,C	S	C	t
Adelomyia melanogenys	Fm	U,M	S	C	t
Heliomaster longirostris	Fd,Fh	C	S	U	
Acestrura bombus	Fh	C	S	U	
TROGONIDAE (3)					
Trogon melanurus	Fh	M,C	S	F	t
Trogon collaris	Fh	M,C	S	U	t
Trogon violaceus	Fh	C	S	F	t
ALCEDINIDAE (2)					
Ceryle torquata	Rm	W	S	F	
Chloroceryle americana	Rm	W	S	F	
MOMOTIDAE (1)					
Momotus momota	Fd,Sc	U,C	S	C	t
BUCCONIDAE (1)					
Malacoptila panamensis	Fh	U	S	R	
CAPITONIDAE (1)					
Eubucco bourcierii	Fm,Fh	C	S,M	U	t
RAMPHASTIDAE (3)					
Aulacorhynchus haematopygus	Fm	C	S,G	U	t
Pteroglossus erythropygius	Fh	C	S,G	U	t
Ramphastos swainsonii	Fh	C	S,G	U	t
PICIDAE (8)					
Picumnus olivaceus	Fh	M,C	S,M	F	t

APPENDIX 3

	Habitats	Foraging	Sociality	Abundunce	Evidence
Picumnus sclateri	Fd,Fh	M,C	S,M	U?	t?
Piculus rubiginosus	Fd,Fh,Sc	M,C	S,M	C	t
Dryocopus lineatus	Fh,Fr	C	S	U	t
Melanerpes pucherani	Fh	C	S	F	t
Veniliornis kirkii	Fh,Fd	M,C	S,M	F	t
Veniliornis callonotus	Fh,Fd	M,C	S,M	F	t
Campephilus gayaquilensis	Fh,Fd	U,C	S	U	t
DENDROCOLAPTIDAE (6)					
Dendrocincla fuliginosa	Fh	U,M	S,M	U	t
Sittasomus griseicapillus	Fd,Fh	M	S,M	F	t
Glyphorynchus spirurus	Fh	U,M	M	R	t
Xiphorhynchus erythropygius	Fh	M,C	S,M	F	t
Lepidocolaptes souleyetii	Fd,Sc	M,C	S,M	C	t
Campyloramphus trochilirostris	Fh	M	S,M	F	t
FURNARIIDAE (9)					
Furnarius cinnamomeus	Rm,Sc	T	S	C	t
Synallaxis brachyura	Fh,Sg	T,M	S,M	F	t
Synallaxis tithys	Fd	T,U	S,M	U	t
Synallaxis stictothorax	Sc	U,M	S	F	t
Cranioleuca erythrops	Fm, Fh, Fd	M,C	M,S	F	t
Anabacerthia variegaticeps	Fm	M,C	M	R	
Hylocryptus erythrocephalus	Fm	T,U	S	R	t
Xenops rutilans	Fd, Fh	M,C	M,S	C	t
Xenops minutus	Fh	U,M	M	R?	
FORMICARIIDAE (9)					
Taraba major	Fh	U,M	S	F	t
Sakesphorus bernardi	Fd,Sc	U,C	S,M	C	t
Thamnophilus atrinucha	Fh	U,M	S,M	U	t
Dysithamnus mentalis	Fh, Fd	U,M	M,S	C	t
Myrmotherula schisticolor	Fm	U,M	M	U	t
Pyriglena pacifica	Fh	U	S	F	t
Formicarius nigricapillus	Fh, Fm	T	S	F	t
Grallaria guatimalensis	Fm	T	S	R	
Grallaria watkinsi	Fd, Fh	T	S	F	t

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous forest
Fm	Montane evergreen forest
Fr	Riparian forest
B	Bamboo thickets
Sc	Desert-scrub
Sg	Second growth
R	River
Rm	River margins
Sm	Stream margins
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 3

	Habitats	Foraging	Sociality	Abundunce	Evidence
RHYNOCRYPTIDAE (1)					
Melanopareia elegans	Sc,Fd	T,U	S	C	t
PIPRIDAE (3)					
Schiffornis turdinus	Fh	U	S	R	
Manacus manacus	Fh	U	S	F	t
Pipra mentalis?	Fh	U,M	S	R	
TYRANNIDAE (37)					
Phyllomyias griseiceps	Fh	C	S	C	t
Zimmerius viridiflavus	Fh	C	S	F	t
Camptostoma obsoletum	Sc,Fd,Fh	C	S,M	C	t
Phaeomyias murina	Sc,Fd	C	S	U?	t
Myiopagis subplacens	Fd,Fh	U,C	S,M	C	t
Elaenia flavogaster	Sg	C	S,M	F	t
Mecocerculus calopterus	Fm	C	M	R	
Euscarthmus meloryphus	Sc,Sg,Fd	U	S,M	C	t
Mionectes oleagineus	Fh	U,C	S,M	U	t
Leptopogon superciliaris	Fh	M,C	M	R	t?
Capsiempis flaveola	Fh,B	C	S	F	t
Lophotriccus pileatus	Fh,Fd	M,C	S,M	C	t
Todirostrum cinereum	Sc,Sg,Fd	M,C	S,M	U	t
Tolmomyias sulphurescens	Fd	C	M	U	t
Platyrinchus mystaceus	Fh	U	S	F	t
Onychorhynchus occidentalis	Fh	M	S	R	
Myiobius atricaudus	Fh	M	M	R	
Myiophobus fasciatus	Fd,Fh,Sg	U,M	M	F	t
Contopus fumigatus	Fm	C	S,M	F	t
Contopus (sordidulus)	Fh	C	S	R(Mn)	
Contopus cinereus	Fd	U,C	S,M	U	t
Empidonax virescens	Fh	M	S	U(Mn)	t
Lathrotriccus griseipectus	Fh	M,C	S,M	F	t
Pyrocephalus rubinus	Sc,Sg	C,A	S	F	
Fluvicola atripennis	Rm,Sg	T	S	F	
Muscigralla brevicauda	Sc	T	S	U?	
Attila torridus	Fm	C	S	F	t
Myiarchus tuberculifer	Fh	C	S,M	C	t

APPENDIX 3

	Habitats	Foraging	Sociality	Abundunce	Evidence
Myiarchus phaeocephalus	Sc	M,C	S	F	t
Megarynchus pitangua	Fh,Fd	C	S	F	t
Myiozetetes similis	Fr,Sg	C	S	F	t
Myiodynastes bairdii	Sc,Fd	C	S	F	t
Myiodynastes maculatus	Fh	C	S,M	C	t
Tyrannus melancholicus	Fr,Sg	C,A	S	U	
Tyrannus niveigularis	Sc	C,A	S	U	
Pachyramphus homochrous	Fh	C	S	U	t
Tityra semifasciata	Fh	C	S	U	t
HIRUNDINIDAE (2)					
Progne chalybea	Sg,Fd,Fh	A	G	F	
Stelgidopteryx ruficollis	Rm,Sg	A	G	C	t
TROGLODYTIDAE (8)					
Campylorhynchus fasciatus	Sc,Fd	C	S,G	F	t
Thryothorus mystacalis	Fh,B	U,M	S,M	F	t
Thryothorus paucimaculatus	Fh,Fd	U,M	S,M	C	t
Thryothorus superciliaris	Sc,Fd	U	S	C	t
Troglodytes aedon	Sg,Sc	U	S	F	t
Troglodytes solstitialis	Fm	C	S,M	U	t
Henicorhina leucophrys	Fm	U,T	S,M	C	t
Microcerculus marginatus	Fh	T	S	U	t
MIMIDAE (1)					
Mimus longicaudatus	Sc	C,T	S,G	C	t
TURDIDAE (4)					
Catharus dryas	Fm	T	S	R?	
Catharus ustulatus	Fh,Fm	T,M	S	U(Mn)	
Turdus maculirostris	Fh,Fr	M,C	S	F	t
Turdus reevei	Sc,Fd	C,T	S,G	U	t
SYLVIIDAE (2)					
Ramphocaenus melanurus	Fh	M	S,M	U	t
Polioptila plumbea	Sc,Fd	C	S,M	F	t
VIREONIDAE (3)					
Cyclarhis gujanensis	Fd,Fh	C	S,M	F	t
Vireo olivaceus	Sc,Sg,Fr	C	S,M	C	t
Hylophilus minor	Fh,Fd	M,C	M	C	t

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous forest
Fm	Montane evergreen forest
Fr	Riparian forest
B	Bamboo thickets
Sc	Desert-scrub
Sg	Second growth
R	River
Rm	River margins
Sm	Stream margins
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 3

	Habitats	Foraging	Sociality	Abundunce	Evidence
EMBERIZIDAE					
PARULINAE (6)					
Parula pitiayumi	Fh	C	S,M	C	t
Setophaga ruticilla	Fh	M	S,M	R(Mn)	
Seiurus noveboracensis	Rm	T	S	R(Mn)	
Myioborus miniatus	Fm	C	M	C	t
Geothlypis aequinoctialis	Sg	U	S,M	F	
Basileuterus fraseri	Fh,Fd	U,M	S,M	C	t
COEREBINAE (1)					
Coereba flaveola	Sc,Fd,Fh	C	S	C	t
THRAUPINAE (15)					
Dacnis lineata	Fh	C	M	U?	
Chlorophanes spiza	Fh	C	M	U?	
Tangara icterocephala	Fh	C	M	F	t
Tangara gyrola	Fh	C	G,M	C	
Euphonia laniirostris	Fd,Fh	C	S,M	C	t
Euphonia xanthogaster	Fh	U,C	S,M	C	t
Euphonia saturata	Fh,Fd?	C	S	U?	
Chlorospingus canigularis	Fm	M,C	G,M	C	t
Thraupis palmarum	Fh	C	S,M	R?	
Thraupis episcopus	Fr,Fh	C	S,M	C	t
Piranga flava	Fd,Fh	C	S,M	F	t
Piranga rubra	Fr,Fh	C	S,M	R(Mn)	t
Ramphocelus icteronotus	Sg,Fr	U,C	G,M	F	t
Tachyphonus luctuosus	Fh	M,C	M	U	t
Hemithraupis guira	Fh,Fr	C	M	X	
ICTERINAE (8)					
Sturnella bellicosa	Sc	T,U	S,G	U	
Dives warzewiczii	Sc,Sg,Fr	T,C	G,S	F	t
Molothrus bonariensis	Sc,Sg	T,C	S,G	U	t
Scaphidura oryzivora	Fr,Sg	T,C	S,G	R?	
Icterus graceannae	Sc,Fd	C	S	F	t
Icterus mesomelas	Fd,Sg	C	S,G	U	t
Amblycercus holosericeus	Fh,B	U,M	S,M	F	t
Cacicus cela	Fr,Fh	C	S,G,M	F	t

APPENDIX 3

	Habitats	Foraging	Sociality	Abundunce	Evidence
CARDINALINAE (4)					
Saltator albicollis	Fh	M,C	S	F	t
Saltator maximus	Fh,Fr	M,C	S,M	C	t
Pheucticus chrysogaster	Sc,Fd,Fh	C	S	C	t
Cyanocompsa cyanoides	Fh	U	S	U	t
EMBERIZINAE (10)					
Amaurospiza concolor	Fm,B	M	S	R	
Volatinia jacarina	Sc,Sg	T,U	S,G	F	
Tiaris obscura	Sg	T,U	S,G	U?	
Sporophila americana	Sg	T,U	S,G,M	F	
Sporophila telasco	Sc	T,U	G	F	
Atlapetes brunneinucha	Fm	T,U	S,M	F	t
Poospiza hispaniolensis	Sc	U	S	F	t
Arremon aurantiirostris	Fh	T,U	S,M	U	t?
Arremon abeillei	Fd,Fh	T,U	S,M	F	t
Rhodospingus cruentus	Sc,Fd	T,C	G,M	F	
CARDUELINAE (1)					
Carduelis siemiradzkii	Fd,Sg	U,C	G	F	t

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous forest
Fm	Montane evergreen forest
Fr	Riparian forest
B	Bamboo thickets
Sc	Desert-scrub
Sg	Second growth
R	River
Rm	River margins
Sm	Stream margins
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(Mn)	Migrant from north
Evidence	
t	Tape

APPENDIX 4

Preliminary List of the Birds of Cerro Blanco

T. A. Parker, III

	Habitats	Foraging	Sociality	Abundunce	Evidence
TINAMIDAE (1)					
Crypturellus transfasciatus	Fd	T	S	F	t
FREGATIDAE (1)					
Fregata magnificens	A	A	S,G	F(V)	
CATHARTIDAE (3)					
Sarcoramphus papa	Fd,Fh	T	S	U	
Coragyps atratus	Fd,Fh,Sc	T	G,S	C	t
Cathartes aura	Fd,Fh,Sc	T	S	C	
ACCIPITRIDAE (15)					
Elanoides forficatus	Fd,Fh	C,A	S,G	F	t
Harpagus bidentatus	Fh	C,M	S	R	
Ictinia plumbea	Fd,Fh	C,A	S	F(M?)	
Accipiter bicolor	Fd,Fh	U,C	S	U	
Geranospiza caerulescens	Fd,Fh	T,C	S	F	
Leucopternis occidentalis	Fd,Fh	C,T	S	U	
Asturina nitida	Fd,Fe	C,T	S	F?	
Buteogallus urubitinga	Fd,Fh	T,C	S	R	
B. meridionalis	Sc	T	S	U	
Parabuteo unicinctus	Sc,Fd	T	S	F	
Buteo magnirostris	Fd,Fh,Sg	C,T	S	F	t
B. brachyurus	Fh	C,A	S	U	
B. polyosoma	Fd,Sc	T	S	U	
B. albonotatus	Fd,Fh,Sc	T?	S	R	
Spizaetus tyrannus	Fh	C,T	S	R	
FALCONIDAE (6)					
Herpetotheres cachinnans	Fd,Fh	T,C	S	F	t
Micrastur semitorquatus	Fd,Fh	M,C	S	R	t
M. ruficollis	Fh	U,M	S	U	
Polyborus plancus	Sc,Fd	T	S	F	
Falco rufigularis	Fd,Fh	A	S	U	
F. sparverius	Sc	T,A	S	U	
CRACIDAE (1)					
Ortalis erythroptera	Fd,Fh	T,C	G	U	
COLUMBIDAE (7)					
Columba cayennensis	Fh,Fd	C	S,G	F	

APPENDIX 4

	Habitats	Foraging	Sociality	Abundunce	Evidence
Zenaida asiatica	Sc,Fd	T,C	S,G	U	
Columbina buckleyi	Sc,Fd	T	S,G	C	t
C. cruziana	Sc,Fd	T	S,G	U	t
Claravis pretiosa	Fh	T,C	S,G	U	
Leptotila ochraceiventris	Fd,Fh	T	S	R	
L. verreauxi	Fd,Fh,Sc	T	S	C	t
PSITTACIDAE (6)					
Ara ambigua	Fd,Fh	C	S,G	R	
Aratinga erythrogenys	Fd,Fh,Sc	C	G	F	t
Forpus coelestis	Sc,Fd	U,C	S,G	C	t
Brotogeris pyrrhopterus	Fd,Fh	C	S,G	F	t
Pionus chalcopterus	Fd,Fh	C	S,G	U	
Amazona autumnalis	Fh	C	S,G	U	t
CUCULIDAE (3)					
Piaya cayana	Fh	C,M	S,M	U	t
Crotophaga sulcirostris	Sc	T,U	G	C	
Tapera naevia	Sc	T,U	S	U	
TYTONIDAE (1)					
Tyto alba	Sc,Fd	T	S	U	
STRIGIDAE (2)					
Pulsatrix perspicillata	Fd,Fh	C,T	S	F	t
Glaucidium (brasilianum)	Fd,Fh,Sc	U,C	S	C	t
CAPRIMULGIDAE (2)					
Chordeiles acutipennis	Sc	A	S	U	
Nyctidromus albicollis	Fd,Fh	A	S	C	
APODIDAE (3)					
Streptoprocne zonaris	Fd,Fh	A	G	F(V)	
Chaetura cinereiventris	Fd,Fh	A	S	U	
C. brachyura	Fd	A	S	U	
TROCHILIDAE (5)					
Phaethornis superciliosus	Fh	U	S	U	
P. longuemareus	Fh	U	S	?	
Amazilia amazilia	Fd,Fh,Sc	U,C	S	C	
Heliomaster longirostris	Fd,Fh	C	S	U	
Myrmia micrura	Sc	U,C	S	U	

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous forest
Fe	Forest edges
Fsm	Forest stream margins
Sc	Desert-scrub
Sg	Second growth
Sm	Stream margins
A	Aerial
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(M)	Migrant
(Mn)	Migrant from north
(Ms)	Migrant from south
(V)	Vagrant
Evidence	
t	Tape

APPENDIX 4

	Habitats	Foraging	Sociality	Abundunce	Evidence
TROGONIDAE (2)					
Trogon melanurus	Fd,Fh	M,C	S	U	
T. violaceus	Fh	C	S	R	
ALCEDINIDAE (2)					
Ceryle torguata	Sm	W	S	U	
Chloroceryle americana	Sm	W	S	U	
MOMOTIDAE (1)					
Momotus momota	Fd,Fh	U,C	S	U	
PICIDAE (6)					
Picumnus sclateri	Fd,Fh,Sc	M,C	M,S	C	t
Melanerpes pucherani	Fh,Fe	M,C	S,M	X	
Piculus rubiginosus	Fd,Fh	M,C	S,M	F	t
Dryocopus lineatus	Fh	M,C	S	U	
Veniliornis callonotus	Fd,Fh,Sc	M,C	S,M	C	t
Campephilus gayaquilensis	Fd,Fh	M,C	S	U	t
DENDROCOLAPTIDAE (3)					
Sittasomus griseicapillus	Fh	U,M	M,S	F	t
Lepidocolaptes souleyetii	Fd,Fh,Sc	M,C	S,M	C	t
Campyloramphus trochilirostris	Fh,Fd	U,M	S,M	F	t
FURNARIIDAE (3)					
Furnarius cinnamomeus	Sg,Sc	T	S	F	
Synallaxis tithys	Fd,Fh	T,U	S	U	
Xenops rutilans	Fd,Fh	M,C	M	F	t
FORMICARIIDAE (4)					
Taraba major	Fh	U,M	S	U	t
Sakesphorus bernardi	Fd,Fh,Sc	U,C	S,M	C	t
Dysithamnus mentalis	Fh	U,M	M,S	C	t
Pyriglena pacifica	Fh	U	S	R	
RHINOCRYPTIDAE (1)					
Melanopareia elegans	Fd,Sc	T,U	S	F	
TYRANNIDAE (23)					
Camptostoma obsoletum	Fd,Fh,Sc	C	S,M	C	t
Phaeomyias murina	Sc,Fd	C	S	U	
Myiopagis subplacens	Fd,Fh	U,C	S,M	C	t
Elaenia flavogaster	Sc	C	S	F	

APPENDIX 4

	Habitats	Foraging	Sociality	Abundunce	Evidence
Euscarthmus meloryphus	Sc,Fe	U	S	C	t
Lophotriccus pileatus	Fd,Fh	U,C	S,M	F	t
Todirostrum cinereum	Fd	M,C	S,M	F	t
Tolmomyias sulphurescens	Fd	C	M	U	
Myiophobus fasciatus	Fd,Sc	U,M	S	C	t
Contopus cinereus	Fd	U,M	S,M	U	t
Lathrotriccus griseipectus	Fh	M	S,M	R?	
Fluvicola atripennis	Sm,M	T	S	F	
Muscigralla brevicauda	Sc	T	S	U	
Myiarchus tuberculifer	Fd,Fh	C,M	S,M	U	t
M. phaeocephalus	Sc,Fd	M,C	S,M	U	
Megarynchus pitangua	Fd,Fh	C	S	F	t
Myiozetetes similis	Fd,Fh,Sg	C	S	U	t
Myiodynastes bairdii	Fd,Sc	C	S,M	F	
M. maculatus	Fd,Fh	C	S,M	U?	
Tyrannus niveigularis	Sc	C,A	S	U	
T. melancholicus	Sg,Fe	C,A	S	F	
Pachyramphus albogriseus	Fd,Fh	C	M,S	U	
P. homochrous	Fd,Fh	C	M,S	U	t
HIRUNDINIDAE (3)					
Progne chalybea	Sg,Fd,Fh	A	G	F	
Notiochelidon cyanoleuca	Sc,Sg	A	G	F(Ms?)	
Stelgidopteryx ruficollis	Sg,Sm	A	G	F	
CORVIDAE (1)					
Cyanocorax mystacalis	Fd,Sc	C,T	G	F	t
TROGLODYTIDAE (4)					
Campylorhynchus fasciatus	Fd,Sc	C,M	S,G	F	t
Thryothorus superciliaris	Fd,Sc	U	S,M	C	t
T. paucimaculatus	Fd,Fh	U,M	S,M	C	t
Troglodytes aedon	Sg,Sc	U	S	F	t
MIMIDAE (1)					
Mimus longicaudatus	Sc,Sg	C,T	S	F	
TURDIDAE (2)					
Turdus maculirostris	Fh,Fd	T,C	S	C	t
T. reevei	Fd,Fh	C	S,G	F	t

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous forest
Fe	Forest edges
Fsm	Forest stream margins
Sc	Desert-scrub
Sg	Second growth
Sm	Stream margins
A	Aerial
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(M)	Migrant
(Mn)	Migrant from north
(Ms)	Migrant from south
(V)	Vagrant
Evidence	
t	Tape

APPENDIX 4

	Habitats	Foraging	Sociality	Abundunce	Evidence
SYLVIIDAE (2)					
Ramphocaenus melanurus	Fh	M	S	U	
Polioptila plumbea	Fd,Fh,Sc	C	S,M	C	t
VIREONIDAE (3)					
Cyclarhis gujanensis	Fd	C	S,M	U	t
Vireo olivaceus	Fh,Fd	C	S,M	C	t
Hylophilus minor	Fh	M,C	M	F	t
EMBERIZIDAE					
PARULINAE (4)					
Parula pitiayumi	Fd,Fh	C	M	F	t
Seiurus noveboracensis	Sm	T	S	R(Mn)	
Setophaga ruticilla	Fh	M,C	S,M	R(Mn)	
Basileuterus fraseri	Fd,Fh	U,M	S,M	C	t
COEREBINAE (1)					
Coereba flaveola	Fd,Fh,Sc	C	S	F	
THRAUPINAE (5)					
Euphonia laniirostris	Fd,Fh	C	S,M	C	t
Thraupis episcopus	Fd,Fh	C	S,M	C	t
Piranga rubra	Fh	C	M,S	R(Mn)	
Tachyphonus luctuosus	Fh	C,M	M	U	t
Hemithraupis guira	Fh	C	M	F	t
CARDINALINAE (3)					
Saltator albicollis	Fd,Sc	M	S,M	U	
S. maximus	Fh	M,C	S,M	F	t
Pheucticus chrysogaster	Fd,Sc	C	S,M	U	
ICTERINAE (6)					
Sturnella bellicosa	Sc	T,U	S,G	U	
Dives warszewiczi	Sg,Sc	T,C	S,G	C	t
Molothrus bonariensis	Sg,Sc	T,C	S,G	U	
Cacicus cela	Fd,Fh	C	S,G,M	F	t
Icterus graceannae	Fd,Sc	C	S	X	
I. mesomelas	Fd,Fh	C	S	F	t
EMBERIZINAE (7)					
Volatinia jacarina	Sg,Sc	T,U	S,G	F	
Sporophila americana	Sg,Sc,Fd	T,U	S,G,M	C	

APPENDIX 4

	Habitats	Foraging	Sociality	Abundunce	Evidence
S. peruviana	Sc	T,U	G,M	?	
S. telasco	Sg,Sc	T,U	G,M	F	
Sicalis flaveola	Sc,Sg,Fd	T,U	S,G	U	
Rhodospingus cruentus	Fd,Fh	U,C	G,M	C	
Arremon abeillei	Fd,Fh	T,U	S,M	F	
CARDUELINAE (1)					
Carduelis siemiradzkii	Fd,Sc	U,C	G	U	t

Habitats	
Fh	Mature evergreen forest
Fd	Deciduous forest
Fe	Forest edges
Fsm	Forest stream margins
Sc	Desert-scrub
Sg	Second growth
Sm	Stream margins
A	Aerial
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded
(M)	Migrant
(Mn)	Migrant from north
(Ms)	Migrant from south
(V)	Vagrant
Evidence	
t	Tape

APPENDIX 5

Preliminary List of the Birds of Jauneche

T. A. Parker, III

	Habitats	Foraging	Sociality	Abundunce	Evidence
TINAMIDAE (3)					
Tinamus major	Fh	T	S	E	
Crypturellus soui	Fh	T	S	F	t
C. transfasciatus	Fe	T	S	U	t
ARDEIDAE (7)					
Ardea cocoi	Sm,M	W	S	U	
Egretta alba	Sm,M	W	S	U	
E. thula	Sm,M	W	S	U	
Butorides striatus	Sm,M	W	S	F	t
Bubulcus ibis	Sg,M	T	G	F	
Nycticorax nycticorax	Sm,M	W	S	U	
Tigrisoma lineatum	Sm	W	S	F	
CATHARTIDAE (2)					
Coragyps atratus	Sg,Fe	T	S,G	C	t
Cathartes aura	Sg,Fh	T	S	C	
ACCIPITRIDAE (8)					
Elanoides forficatus	Fh	A,C	S,G	F	t
Harpagus bidentatus	Fh	M,C	S	R?	
Geranospiza caerulescens	Fh,Sm	T,C	S	R	
Leucopternis occidentalis	Fh	T,C	S	R	
L. plumbea	Fh,Sm	T	S	R	t
Buteogallus urubitinga	Fe,Sm	T,U	S	R	
Buteo magnirostris	Fe	T,C	S	U	
Spizaetus tyrannus	Fh	M,C	S	R	
FALCONIDAE (4)					
Herpetotheres cachinnans	Fh,Sg	T,C	S	U	t
Micrastur ruficollis	Fh	U,M	S	U	t
Polyborus plancus	Sg	T	S	U	
Falco rufigularis	Fh,Fe	A	S	R	t
CRACIDAE (2)					
Ortalis erythroptera	Fh,Sg	T,C	G	R	t
Penelope purpurascens	Fh	T,C	S	E	t
PHASIANIDAE (1)					
Odontophorus erythrops	Fh	T	G	E	

APPENDIX 5

	Habitats	Foraging	Sociality	Abundunce	Evidence
RALLIDAE (2)					
Pardirallus maculatus	M	T	S	R	
Laterallus albigularis	M	T	S	F	t
COLUMBIDAE (7)					
Columba cayennensis	Fe,Sg	C	S,G	U	t
C. subvinacea	Fh	C	S	R?	t
Columbina buckleyi	Sg,Fe	T	S,G	F	t
Claravis pretiosa	Fh,Sg	T,C	S,G	C	t
Leptotila verreauxi	Sg,Fe	T	S	F	t
L. pallida	Fe,Fh	T	S	C	t
Geotrygon montana	Fh	T	S	F	t?
PSITTACIDAE (5)					
Ara ambigua	Fh	C	S,G	E	
Aratinga erythrogenys	Fe,Sg	C	G	U	t
Forpus coelestis	Sg	U,C	G	U	t
Pionus chalcopterus	Fh,Sg	C	S,G	U	t
Amazona autumnalis	Fh,Sg	C	S,G	R	t
A. farinosa	Fh	C	S,G	R	t
CUCULIDAE (6)					
Piaya cayana	Fh	C	S,M	U	t
P. minuta	M,Sm	U	S	U	t
Crotophaga major	Sm	U,M	G	U	
C. ani	Sg,M	T,U	G	F	t
C. sulcirostris	Sg,M	T,U	G	C	t
Tapera naevia	Sg	T,U	S	U	t
TYTONIDAE (1)					
Tyto alba	Sg	T	S	U?	
STRIGIDAE (5)					
Otus roboratus	Sg,Fh	M,C	S	C	t
Pulsatrix perspicillata	Fh	M,T	S	F	t
Glaucidium (brasilianum)	Sg,Fh	U,C	S	F	t
Ciccaba nigrolineata	Fh	M,C	S	F	t
C. virgata?	Fh	M,C	S	R	t?
NYCTIBIIDAE (1)					
Nyctibius griseus	Fe	C,A	S	R?	

Habitats	
Fh	Mature evergreen forest
Fe	Forest edges
B	Bamboo thickets
Sg	Second growth
M	Marsh
Rm	River margins
Sm	Stream margins
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
E	Extinct
(V)	Vagrant
Evidence	
t	Tape

APPENDIX 5

	Habitats	Foraging	Sociality	Abundunce	Evidence
CAPRIMULGIDAE (1)					
Nyctidromus albicollis	Fe,Fh	A	S	C	t
APODIDAE (3)					
Streptoprocne zonaris	Fh,Sg	A	G	F(V)	
Chaetura cinereiventris	Fh	A	G	U	
Panyptila cayennensis	Fh	A	S	F	t
TROCHILIDAE (6)					
Phaethornis superciliosus	Fh	U	S	C	t
P. longuemareus	Fh	U	S	U	t
Thalurania colombica	Fh	U,C	S	F	
Damophila julie	Fh	M,C	S	U	
Amazilia amazilia	Fh	C	S	U	
A. tzacatl	Fh	U,C	S	F	t
TROGONIDAE (2)					
Trogon melanurus	Fh	M,C	S	F	t
T. violaceus	Fh	C	S	U	t
ALCEDINIDAE (2)					
Ceryle torquata	Sm	W	S	U	t
Chloroceryle americana	Sm	W	S	F	
MOMOTIDAE (1)					
Momotus momota	Fh	U,C	S	C	t
BUCCONIDAE (2)					
Notharchus tectus	Fh	C	S	U	t
Malacoptila panamensis	Fh	U	S	F	t
CAPITONIDAE (1)					
Capito squamatus	Fh	C	S,M	F	t
RAMPHASTIDAE (1)					
Pteroglossus erythropygius	Fh	C	G	U	t
PICIDAE (7)					
Picumnus olivaceus	Fh	M,C	M,S	F	t
Piculus rubiginosus	Fh	M,C	S,M	F	t
Dryocopus lineatus	Fh	C	S	U	t
Melanerpes pucherani	Fh,Fe	C	S,M	F	t
Veniliornis kirkii	Fh	C	S,M	C	t
V. callonotus	Fh,Sg	M,C	S,M	F	t

APPENDIX 5

	Habitats	Foraging	Sociality	Abundunce	Evidence
Campephilus gayaquilensis	Fh	M,C	S	R	
DENDROCOLAPTIDAE (4)					
Dendrocincla fuliginosa	Fh	U,M	S,M	C	t
Sittasomus griseicapillus	Fh	M	S,M	C	t
Lepidocolaptes souleyetii	Fh,Sg	M,C	S,M	C	t
Campyloramphus trochilirostris	Fh	M	S,M	F	t
FURNARIIDAE (5)					
Furnarius cinnamomeus	Sm,Sg	T	S	F	t
Synallaxis brachyura	Sg,M	T,M	S,M	F	t
Automolus ochrolaemus	Fh	U,M	S,M	F	t
Xenops rutilans	Fh	M,C	M,S	U	t
X. minutus	Fh	U,M	M	R?	
FORMICARIIDAE (6)					
Taraba major	Fe,Sg	U,M	S,M	F	t
Thamnophilus atrinucha	Fh	U,M	S,M	F	t
Dysithamnus mentalis	Fh	U,M	S,M	C	t
Herpsilochmus rufimarginatus	Fh	C	M	R	t
Cercomacra nigricans	Fh,Fe	M	S	C	t
Pyriglena pacifica	Fe	U	S	U	
PIPRIDAE (2)					
Schiffornis turdinus	Fh	U	S	R	
Manacus manacus	Fh,Fe	U	S	C	t
TYRANNIDAE (31)					
Phyllomyias griseiceps	Fh,Sg	C	S	U	t
Ornithion brunneicapillum	Fh	C	S,M	R	t?
Camptostoma obsoletum	Sg,Fe,Fh	C	S,M	C	t
Tyrannulus elatus	Fh,Fe	C	S	C	t
Myiopagis subplacens	Fh	M,C	S,M	U	t
M. viridicata	Fh	U,C	M	F?	t
Elaenia flavogaster	Sg	C	S	F	t
Euscarthmus meloryphus	Sg,Fe	U	S,M	U	t
Mionectes oleagineus	Fh	U,C	S,M	U	t
Leptopogon superciliaris	Fh	M	M	U	t?
Capsiempis flaveola	Fe,B	C	S	F	t
Lophotriccus pileatus	Fh	M,C	S,M	C	t

Habitats	
Fh	Mature evergreen forest
Fe	Forest edges
B	Bamboo thickets
Sg	Second growth
M	Marsh
Rm	River margins
Sm	Stream margins
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
E	Extinct
(V)	Vagrant
Evidence	
t	Tape

APPENDIX 5

	Habitats	Foraging	Sociality	Abundunce	Evidence
Todirostrum cinereum	Sg,Fe	M,C	S,M	U	t
Cnipodectes subbrunneus	Fh	U,M	S	R	
Tolmomyias sulphurescens	Fh	C	M	U	t
Platyrinchus mystaceus	Fh	U	S	F	t
Onychorhynchus occidentalis	Fh	M	S	F	t
Myiobius atricaudus	Fh	M	M	R	
Myiophobus fasciatus	Fe,Sg	U,M	S	F	t
Lathrotriccus griseipectus	Fh	U,M	S,M	F	t
Pyrocephalus rubinus	Sg	C,A	S	F	
Fluvicola atripennis	Rm,Sg	T	S	U	
Myiarchus tuberculifer	Fh	C	S,M	F	t
Megarynchus pitangua	Fh	C	S	C	t
Myiozetetes similis	Fe,Sg	C	S	F	t
Myiodynastes maculatus	Fh	C	S,M	C	t
Tyrannus melancholicus	Fe,Sg	C,A	S	F	
T. niveigularis	Sg,Fe	C,A	S	U	
Pachyramphus albogriseus	Fh	C	M	U	
P. homochrous	Fh	C	S,M	F	t
Tityra semifasciata	Fh	C	S	U	t
HIRUNDINIDAE (2)					
Progne chalybea	Sg,Fh	A	G	F	
Stelgidopteryx ruficollis	Rm,Sg	A	G	C	t
TROGLODYTIDAE (4)					
Campylorhynchus (zonatus)	Sg,Fe	C	S,G	F	t
Thryothorus mystacalis	Fe,B	U,M	S,M	F	t
Thryothorus paucimaculatus	Fh	U,M	S,M	C	t
Troglodytes aedon	Sg	U	S	F	t
TURDIDAE (2)					
Turdus maculirostris	Fh	T,C	S	C	t
T. reevei	Fh	C	S,G	U	t
SYLVIIDAE (2)					
Ramphocaenus melanurus	Fh	M	S,M	U	t
Polioptila plumbea	Sg,Fh	C	S,M	F	t
VIREONIDAE (3)					
Cyclarhis gujanensis	Fh,Fe	C	S,M	U	t

APPENDIX 5

	Habitats	Foraging	Sociality	Abundunce	Evidence
Vireo olivaceus	Fh,Fe	C	S,M	F	t
Hylophilus minor	Fh	M,C	M	C	t
EMBERIZIDAE					
PARULINAE (3)					
Parula pitiayumi	Fh	C	S,M	C	t
Geothlypis aequinoctialis	Sg,M	U	S,M	U	
Basileuterus fraseri	Fh	U,M	S,M	C	t
COEREBINAE (1)					
Coereba flaveola	Fh,Sg	C	S	C	t
THRAUPINAE (10)					
Dacnis lineata	Fh	C	M	F	t
Chlorophanes spiza	Fh	C	M	U	
Tangara cyanicollis	Fh	C	S,M	F	t
Euphonia laniirostris	Fh,Sg	C	S,M	C	t
Euphonia sp.	Fh	U,C	S,M	U	t
Thraupis palmarum	Fh	C	S,M	F	t
T. episcopus	Fh,Sg	C	S,M	C	t
Ramphocelus icteronotus	Sg,Fe	U,C	G,M	U	t
Tachyphonus luctuosus	Fh	M,C	M	C	t
Hemithraupis guira	Fh	C	M	F	t
ICTERINAE (5)					
Sturnella bellicosa	Sg	T,U	S,G	U	
Dives warszewiczi	Sg,Fe	T,C	S,G	C	t
Molothrus bonariensis	Sg	T,C	S,G	U	t
Cacicus cela	Fh,Sg	C	S,G,M	U	t
Amblycercus holosericeus	Fh,B	U	S,M	R	
CARDINALINAE (3)					
Saltator maximus	Fh,Fe	C,M	S,M	C	t
Pitylus grossus	Fh	C,M	S	U	t
Cyanocompsa cyanoides	Fh,Fe	U,M	S	U	t
EMBERIZINAE (5)					
Volatinia jacarina	Sg	T,U	S,G	U	
Sporophila americana	Sg	T,U	S,G,M	F	
Arremon aurantiirostris	Fh	T	S,M	C	t
A. abeillei	Fh	T	S,M	R	
Rhodospingus cruentus	Fh,Sg	T	S,G,M	F	

Habitats	
Fh	Mature evergreen forest
Fe	Forest edges
B	Bamboo thickets
Sg	Second growth
M	Marsh
Rm	River margins
Sm	Stream margins
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
E	Extinct
(V)	Vagrant
Evidence	
t	Tape

APPENDIX 6

Preliminary List of the Birds of Manta Real

T. A. Parker, III

	Habitats	Foraging	Sociality	Abundunce	Evidence
TINAMIDAE (2)					
Tinamus major	Fh	T	S	R	
Crypturellus soui	Fh	T	S	F	t
CATHARTIDAE (2)					
Coragyps atratus	Sg,Fe	T	S,G	C	t
Cathartes aura	Sg,Fh	T	S	C	
ACCIPITRIDAE (5)					
Elanoides forficatus	Fh	A,C	S,G	F	t
Harpagus bidentatus	Fh	M,C	S	R?	
Buteo magnirostris	Fe	T,C	S	U	
Leucopternis occidentalis	Fh	T,C	S	U	
Spizaetus tyrannus	Fh	T,C	S	R	
FALCONIDAE (4)					
Herpetotheres cachinnans	Fe,Sg	T,C	S	F	t
Micrastur ruficollis	Fh	U,M	S	F	t
Polyborus plancus	Sg	T	S	U	
Falco rufigularis	Fh,Fe	A	S	R	t
CRACIDAE (1)					
Ortalis erythroptera	Fe,Sg	T,C	G	U	t
Penelope sp.	Fh	T,C	S	U	t
PHASIANIDAE (1)					
Odontophorus erythrops	Fh	T	G	F	
COLUMBIDAE (7)					
Columba cayennensis	Fe,Sg	C	S,G	F	t
C. subvinacea	Fh	C	S	U?	
C. plumbea	Fh	C	S	F	t
Columbina buckleyi	Sg,Fe	T	S,G	F	t
Claravis pretiosa	Fh,Sg	T,C	S,G	U	
Leptotila pallida	Fe,Fh	T	S	C	t
Geotrygon montana	Fh	T	S	F	t?
PSITTACIDAE (5)					
Ara severa	Sg	C	S,G	U	
Pyrrhura orcesi	Fm	C	G	R	
Forpus coelestis	Sg	U,C	G	F	
Brotogeris pyrrhopterus	Sg,Fe	C	G	C	t

APPENDIX 6

	Habitats	Foraging	Sociality	Abundunce	Evidence
Pionus chalcopterus	Fh,Sg	C	S,G	F	t
CUCULIDAE (3)					
Piaya cayana	Fh,Sg	C	S,M	U	t
Crotophaga ani	Sg	T,U	G	F	t
Tapera naevia	Sg	T,U	S	U	t
STRIGIDAE (3)					
Pulsatrix perspicillata	Fh	T,M	S	F	
Glaucidium (brasilianum)	Sg,Fe	U,C	S	F	t
Ciccaba virgata	Fh	M,C	S	U	
NYCTIBIIDAE (1)					
Nyctibius griseus	Fe,Sg	C,A	S	R?	
CAPRIMULGIDAE (1)					
Nyctidromus albicollis	Fe	A	S	F	t
APODIDAE (2)					
Chaetura cinereiventris	Fh,Sg	A	S	U	
Panyptila cayennensis	Fh	A	S	F	
TROCHILIDAE (12)					
Threnetes ruckeri	Fh	U	S	U	
Phaethornis yaruqui	Fh	U	S	F	t
P. superciliosus	Fh	U	S	F	t
P. longuemareus	Fh	U	S	U	
Florisuga mellivora	Fh	C	S	U	
Thalurania colombica	Fh	U,C	S	F	
Damophila julie	Fh	M,C	S	U	
Amazilia sp.	Fh	C	S	R	
A. tzacatl	Fh	U,C	S	F	t
Heliodoxa jacula	Fm	U	S	F	
Heliothryx barroti	Fh	M,C	S	U	
Acestrura sp.	Fh	C	S	R	
TROGONIDAE (3)					
Pharomachrus auriceps	Fm	C	S	F	t
Trogon melanurus	Fh	M,C	S	F	t
T. collaris	Fh	M	S	F	t
MOMOTIDAE (3)					
Electron platyrhynchum	Fh	C	S	U	t

Habitats	
Fh	Mature evergreen forest
Fm	Montane evergreen forest
Fe	Forest edges
B	Bamboo thickets
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
Evidence	
t	Tape

APPENDIX 6

	Habitats	Foraging	Sociality	Abundunce	Evidence
Baryphthengus martii	Fh	M,C	S	R?	
Momotus momota	Fh	U,C	S	U?	
BUCCONIDAE (4)					
Notharchus tectus	Fh	C	S	U	
Nystalus radiatus	Fh,Fe	C	S	F	
Malacoptila panamensis	Fh	U	S	U	
Micromonacha lanceolata	Fh	C	S	R?	
RAMPHASTIDAE (4)					
Aulacorhynchus haematopygus	Fm	C	S,G	F	t
Pteroglossus erythropygius	Fh	C	G	F	t
Ramphastos brevis	Fh	C	S,G	C	t
R. swainsonii	Fh	C	S,G	U?	t
PICIDAE (7)					
Picumnus olivaceus	Fh,Sg	M,C	M,S	U	
Piculus rubiginosus	Fh,Sg	M,C	S,M	F	t
Celeus loricatus?	Fh	M,C	S,M	R	
Dryocopus lineatus	Fh	C	S	U	t
Melanerpes pucherani	Fh,Fe	C	S,M	F	t
Veniliornis callonotus	Sg	M,C	S,M	F	t
Campephilus gayaquilensis	Fh	M,C	S	F	
DENDROCOLAPTIDAE (6)					
Dendrocincla fuliginosa	Fh	U,M	S,M	C	t
Sittasomus griseicapillus	Fh	M	S,M	F	t
Glyphorynchus spirurus	Fh	U,M	S,M	C	t
Xiphorhynchus erythropygius	Fh	M,C	M,S	F	t
Lepidocolaptes souleyetii	Fh,Sg	M,C	S,M	F	t
Campyloramphus trochilirostris	Fh	M	S,M	U	t
FURNARIIDAE (10)					
Furnarius cinnamomeus	Sg	T	S	F	t
Synallaxis brachyura	Sg	T,M	S	F	t
Hyloctistes subulatus	Fh	M	M	F	t
Cranioleuca erythrops	Fh	C	M	U	
Syndactyla subalaris	Fh	U,M	M	U	t
Anabacerthia variegaticeps	Fm	M	M	F	t
Philydor fuscipennis	Fh	U,M	M	F	

APPENDIX 6

	Habitats	Foraging	Sociality	Abundunce	Evidence
Thripadectes sp. (*ignobilis*?)	Fm	U	M	R	
Xenops rutilans	Fh,Sg	M,C	M,S	U	t
X. minutus	Fh	U,M	M	R?	
FORMICARIIDAE (14)					
Taraba major	Fe,Sg	U,M	S,M	U	t
Thamnophilus atrinucha	Fh	U,M	S,M	U	t
T. unicolor	Fh	U	S	F	t
Thamnistes anabatinus	Fh	C	M	F	t
Myrmotherula fulviventris	Fh	U,M	M	F	t
M. schisticolor	Fh	U,M	M	C	t
Microrhopias quixensis	Fh	U,M	M	F	
Drymophila caudata	Fm,B	U,M	S	U	t
Terenura callinota	Fm	C	M	F	t
Myrmeciza nigricauda	Fh	U	S	U	t
M. exsul	Fh	U	S	C	t
M. immaculata	Fh	U,T	S	F	t
Formicarius nigricapillus	Fh	T	S	U?	
Grallaria guatimalensis	Fm	T	S	R?	
RHYNOCRYPTIDAE (1)					
Scytalopus sp.	Fm	T,U	S	R	
COTINGIDAE (2)					
Ampelioides tschudii	Fm	C	S	U	
Cephalopterus penduliger	Fm	C,M	S	R	
PIPRIDAE (3)					
Schiffornis turdinus	Fh	U	S	U	
Manacus manacus	Fh,Fe	U	S	C	t
Masius chrysopterus	Fm	U	S	F	
TYRANNIDAE (31)					
Phyllomyias griseiceps	Fe,Sg	C	S	F	t
Ornithion brunneicapillum	Fh	C	S,M	R	t?
Camptostoma obsoletum	Sg,Fe	C	S,M	C	t
Tyrannulus elatus	Fh	C	S	C	t
Myiopagis viridicata	Fh	M,C	M	U	t
Elaenia flavogaster	Sg	C	S	U	t
Mionectes sp.	Fh	M	S,M	U?	

Habitats	
Fh	Mature evergreen forest
Fm	Montane evergreen forest
Fe	Forest edges
B	Bamboo thickets
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
Evidence	
t	Tape

APPENDIX 6

	Habitats	Foraging	Sociality	Abundunce	Evidence
M. oleagineus	Fh	U,M	S,M	U	
Leptopogon superciliaris	Fh	M	M	F	t
Capsiempis flaveola	Fe,Sg	C	S	U	
Lophotriccus pileatus	Fh	U,C	S,M	C	t
Todirostrum cinereum	Sg,Fe	M,C	S,M	F	t
T. nigriceps	Fe,Sg	C	S	U	
Cnipodectes subbrunneus	Fh	U,M	S	R	
Tolmomyias sulphurescens	Fh,Sg	C	M	U	
Platyrinchus mystaceus	Fh	U	S	F	t
Onychorhynchus occidentalis	Fh	M	S	U	
Myiotriccus ornatus	Fh	U,M	S,M	C	t
Terenotriccus erythrurus	Fh,Sg	M	S,M	U	
Myiobius barbatus	Fh,Sg	M	M	C	
M. atricaudus	Sg	M	M	R	
Myiophobus fasciatus	Fe,Sg	U,M	S	F	t
Lathrotriccus griseipectus	Fh	M	S	U	
Pyrocephalus rubinus	Sg	C,A	S	F	
Attila torridus	Sg	C	S	R	
Myiarchus tuberculifer	Fh,Sg	C	S,M	F	t
Megarynchus pitangua	Fh,Sg	C	S	F	t
Myiodynastes chrysocephalus	Fm	C	S	U	
Myiozetetes similis	Fe,Sg	C	S	F	t
Tyrannus melancholicus	Fe,Sg	C,A	S	C	
Pachyramphus cinnamomeus	Fh,Fe	C	M	U	
P. albogriseus	Fh	C	M	U	
P. homochrous	Fh,Sg	C	S,M	C	t
Tityra semifasciata	Fh	C	S	U	t
HIRUNDINIDAE (1)					
Progne chalybea	Sg,Fh	A	G	F	t
TROGLODYTIDAE (7)					
Campylorhynchus sp.	Sg,Fe	C	S,G	F	t
Thryothorus mystacalis	Fh,B	U,M	S,M	F	
T. nigricapillus	Fe	U	S	C	t
Troglodytes aedon	Sg	U	S	F	t
Henicorhina leucophrys	Fm	U,T	S	C	t

APPENDIX 6

	Habitats	Foraging	Sociality	Abundunce	Evidence
Microcerculus marginatus	Fh	T,U	S	F	t
Cyphorhinus phaeocephalus	Fh	T,U	S	U	
TURDIDAE (5)					
Myadestes ralloides	Fm	M	S	U	t
Catharus dryas	Fm	T,U	S	F	t
Platycichla leucops	Fh	C	S	U?	
Turdus obsoletus	Fh	T,M	S	U	
T. maculirostris	Fh,Sg	T,C	S	C	t
SYLVIIDAE (2)					
Microbates cinereiventris	Fh	U	S,M	F	t
Polioptila plumbea	Sg,Fh	C	S,M	F	t
VIREONIDAE (5)					
Cyclarhis gujanensis	Fe,Sg	C	S,M	U	t
Vireolanius leucotis	Fh	C	M,S	F	t
Vireo olivaceus	Fh,Fe	C	S,M	U	t
V. leucophrys	Fh	C	M,S	F	t
Hylophilus minor	Fh	M,C	M	C	t
EMBERIZIDAE					
PARULINAE (5)					
Parula pitiayumi	Fh	C	M,S	C	t
Geothlypis aequinoctialis	Sg	U	S,M	U	
Myioborus miniatus	Fm	M,C	M	C	t
Basileuterus fraseri	Sg,Fh	U,M	?	U	
B. tristriatus	Fm	M	M,S	F	t
COEREBINAE (1)					
Coereba flaveola	Fh,Sg	C	S	C	t
THRAUPINAE (19)					
Cyanerpes caeruleus	Fh	C	M	U	
Chlorophanes spiza	Fh	C	M	F	
Dacnis lineata	Fh	C	M	F	t
Tersina viridis	Fe	C,A	S,G	U	
Euphonia xanthogaster	Fh,Sg	U,C	M,S	C	t
E. laniirostris	Sg,Fe	C	S,M	C	t
Tangara arthus	Fm	C	M,S	F	t
T. icterocephala	Fh	M,C	M,S	C	t

Habitats	
Fh	Mature evergreen forest
Fm	Montane evergreen forest
Fe	Forest edges
B	Bamboo thickets
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
Evidence	
t	Tape

APPENDIX 6

Habitats	
Fh	Mature evergreen forest
Fm	Montane evergreen forest
Fe	Forest edges
B	Bamboo thickets
Sg	Second growth
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
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Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
Evidence	
t	Tape

	Habitats	Foraging	Sociality	Abundunce	Evidence
T. cyanicollis	Fh	C	M,S	F	
T. gyrola	Fh	C	M	C	
Thraupis palmarum	Fh,Sg	C	S,M	C	t
T. episcopus	Sg	C	S,M	C	t
Ramphocelus icteronotus	Sg,Fe	U,C	G,M	F	t
Piranga leucoptera	Fm,Fe	C	S,M	F	t
Chlorothraupis stolzmanni	Fh	M,C	M,G	C	t
Tachyphonus luctuosus	Fh	M,C	M	C	t
Chlorospingus flavigularis	Fm	U,M	G,M	F	t
C. canigularis	Fm	C	M,G	C	t
Hemithraupis guira	Fh	C	M	F	
ICTERINAE (5)					
Cacicus cela	Fh,Sg	C	S,G,M	U	t
C. microrhynchus	Fh	C	G,M	F	t
Dives warszewiczi	Sg,Fe	T,C	S,G	C	t
Icterus mesomelas	Fe,Sg	C	S	F	t
Sturnella bellicosa	Sg	T,U	S,G	U	
CARDINALINAE (4)					
Saltator maximus	Fh,Fe	M,C	S,M	C	t
S. atripennis	Fh	C	M,S	U	
Pitylus grossus	Fh	M,C	S	U	t
Cyanocompsa cyanoides	Fh,Fe	U	S	U	t
EMBERIZINAE (6)					
Volatinia jacarina	Sg	T,U	S,G	U	
Sporophila americana	Sg	T,U	S,G,M	F	
Tiaris obscura	Sg	U	S,M	U	
Atlapetes tricolor	Fm	U	S	U	
A. brunneinucha	Fm	T,U	S	F	t
Arremon aurantiirostris	Fh	T,U	S,M	F	t

Preliminary List of the Birds of the Reserva Militar de Arenillas

APPENDIX 7

T. A. Parker, III

	Habitats	Foraging	Sociality	Abundunce	Evidence
TINAMIDAE (1)					
Crypturellus transfasciatus	Fd	T	S	F	
PELECANIDAE (1)					
Pelecanus occidentalis	Mg,O	W	S,G	F	
PHALACROCORACIDAE (1)					
Phalacrocorax olivaceus	Mg,O	W	S,G	C	
FREGATIDAE (1)					
Fregata magnificens	Mg,O	W,A	S	C	
ARDEIDAE (9)					
Ardea herodias	S	W,T	S	R	
A. cocoi	S	W,T	S	U	
Egretta alba	S	W,T	S,G	C	
E. thula	S	W,T	S,G	C	
Florida caerulea	S	W,T	S	U	
Hydranassa tricolor	S	W,T	S	U	
Butorides striatus	Mg,S	W,T	S	F	
Bubulcus ibis	P	T	G	F	
Nyctanassa violacea	Mg,S	T,W	S	F	
CICONIIDAE (1)					
Mycteria americana	S	W	G,S	U	
THRESKIORNITHIDAE (2)					
Eudocimus albus	S,Mg	T,W	G	F	
Platalea ajaja	S	W	G,S	U	
CATHARTIDAE (2)					
Coragyps atratus	Fd,Sc	T	S,G	C	
Cathartes aura	Fd,Sc	T	S	C	
ACCIPITRIDAE (5)					
Gampsonyx swainsonii	Sc	T	S	U	
Buteogallus subtilis	Mg	T	S	U	
B. meridionalis	P,Sc	T	S	U	
Parabuteo unicinctus	Sc,Fd	T	S	F	
Buteo polyosoma	Sc	T	S	U	
PANDIONIDAE (1)					
Pandion haliaetus	Mg	W	S	F	

Habitats	
Fd	Deciduous forest
Fe	Forest edges
Mg	Mangroves
Sc	Desert-scrub
Sg	Second growth
P	Pasture
M	Marsh
S	Shores
Sm	Stream margins
A	Aerial
O	Ocean
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
Evidence	
t	Tape

APPENDIX 7

	Habitats	Foraging	Sociality	Abundunce	Evidence
FALCONIDAE (4)					
Herpetotheres cachinnans	Fd	T,C	S	F	
Polyborus plancus	Sc,Fd	T	S	F	
Falco rufigularis	Fd	A	S	R	
F. sparverius	Sc	A	S	F	
CRACIDAE (1)					
Ortalis erythroptera	Fd	T,C	G	R	
RALLIDAE (4)					
Rallus longirostris	Mg	T	S	U	
Aramides axillaris	Mg	T	S	F	
Laterallus albigularis	M	T	S	F	
Gallinula chloropus	M,Mg	T	S,G	F	
JACANIDAE (1)					
Jacana jacana	M	T	S,G	F	
CHARADRIIDAE (2)					
Charadrius collaris	S	T	S	F	
C. wilsonia	S	T	S	F	
RECURVIROSTRIDAE (1)					
Himantopus mexicanus	S,M	T	S,G	F	
LARIDAE (3)					
Larus atricilla	S,O	T,W	S,G	F	
L. cirrocephalus	S,O	T,W	S,G	F	
Gelochelidon nilotica	S	T,W,A	S	U	
COLUMBIDAE (6)					
Columba cayennensis	Fd	C	S,G	R	
Zenaida asiatica	Sc,Fd	T,C	S,G	C	
Columbina buckleyi	Sc,Fd	T	S,G	F	
C. cruziana	Sc,Fd	T	S,G	C	
Claravis pretiosa	Fd	T,C	S,G	R	
Leptotila verreauxi	Fd	T	S	F	
PSITTACIDAE (4)					
Aratinga erythrogenys	Fd,Sc	C	G	U	
Forpus coelestis	Sc,Fd	U,C	G	C	
Brotogeris pyrrhopterus	Fd	C	S,G	F	
Pionus chalcopterus	Fd	C	S,G	U	

APPENDIX 7

	Habitats	Foraging	Sociality	Abundunce	Evidence
CUCULIDAE (2)					
Crotophaga sulcirostris	Sc	T,U	G	F	
Tapera naevia	Sc	T,U	S	U	
STRIGIDAE (2)					
Otus roboratus	Fd	M,C	S	U?	
Glaucidium (brasilianum)	Fd,Sc	U,C	S	C	
CAPRIMULGIDAE (1)					
Chordeiles acutipennis	Sc	A	S	F	
APODIDAE (2)					
Chaetura cinereiventris	Fd	A	S	U	
C. brachyura	Fd	A	S	F	
TROCHILIDAE (2)					
Amazilia amazilia	Fd,Sc	U,C	S	F	
Myrmia micrura	Sc	U,C	S	F	
TROGONIDAE (1)					
Trogon melanurus	Fd	M,C	S	U	
ALCEDINIDAE (2)					
Ceryle torquata	Mg,Sm	W	S	U	
Chloroceryle americana	Sm	W	S	U	
MOMOTIDAE (1)					
Momotus momota	Fd	U,C	S	U	
PICIDAE (5)					
Picumnus sclateri	Fd,Sc	M,C	M,S	F	
Piculus rubiginosus	Fd	M,C	S,M	F	
Dryocopus lineatus	Fd,Mg	M,C	S	U	
Veniliornis callonotus	Fd,Mg	M,C	S,M	C	
Campephilus gayaquilensis	Fd	U,C	S	R	
DENDROCOLAPTIDAE (1)					
Lepidocolaptes souleyetii	Fd,Sc	M,C	S,M	C	
FURNARIIDAE (3)					
Furnarius cinnamomeus	Sg,Sc	T	S	F	
Synallaxis tithys	Fd	T,U	S	F	
S. stictothorax	Sc,Fd	T,U	S	C	
RHINOCRYPTIDAE (1)					
Melanopareia elegans	Fd,Sc	T,U	S	F	

Habitats	
Fd	Deciduous forest
Fe	Forest edges
Mg	Mangroves
Sc	Desert-scrub
Sg	Second growth
P	Pasture
M	Marsh
S	Shores
Sm	Stream margins
A	Aerial
O	Ocean
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
Evidence	
t	Tape

APPENDIX 7

	Habitats	Foraging	Sociality	Abundunce	Evidence
FORMICARIIDAE (2)					
Sakesphorus bernardi	Sc,Fd	U,C	S,M	C	
Grallaria watkinsi	Fd	T	S	U	
TYRANNIDAE (18)					
Phaeomyias murina	Sc,Fd	C	S	U	
Camptostoma obsoletum	Fd,Sc,Mg	C	S,M	C	
Myiopagis subplacens	Fd	U,C	S,M	U	
Elaenia flavogaster	Sg	C	S	U	
Euscarthmus meloryphus	Sc,Fe	U	S,M	C	
Todirostrum cinereum	Fd	M,C	S,M	F	
Tolmomyias sulphurescens	Fd	C	M	U	
Myiophobus fasciatus	Fd,Sc	U,M	S	F	
Contopus cinereus	Fd	U,M	S,M	U	
Pyrocephalus rubinus	Sg,Sc	C,A	S	F	
Fluvicola atripennis	Mg,Sm,M	T	S	F	
Muscigralla brevicauda	Sc	T	S	F	
Myiarchus phaeocephalus	Fd,Sc	C,M	S,M	U	
Megarynchus pitangua	Fd	C	S	U	
Myiozetetes similis	Fd,Sg	C	S	U	
Myiodynastes bairdii	Fd,Sc	C	S,M	F	
Tyrannus melancholicus	Sg	C,A	S	U	
T. niveigularis	Fd,Sc	C,A	S	U	
HIRUNDINIDAE (2)					
Progne chalybea	Sg,Fd	A	G	F	
Stelgidopteryx ruficollis	Sg,Sm	A	G	F	
CORVIDAE (1)					
Cyanocorax mystacalis	Fd	C,T	G	F	
TROGLODYTIDAE (4)					
Campylorhynchus fasciatus	Fd,Sc	C,M	S	F	
Thryothorus superciliaris	Fd,Sc,Mg	U,M	S	C	
T. paucimaculatus	Fd	U,M	S,M	U	
Troglodytes aedon	Sg,Sc	U	S	F	
MIMIDAE (1)					
Mimus longicaudatus	Sc,Sg	C,T	S	F	

APPENDIX 7

	Habitats	Foraging	Sociality	Abundunce	Evidence
TURDIDAE (2)					
Turdus maculirostris	Fd	T,C	S	R	
T. reevei	Fd	C	S,G	U	
SYLVIIDAE (1)					
Polioptila plumbea	Fd,Sc	C	S,M	F	
VIREONIDAE (1)					
Cyclarhis gujanensis	Fd,Mg	C	S,M	U	
EMBERIZIDAE					
PARULINAE (1)					
Basileuterus fraseri	Fd	U,M	S,M	R	
COEREBINAE (1)					
Coereba flaveola	Fd,Sc	C	S	U	
THRAUPINAE (2)					
Euphonia laniirostris	Fd	C	S,M	U	
Thraupis episcopus	Fd	C	S,M	F	
ICTERINAE (6)					
Sturnella bellicosa	Sc,P	T,U	S,G	F	
Dives warszewiczi	Sc,Sg	T,C	S,G	C	
Molothrus bonariensis	Sg	T,C	S,G	U	
Cacicus cela	Fd	C	S,G,M	U	
Icterus graceannae	Fd,Sc	C	S	F	
I. mesomelas	Fd	C	S	U	
EMBERIZINAE (8)					
Volatinia jacarina	Sg,Sc	T,U	S,G	U	
Sporophila americana	Sg,Sc,Fd	T,U	S,G,M	F	
S. peruviana	Sc	T,U	G,M	C	
S. telasco	Sg,Sc	T,U	G,M	F	
Sicalis flaveola	Sc,Sg,Fd	T	S,G	F	
Rhodospingus cruentus	Fd	U,C	G,M	C	
Phrygilus plebejus	Sc,Fd	T	S,G	F	
Arremon abeillei	Fd	T	S,M	F	

Habitats	
Fd	Deciduous forest
Fe	Forest edges
Mg	Mangroves
Sc	Desert-scrub
Sg	Second growth
P	Pasture
M	Marsh
S	Shores
Sm	Stream margins
A	Aerial
O	Ocean
Foraging Position	
T	Terrestrial
U	Undergrowth
M	Middlestory
C	Canopy
A	Aerial
W	Water
Sociality	
S	Solitary or in pairs
G	Gregarious
M	Mixed-species flocks
Abundance	
C	Common
F	Fairly common
U	Uncommon
R	Rare
Evidence	
t	Tape

APPENDIX 8

Birds of Six Forests in Western Ecuador

T. A. Parker, III

	CEB	MAC	CAC	CAB	CMU	RPS
TINAMIDAE						
Tinamus major				U	F	X
Crypturellus berlepschi +						X
C. soui		F		F	C	X
C. transfaciatus *	F	F				
CATHARTIDAE						
Sarcoramphus papa	U	U	X	F		
Coragyps atratus	C	F	X	U	C	X
Cathartes aura	C	C	X	U	F	X
ACCIPITRIDAE						
Elanoides forficatus	F	U	X	U	U	X
Leptodon cayanensis		R				X
Harpagus bidentatus	R			U?		X
Ictinia plumbea	F	R		F	F	X
Accipiter bicolor	U					
Buteo magnirostris	F			F	F	X
B. brachyurus	U	R			X	X
B. polyosoma	U					
B. albonotatus	R					
Leucopternis occidentalis *	U	U	X	U	X	X
L. semiplumbea						X
L. plumbea +	?			R?		X
Asturina nitida	F?					
Parabuteo unicinctus	F	U				
Buteogallus urubitinga	F	R		U	X	X
B. meridionalis	U					
Spizaetus ornatus		R				X
S. tyrannus	R	R				X
Geranospiza caerulescens	F	U				X
PANDIONIDAE						
Pandion haliaetus		U			X	X
FALCONIDAE						
Herpetotheres cachinnans	F	U		F	X	X
Micrastur semitorquatus	R					X
M. ruficollis	U	F		U	F	X

APPENDIX 8

	CEB	MAC	CAC	CAB	CMU	RPS
Polyborus plancus	F	F				X
Falco rufigularis	U	R				X
F. peregrinus		R				
F. sparverius	U	U				X
CRACIDAE						
Ortalis erythroptera *	U	F	F	U	F	X
Penelope purpurascens	E?	R		?		E?
Crax rubra	E?			X		
PHASIANIDAE						
Odontophorus erythrops		R		U		X
Rhynchortyx cinctus				?		
RALLIDAE						
Amaurolimnas concolor						X
Aramides wolfi +						X
COLUMBIDAE						
Columba speciosa		U		U		X
C. cayennensis	F	U			F	X
C. subvinacea		C	X	U?	F	X
C. goodsoni +				C	U	X
Zenaida auriculata		F				
Z. asiatica	U	F				
Columbina buckleyi *	C	F/C			C	X
C. cruziana	U	C				
Claravis pretiosa	U	U			F	X
Leptotila ochraceiventris *	R	R				
L. verreauxi	C	C	F			
L. pallida				C	C	X
Geotrygon montana				F	X	
PSITTACIDAE						
Ara ambigua	R	R				
A. severa						X
Aratinga erythrogenys *	F	F	X		F	X
Forpus coelestis *	C	C				X
Brotogeris pyrrhopterus *	F					
Pionopsitta pulchra +				C		X

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F	Fairly common
U	Uncommon
R	Rare
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CMU Cerro Mutiles (Reserva "Jardín Tropical"); evergreen (moist) forest on ridge SE of Esmeraldas (E of Río Esmeraldas)

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	CEB	MAC	CAC	CAB	CMU	RPS
Pionus menstruus				C	F	X
P. chalcopterus	U	U		F	U	X
Amazona autumnalis	U			R?		X
A. farinosa				C	U	X
CUCULIDAE						
Piaya cayana	U	U	X	U	F	X
P. minuta				R		
Crotophaga ani				F	X	X
C. sulcirostris	C	C				X
Tapera naevia	U	U				
TYTONIDAE						
Tyto alba	U	U				X
STRIGIDAE						
Otus roboratus *		C				
Lophostrix cristata				F		X
Pulsatrix perspicillata	F	U		U	F	X
Glaucidium (brasilianum) *	C	C				
Speotyto cunicularia		U				
Ciccaba nigrolineata		F				X
C. virgata				U	X	
NYCTIBIIDAE						
Nyctibius griseus		F		R?	F	X
CAPRIMULGIDAE						
Lurocalis semitorquatus		U		U		
Nyctidromus albicollis	C	F			C	X
Chordeiles acutipennis	U					
APODIDAE						
Streptoprocne zonaris	F	U/R				X
Chaetura cinereiventris *	U	C	X	F	F	X
C. brachyura	U	U				
Panyptila cayennensis					X	X
TROCHILIDAE						
Glaucis aenea				U		X
Threnetes ruckeri				F	X	X
Phaethornis yaruqui				C	X	

APPENDIX 8

	CEB	MAC	CAC	CAB	CMU	RPS
P. superciliosus *	U	C	X	X	F	X
P. longuemareus	?			F	X	X
Eutoxeres aquila				U		X
Florisuga mellivora				F	X	X
Anthracothorax prevostii					X	
Popelairia conversii				X		X
Thalurania colombica +		F	X	F	F	X
Damophila julie		U		X	X	X
Hylocharis grayi					X	
Amazilia amabilis					X	X
A. tzacatl		C	X	U	F	X
A. amazilia	C	F				
Chalybura buffoni				X		
Adelomyia melanogenys		C	X			
Heliodoxa jacula +				F?		
Heliothryx barroti				U		X
Heliomaster longirostris	U	U				X
Acestrura bombus *		U	X			X
Myrmia micrura	U					
TROGONIDAE						
Trogon melanurus *	U	F		U	C	X
T. comptus				?		
T. viridis				C	F	X
T. collaris		U		C		X
T. rufus				U		
T. violaceus	R	F			C	X
MOMOTIDAE						
Electron platyrhynchum						X
Baryphthengus martii				F	X	
Momotus momota *	U	C			X	X
GALBULIDAE						
Galbula ruficauda					U	X
BUCCONIDAE						
Notharchus macrorhynchos				F		X
N. tectus					F	X

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Nystalus radiatus				F	U	X
Malacoptila panamensis		R		U	F	X
Micromonacha lanceolata				R?		
CAPITONIDAE						
Capito squamatus *				F		X
Eubucco bourcierii		U				X
RAMPHASTIDAE						
Aulacorhynchus haematopygus		U				X
Pteroglossus erythropygius *		U		F	U	X
Ramphastos brevis +				C	F	X
R. swainsonii		U		C	F	X
PICIDAE						
Picumnus olivaceus		F	X		X	X
P. sclateri *	C	U?				
Piculus rubiginosus	F	C	X	F	F	X
P. leucolaemus				F		X
Celeus loricatus				F	F	X
Dryocopus lineatus	U	U		U	F	X
Melanerpes pucherani	X	F		F	F	X
Veniliornis kirkii	X	F	X	F	F	X
V. callonotus *	C	F	X		U	X
Campephilus gayaquilensis *	U	U		F	U	X
DENDROCOLAPTIDAE						
Dendrocincla fuliginosa		U		C	C	X
Sittasomus griseicapillus *	F	F	X		C	X
Glyphorynchus spirurus		R		F		X
Dendrocolaptes certhia				U		
Xiphorhynchus lacrymosus				C	C	
X. erythropygius		F	X	C		X
Lepidocolaptes souleyetii	C	C			C	X
Campylorhamphus trochilirostris *	F	F	F	X	X	
FURNARIIDAE						
Furnarius cinnamomeus *	F	C	X		F	X
Synallaxis brachyura		F	F	F	F	X
S. tithys *	U	U				

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	CEB	MAC	CAC	CAB	CMU	RPS
S. stictothorax *		F				
Cranioleuca erythrops		F	F			
Hyloctistes subulatus				F		X
Philydor fuscipennis						X
Anabacerthia variegaticeps		R				
Automolus rubiginosus						X
A. ochrolaemus				X	C	X
Hylocryptus erythrocephalus *		R				
Xenops rutilans *	F	C	X			X
X. minutus		R?		C	C	X
Sclerurus mexicanus						X
S. guatimalensis					U	X
FORMICARIIDAE						
Cymbilaimus lineatus				F	U	X
Taraba major *	U	F	F	U	F	X
Sakesphorus bernardi *	C	C				
Thamnophilus atrinucha		U		C	C	X
Thamnistes anabatinus				C		
Dysithamnus mentalis *	C	C	F		F	X
D. puncticeps				C		
Myrmotherula surinamensis				U	X	X
M. fulviventris				F	F	X
M. axillaris				C	C	X
M. schisticolor		U	U	R		X
Herpsilochmus rufimarginatus		?			C	X
Microrhopias quixensis				C	C	X
Cercomacra tyrannina				U	F	X
C. nigricans					F	
Sipia nigricauda +				F	U	
Pyriglena pacifica *	R	F	X			X
Myrmeciza exsul				C	F	X
M. immaculata				U	X	X
Hylophylax naevioides				U	F	X
Formicarius nigricaplllus		F	X	U?	F	X
Pittasoma rufopileatum						X

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	CEB	MAC	CAC	CAB	CMU	RPS
Grallaria guatimalensis		R				
G. watkinsi *		F				
Hylopezus perspicillata						X
RHINOCRYPTIDAE						
Melanopareia elegans *	F	C				
TYRANNIDAE						
Phyllomyias griseiceps *		C		F	F	X
Zimmerius viridiflavus		F	X	C	U	X
Camptostoma obsoletum	C	C	X	F	F	X
Phaeomyias murina *	U	U?				
Ornithion brunneicapillum				F		
Tyrannulus elatus				F		
Myiopagis caniceps				U	U	X
M. subplacens *	C	C	X			?
M. viridicata					C	X
Elaenia flavogaster *	F	F		U	F	X
Mecocerculus calopterus *		R				
Euscarthmus meloryphus *	C	C				
Mionectes olivaceus				U		X
M. oleagineus		U			F	X
Leptopogon superciliaris		R			R	X
Capsiempis flaveola *		F				X
Myiornis ecaudatus				F	U	
Lophotriccus pileatus	F	C		U	C	X
Todirostrum nigriceps						X
T. cinereum *	F	U			U	X
Rhynchocyclus brevirostris				X		X
Tolmomyias sulphurescens *	U	U				
Platyrinchus mystaceus *		F			F	?
P. coronatus				U	?	?
Onychorhynchus occidentalis *		R				
Terenotriccus erythrurus					F	X
Myiobius barbatus					U	X
M. atricaudus *		R				X
Myiophobus fasciatus *	C	F	X	F	F	X

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	CEB	MAC	CAC	CAB	CMU	RPS
Contopus borealis				R		
C. fumigatus		F				
C. (sordidulus)		R				
C. cinereus	U	U				X
Empidonax virescens		U		F	C	X
Lathrotriccus griseipectus *	R?	F				?
Pyrocephalus rubinus	F	F			F	X
Fluvicola atripennis *	F	F				X
Muscigralla brevicauda	U	U?				
Attila torridus *		F		R		X
A. spadiceus				U	U	?
Rhytipterna holerythra					F	X
Sirystes albogriseus				F		X
Myiarchus tuberculifer	U	C	F			X
M. phaeocephalus *	U	F				?
M. sp.				U		
Megarynchus pitangua *	F	F			U	X
Myiozetetes cayanensis				F		X
M. similis *	U	F				X
M. granadensis					U	X
Conopias albovittatus				F		
Myiodynastes bairdii *	F	F				
M. maculatus	U?	C			F	X
Tyrannus niveigularis *	U	U				X
T. melancholicus	F	U		U	C	X
Pachyramphus cinnamomeus				U	F	X
P. polychopterus				F		
P. albogriseus	U					X
P. homochrous	U	U		F	F	X
Tityra semifasciata *		U		F		X
T. inquisitor				F	X	X
PIPRIDAE						
Schiffornis turdinus		R		F		X
Manacus manacus		F		F	C	X
Pipra mentalis		R		X	F	X

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P. coronata						X
Chloropipo holochlora						X
COTINGIDAE						
Lipaugus unirufus				C		X
Cotinga nattererii +					U	
Carpodectes hopkei +				F		X
Querula purpurata					F	X
Cephalopterus penduliger +				R		X
HIRUNDINIDAE						
Progne chalybea	F	F	X	U	F	X
Notiochelidon cyanoleuca	F					X
Neochelidon tibialis						X
Stelgidopteryx ruficollis	F	C		F	C	X
CORVIDAE						
Cyanocorax mystacalis *	F					
TROGLODYTIDAE						
Campylorhynchus fasciatus	F	F				
C. zonatus				U	U	X
Thryothorus mystacalis		F				X
T. paucimaculatus *	C	C	F			
T. nigricapillus				C	?	X
T. thoracicus				C	F	
T. superciliaris *	C	C				
Troglodytes aedon	F	F	X	C	F	X
T. solstitialis		U	X			
Henicorhina leucophrys		C	X			
Microcerculus marginatus		U		F	F	X
Cyphorhinus phaeocephalus				F		X
MIMIDAE						
Mimus longicaudatus	F	C				
TURDIDAE						
Catharus dryas		R?				
C. ustulatus		U				X
Turdus reevei *	F	U				X
T. maculirostris *	C	F			F	X

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T. albicollis				F		
SYLVIIDAE						
Ramphocaenus melanurus	U	U			X	X
Microbates cinereiventris				F		
Polioptila plumbea *	C	F				X
VIREONIDAE						
Cyclarhis gujanensis	U	F	X			X
Vireolanius leucotis				F	F	
Vireo olivaceus *	C	C			U	X
Hylophilus minor	F	C	X	C	C	X
EMBERIZIDAE						
ICTERINAE						
Molothrus bonariensis	U	U			X	X
Scaphidura oryzivora		R?		U	U	X
Zarhynchus wagleri				F	U	
Cacicus cela	F	F			?	X
C. microrhynchus				F	U	X
Amblycercus holosericeus		F	X			X
Dives warszewiczi	C	F				X
Icterus graceannae *	X	F				
I. mesomelas	F	U			U	X
Sturnella bellicosa	U	U			X	
PARULINAE						
Parula pitiayumi	F	C	X			X
Dendroica fusca				R		
D. castanea				R		
Seiurus noveboracensis	R	R				X
Geothlypis aequinoctialis		F				X
G. semiflava						X
Setophaga ruticilla	R	R		R		X
Myioborus miniatus		C	X			
Basileuterus fraseri *	C	C	X			
Phaeothlypis fulvicauda						X
COEREBINAE						
Coereba flaveola	F	C	X	C	C	X

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THRAUPINAE						
Cyanerpes caeruleus				C	F	X
Chlorophanes spiza		U?		C	C	X
Dacnis cayana				F	F	X
D. lineata		U?		U	C	X
D. venusta				F		X
D. berlepschi						X
Euphonia xanthogaster		C	F	C	X	X
E. fulvicrissa				U		
E. saturata +		U?				X
E. laniirostris	C	C	X	F	X	X
Tangara johannae +						X
T. icterocephala		F		F		X
T. larvata				F	F	X
T. cyanicollis	X	X				
T. palmeri +				U		X
T. gyrola		C		C	F	X
T. florida				U		
Thraupis palmarum		R?		F	F	X
T. episcopus	C	C	X	U	C	X
Ramphocelus icteronotus		F		C	F	X
Piranga flava		F				
P. rubra	R	R		R	F	X
Chlorothraupis stolzmanni +				C		
Tachyphonus luctuosus	U	U		F	C	X
T. delatrii				F		X
Heterospingus xanthopygius +				F		X
Mitrospingus cassini				F		X
Hemithraupis guira	F	X			C	X
Chlorospingus canigularis *		C				
CARDINALINAE						
Saltator maximus	F	C		F	C	X
S. atripennis						X
S. albicollis *	U	F				
Pitylus grossus				U	F	X

APPENDIX 8

	CEB	MAC	CAC	CAB	CMU	RPS
Pheucticus chrysogaster	U	C	X			
P. ludovicianus				R		X
Cyanocompsa cyanoides		U		U	F	X
EMBERIZINAE						
Volatinia jacarina	F	F			F	X
Tiaris obscura		U?			F	X
Sporophila americana	C	F		X	C	X
S. peruviana	?					
S. telasco	F	F				
Amaurospiza concolor		R				
Rhodospingus cruentus *	C	F			F	X
Atiapetes brunneinucha		F	X			
Arremon aurantiirostris		U				X
A. abeillei *	F	F				
Poospiza hispaniolensis		F				
Sicalis flaveola	U					
CARDUELINAE						
Carduelis siemeradzkii *	U	F				

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APPENDIX 9

Mammal List; January-February Trip

Louise Emmons, Luis Albuja V.

A. Mammals collected, seen, or identified from tracks, calls, skins, or skeletal parts by expedition members, or previously reported (Albuja, 1982).

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Didelphidae				
Caluromys derbianus		X		
Didelphis marsupialis		X	X	
Myrmecophagidae				
Tamandua mexicana		X		
Megalonychidae				
Choloepus hoffmanni		X		
Dasypodidae				
Dasypus novemcinctus		X	X	X
Phyllostomidae				
Phyllostomus hastatus *			X	
Mimon crenulatum *			X	
Anoura geoffroyi *		X		
Glossophaga longirostris *		X		
Glossophaga soricina *		X		
Carollia castanea *			X	
Carollia perspicillata *		X	X	
Rhinophylla alethina *			X	
Sturnira lilium *		X		
Platyrrhinus helleri *		X		
Artibeus fraterculus *		X		
Artibeus glaucus *		X		
Artibeus jamaicencis *		X		
Artibeus phaeotis *		X	X	
Artibeus watsoni *		X	X	
Vampyressa pusilla *		X		
Desmodus rotundus *		X		
Cebidae				
Alouatta palliata		X	X	
Cebus albifrons		X		
Procyonidae				
Procyon cancrivorus	X	X		
Potos flavus		X	X	

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Mustelidae				
Eira barbara		X	X	
Felidae				
Felis yagouaroundi		X		X
Tayassuidae				
Tayassu tajacu	X	X		X
Tayassu pecari *	X			
Cervidae				
Mazama americana *		X		
Odocoileus virginianus		X		
Sciuridae				
Sciurus stramineus	X	X		
Sciurus granatensis		X	X	X
Muridae				
Oryzomys alfaroi *		X		
Oryzomys xantheolus *		X		
Dasyproctidae				
Dasyprocta punctata		X		X
Agoutidae				
Agouti paca		X	X	
Echimyidae				
Proechimys sp.	X	X		
Leporidae				
Sylvilagus brasiliensis		X		

* specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito; a few duplicates are in the National Museum of Natural History, Washington

B. List of large mammals based on information provided by inhabitants of the localities. The degree of reliability of the information is unknown.

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Didelphidae				
Caluromys derbianus		X		
Metachirus nudicaudatus			X	
Philander opossum			X	
Chironectes minimus			X	
Didelphis marsupialis		X		
Marmosa sp.			X	

APPENDIX 9

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Myrmecophagidae				
Tamandua mexicana	X	X	X	
Cyclopes didactylus			X	
Bradypodidae				
Bradypus variegatus			X	
Megalonychidae				
Choloepus hoffmanni		X	X	
Dasypodidae				
Cabassous centralis			X	
Dasypus novemcinctus	X	X	X	
Phyllostomidae				
Desmodus rotundus	X	X		
Cebidae				
Alouatta palliata	X			X
Cebus albifrons	X			
Cebus capuchinus				X
Canidae				
Dusicyon sechurae		X		
Procyonidae				
Nasua narica	X	X		
Potos flavus	X	X		
Procyon cancrivorus	X	X		
Mustelidae				
Eira barbara	X	X	X	
Galictis vittata	X			
Felidae				
Felis concolor	X			X
Felis pardalis	X	X		
Felis tigrina		X		
Felis wiedii	X			
Felis yagouaroundi	X			
Panthera onca	X	X	X	
Tayassuidae				
Tayassu tajacu	X	X		X
Tayassu pecari	X			X

APPENDIX 9

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Cervidae				
Mazama americana	X	X	X	
Mazama cf. *fuscata*		X		
Odocoileus virginianus	X	X		
Sciuridae				
Sciurus stramineus	X	X		X
Sciurus granatensis		X	X	
Erethizontidae				
Coendou sp.		X		
Dasyproctidae				
Dasyprocta punctata	X	X	X	X
Agoutidae				
Agouti paca	X	X	X	X
Leporidae				
Sylvilagus brasiliensis			X	

* specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito; a few duplicates are in the National Museum of Natural History, Washington

APPENDIX 10

Mammal List; July Trip

Luis Albuja V.

A. Mammals collected, seen, or identified from tracks, calls, skins, or skeletal parts by expedition members, or previously reported (Albuja, 1982).

	Jauneche	Manta Real	Cerro Blanco	Cerro Pata de Pájaro
Didelphidae				
Caluromys derbianus	X			
Didelphis marsupialis	X		X	
Marmosa sp.		X		
Philander opossum		X		
Myrmecophagidae				
Tamandua mexicana	X			
Megalonychidae				
Choloepus hoffmanni			X	
Dasypodidae				
Dasypus novemcinctus	X	X		X
Phyllostomidae				
Micronycteris megalotis *	X			X
Phyllostomus discolor *	X			
Mimon crenulatum *		X		
Anoura caudifera *				X
Glossophaga longirostris *		X		X
Glossophaga soricina *			X	
Lonchophylla robusta *		X		
Choeroniscus minor *		X		
Carollia castanea *	X			
Carollia perspicillata *	X			X
Carollia brevicauda *		X		X
Rhinophylla alethina *				X
Sturnira lilium *		X	X	
Platyrrhinus helleri *		X	X	
Platyrrhinus cf. *infuscus* *		X		X
Platyrrhinus vittatus *		X		
Vampyressa pusilla *		X		X
Vampyressa nymphaea *				X
Chiroderma villosum *			X	X
Uroderma bilobatum *			X	
Artibeus fraterculus *	X		X	

APPENDIX 10

	Jauneche	Manta Real	Cerro Blanco	Cerro Pata de Pájaro
Artibeus glaucus *		X		X
Artibeus jamaicencis *	X	X		X
Artibeus phaeotis *		X		
Artibeus watsoni *		X		
Desmodus rotundus *	X			
Vespertilionidae				
Myotis sp. *				X
Cebidae				
Alouatta palliata	X	X	X	X
Cebus albifrons	X		X	X
Felidae				
Felis pardalis		X	X	
Felis yagouaroundi			X	
Panthera onca		X	X	
Procyonidae				
Basaricyon gabbii		X		
Nasua narica	X		X	
Potos flavus	X	X		
Procyon cancrivorus			X	
Mustelidae				
Eira barbara			X	
Tayassuidae				
Tayassu tajacu *			X	
Tayassu pecari *		X	X	X
Cervidae				
Mazama americana *	X	X	X	
Odocoileus virginianus *			X	
Sciuridae				
Sciurus stramineus	X		X	
Sciurus granatensis	X	X?	X	X
Heteromyidae				
Heteromys australis *	X			
Muridae				
Oryzomys albigularis *	X	X		
Oryzomys alfaroi *	X			

* specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito

APPENDIX 10

	Jauneche	Manta Real	Cerro Blanco	Cerro Pata de Pájaro
Oryzomys caliginosus *			X	X
Oryzomys xantheolus *	X	X?	X	
Dasyproctidae				
Dasyprocta punctata *	X	X	X	X
Agoutidae				
Agouti paca *	X	X	X	X
Echimyidae				
Proechimys decumanus *			X	
Erethizontidae				
Coendou rothschildi *			X	
Leporidae				
Sylvilagus brasiliensis *			X	

B. List of large mammals based on information provided by inhabitants of the localities.

	Jauneche	Manta Real	Cerro Blanco	Cerro Pata de Pájaro
Didelphidae				
Caluromys derbianus	X			X
Metachirus nudicaudatus	X			
Philander opossum	X	X	X	
Chironectes minimus	X			
Didelphis marsupialis	X	X	X	X
Marmosa sp.	X	X	X	X
Myrmecophagidae				
Cyclopes didactylus	X	X		X
Myrmecophaga tridactyla			X	
Tamandua mexicana	X	X	X	X
Bradypodidae				
Bradypus variegatus	X	X	?	X
Megalonychidae				
Choloepus hoffmanni	X			
Dasypodidae				
Dasypus novemcinctus	X	X	X	X
Phyllostomidae				
Desmodus rotundus	X	X	X	X

APPENDIX 10

	Jauneche	Manta Real	Cerro Blanco	Cerro Pata de Pájaro
Cebidae				
Alouatta palliata	X	X	X	X
Cebus albifrons	X		X	X
Procyonidae				
Nasua narica	X	X	X	X
Potos flavus	X	X	X	X
Procyon cancrivorus	X	X	X	X
Mustelidae				
Eira barbara	X	X	X	X
Mustela frenata	X	X	X	X
Lutra longicaudis	X			
Felidae				
Felis concolor		X	X	
Felis pardalis	X	X	X	X
Felis tigrina	X	X	X	
Felis wiedii	X	X	X	
Felis yagouaroundi	X	X	X	X
Panthera onca		X	X	
Tayassuidae				
Tayassu tajacu	X	X	X	
Tayassu pecari	X	X	X	
Cervidae				
Mazama americana	X	X	X	X
Odocoileus virginianus			X	
Sciuridae				
Sciurus stramineus	X		X	
Sciurus granatensis	X	X	X	X
Erethizontidae				
Coendou rothschildi	X		X	
Dasyproctidae				
Dasyprocta punctata	X	X	X	X
Agoutidae				
Agouti paca	X	X	X	X
Leporidae				
Sylvilagus brasiliensis	X	X	X	X

* specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito

APPENDIX 11

Amphibian and Reptile List; January-February Trip

Ana Almendáriz, John L. Carr

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Amphibia				
ANURA				
Bufonidae				
Bufo marinus		A,B	D	
Centrolenidae				
Centrolene prosoblepon			+	
Hyalinobatrachium valerioi			+	
Dendrobatidae				
Colostethus infraguttatus	+			
Colostethus sp. 1		+		
Colostethus sp. 2		+	+	
Epipedobates erythromos			+	
Hylidae				
Hyla rosenbergi			+	
Ololygon sugillata			A	
Smilisca phaeota			+	
Trachycephalus jordani		C		
Leptodactylidae				
Ceratophrys stolzmani		C		
Eleutherodactylus achatinus		+	+	
Eleutherodactylus anomalus			+	
Eleutherodactylus chalceus			+	
Eleutherodactylus longirostris			+	
Eleutherodactylus cf. *phoxocephalus*		+		
Eleutherodactylus sp. 1		+		
Eleutherodactylus sp. 2		+		
Eleutherodactylus sp. 3			+	
Eleutherodactylus sp. 4			+	
Eleutherodactylus sp. 5			+	
Eleutherodactylus sp. 6			+	
Eleutherodactylus sp. 7			+	
Eleutherodactylus sp. 8			+	
Leptodactylus pentadactylus			A	
Leptodactylus ventrimaculatus				+

APPENDIX 11

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Microhylidae				
Nelsonophryne aterrima			+	
APODA				
Caeciliidae				
Caecilia sp.			+	
Oscaecilia equatorialis			+	
Reptilia				
SAURIA				
Gekkonidae				
Phyllodactylus reissii		+		
Iguanidae				
Anolis chloris			+	
Anolis fasciatus		+		
Anolis gracilipes	+		+	
Anolis peraccae		+		
Anolis princeps			+	
Anolis sp. 1[a]			+	
Anolis sp. 2			+	
Basiliscus cf. *galeritus*			A	
Enyalioides heterolepis			+	
Iguana iguana	E	A,C		
Ophryoessoides iridescens	+	+		
Polychrus femoralis		*		
Gymnophthalmidae				
Echinosaura horrida			+	
Teiidae				
Ameiva septemlineata		+		
Ameiva sp.	A		A	
Dicrodon guttulatum		C		
SERPENTES				
Boidae				
Boa constrictor	E	C	E	E
Colubridae				
Chironius sp.			B	
Coniophanes fissidens			+	

+	specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito
*	specimen deposited in the National Museum of Natural History, Washington
A	seen alive, but not collected
B	dead or road killed specimen, not preserved
C	seen in the Museo de Salango or Centro de Interpretación, Parque Nacional Machalilla
D	identified based on call
E	reported by local inhabitants

APPENDIX 11

+	specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito
*	specimen deposited in the National Museum of Natural History, Washington
A	seen alive, but not collected
B	dead or road killed specimen, not preserved
C	seen in the Museo de Salango or Centro de Interpretación, Parque Nacional Machalilla
D	identified based on call
E	reported by local inhabitants

	Cerro Blanco	Parque Nacional Machalilla	Cabeceras de Bilsa	Cerro Mutiles
Imantodes cenchoa			+	
Leptodeira septentrionalis larcorum		+		
Leptodeira septentrionalis ornata			+	
Oxybelis brevirostris			+	
Tantilla equatoriana			+	
Tantilla supracincta			+	
Elapidae				
Micrurus ancoralis			B	
Viperidae				
Bothriechis schlegelii			+	
Bothrops atrox	E	+	E	E
TESTUDINES				
Cheloniidae				
Chelonia mydas		C		
Lepidochelys olivacea		C		
Dermochelyidae				
Dermochelys coriacea		E		
Emydidae				
Rhinoclemmys annulata		C	E	E

[a] Anolis sp. 1 appears referable to a species being described by Ernest Williams from the vicinity of Santo Domingo de los Colorados and the Río Palenque Science Center.

Amphibian and Reptile List; July Trip

APPENDIX 12

Ana Almendáriz, John L. Carr

	Cerro Blanco	Jauneche	Manta Real	Cerro Pata de Pájaro
Amphibia				
ANURA				
Bufonidae				
Atelopus balios			+	
Bufo caeruleostictus			+	+
Bufo marinus	A	A	C	
Dendrobatidae				
Colostethus infraguttatus	+	+		
Colostethus sp. 1[a]		+		
Hylidae				
Gastrotheca cornuta			+	
Ololygon quinquefasciata		+		
Ololygon sugillata	+	+		
Phrynohyas venulosa		+		
Trachycephalus jordani		+		
Leptodactylidae				
Barycholos pulcher		+	+	
Eleutherodactylus achatinus	+			+
Eleutherodactylus cf. *celator*			+	
Eleutherodactylus cf. *walkeri*			+	
Eleutherodactylus w-nigrum			+	
Eleutherodactylus sp. 1[b]			+	
Eleutherodactylus sp. 2[b]			+	+
Reptilia				
SAURIA				
Gekkonidae				
Gonatodes caudiscutatus	+			
Phyllodactylus reissii	+			
Gymnophthalmidae				
Alopoglossus festae			+	+
Iguanidae				
Basiliscus galeritus			+	
Iguana iguana	A	A		
Ophryoessoides iridescens	+	+		

+	specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito
A	seen alive, but not collected
B	seen in the collection or records of the biological station
C	reported by local inhabitants

APPENDIX 12

+	specimen(s) deposited in the collection of the Escuela Politécnica Nacional, Quito
A	seen alive, but not collected
B	seen in the collection or records of the biological station
C	reported by local inhabitants

	Cerro Blanco	Jauneche	Manta Real	Cerro Pata de Pájaro
Teiidae				
Ameiva sp.	A	A		
SERPENTES				
Boidae				
Boa constrictor		C		
Colubridae				
Atractus sp.		B		
Lampropeltis triangulum		B		
Leptodeira septentrionalis		B		
Oxybelis sp.		B		
Oxyrhopus petola	+			
Elapidae				
Micrurus sp.		C		
Viperidae				
Bothriechis schlegelii		C		+
Bothrops atrox	+	C		
TESTUDINES				
Chelydridae				
Chelydra serpentina		B	C	
Emydidae				
Rhinoclemmys annulata		C	C	
Kinosternidae				
Kinosternon leucostomum			C	

[a] the same as Colostethus sp. 1 at Parque Nacional Machalilla
[b] not the same as Eleutherodactylus spp. 1 and 2 in Appendix 11

Plant List: Cerro Mutiles

APPENDIX 13

Robin B. Foster, Alwyn H. Gentry, Carmen Josse

The lists compiled here are a combination of the field lists of plants observed by R. Foster with the plant collection lists of A. Gentry, C. Josse, and P. Yanez. These identifications are based on the experience of the authors and made without direct benefit of herbarium comparisons, published references, or detailed study. Most were neither flowering nor fruiting. They are certainly at least 90-95% correct, but should still be used with caution. Where the local, common name(s) are known, they follow the scientific name.

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

Moist Forest

ACANTHACEAE	
Justicia pectoralis cf.	H
Mendoncia gracilis cf.	V
Pseuderanthemum cuspidatum cf.	H
Ruellia sp.	H
Trichanthera gigantea	T
AMARANTHACEAE	
Alternanthera villosa	H
Chamissoa altissima	V
Iresine angustifolia	V
AMARYLLIDACEAE	
Bomarea obovata cf.	H
ANACARDIACEAE	
Spondias mombin, jobo	T
Tapirira sp.	T
ANNONACEAE	
Annona sp.	S
APOCYNACEAE	
Aspidosperma jaunechense	T
Forsteronia subcordata cf.	V
Prestonia obovata	V
Prestonia sp.	V
ARACEAE	
Anthurium scandens	E
Anthurium sp. 1	E
Anthurium sp. 2	E
Dieffenbachia seguine cf.	H
Heteropsis integerrima cf.	E
Monstera dubia	E
Monstera lechleriana cf.	E
Monstera sprucei cf.	E
Philodendron barrosoanum cf.	E
Philodendron sp. 1	E
Philodendron sp. 2	E
Syngonium podophyllum cf.	E
BIGNONIACEAE	
Amphilophium paniculatum	V
Anemopaegma chrysanthum	V
Arrabidaea candicans	V
Arrabidaea verrucosa	V
Arrabidaea sp.	V
Callichlamys latifolia	V
Cydista decora	V
Macfadyena unguis-cati	V
Mansoa hymenaea	V
Mansoa verrucifera	V
Paragonia pyramidata	V
Pithecoctenium crucigerum	V
? sp.	V
BOMBACACEAE	
Ochroma pyramidale, balsa	T
Pochota(Bombacopsis) trinitensis, jolote	T
Pseudobombax milleii, beldaco	T
BORAGINACEAE	
Cordia alliodora, laurel	T

APPENDIX 13

Cerro Mutiles

Cordia panamensis	T
Cordia sp.	T
Tournefortia bicolor cf., surumbaco	V
BROMELIACEAE	
Aechmea magdalenae	H
Aechmea pyramidata cf.	E
Tillandsia sp. 1	E
Tillandsia sp. 2	E
CACTACEAE	
Rhipsalis micrantha	E
CAPPARIDACEAE	
Capparis ecuadorica	S
Capparis magnifica cf.	T
Capparis sp.	S
CELASTRACEAE	
Perrottetia sessiliflora	T
COMMELINACEAE	
Campelia zanonia	H
Dichorisandra hexandra	V
COMPOSITAE	
Mikania sp.	V
CONVOLVULACEAE	
? sp.	V
CUCURBITACEAE	
Cayaponia cruegeri cf.	V
Gurania spinulosa	V
Gurania sp.	V
Pseudosicydium acariianthum	V
Sicydium sp.	V
CYCADACEAE	
Zamia lindenii	S
CYCLANTHACEAE	
Asplundia sp.	H
Carludovica palmata	H

ELAEOCARPACEAE	
Sloanea meianthera cf.	T
ERYTHROXYLACEAE	
Erythroxylum patens	S
EUPHORBIACEAE	
Acalypha obovata	S
Acalypha sp.	S
Adelia triloba	S
Cleidion sp.	S
Croton schiedianus	T
Omphalea diandra	V
Phyllanthus juglandifolius	S
Sapium sp.	T
? sp.	T
FLACOURTIACEAE	
Casearia arborea	T
Xylosma benthamii cf.	S
? sp.	S
GESNERIACEAE	
Drymonia serrulata cf.	E
GRAMINEAE	
Guadua sp.	T
Streptogyne americana cf.	H
GUTTIFERAE	
Clusia fructiangusta cf.	E
HIPPOCRATEACEAE	
Hippocratea volubilis	V
Peritassa sp.	V
LAURACEAE	
Ocotea cernua, jigua menuda	T
Ocotea nicaraguensis cf.	T
? sp. 1	T
? sp. 2	T
LECYTHIDACEAE	
Eschweilera rimbachii cf.	T

Grias peruviana	T
Gustavia sp.	T
LEGUMINOSAE-CAESALPINIOIDEAE	
Swartzia haughtii	T
Swartzia sp.	T
LEGUMINOSAE-MIMOSOIDEAE	
Acacia riparia cf.	V
Albizia guachapele, guachapelí	T
Inga corruscans	T
Inga sapindoides	T
Inga umbellifera	T
Inga sp.	T
Pithecellobium arboreum cf.	T
LEGUMINOSAE-PAPILIONOIDEAE	
Canavalia eurycarpa cf.	V
Canavalia villosa cf.	V
Erythrina poeppigiana	T
Lecointea sp.	T
Platymiscium sp.	T
LOGANIACEAE	
Strychnos sp.	V
LORANTHACEAE	
Psittacanthus cupulifer cf.	E
MALPIGHIACEAE	
Hiraea sp.	V
Mascagnia sp.	V
Stigmaphyllon sp.	V
? sp.	V
MARANTACEAE	
Calathea legrelleana cf.	H
Calathea lutea	H
MELIACEAE	
Cedrela odorata	T
Guarea glabra	T
Guarea sp.	T
Trichilia maynensis cf.	T
Trichilia pallida	T
Trichilia pleeana cf.	T
MENISPERMACEAE	
Anomospermum sp.	V
Cissampelos tropaeolifolia	V
Disciphania sp.	V
MORACEAE	
Brosimum alicastrum, tillo blanco	T
Brosimum guianense	T
Castilla tunu	T
Cecropia obtusifolia cf., guarumo	T
Cecropia peltata, guarumo	T
Clarisia biflora	T
Coussapoa eggersii (villosa), matapalo	T,E
Ficus obtusifolia, matapalo	T,E
Ficus trigonata, matapalo	T,E
Ficus yoponensis	T
Ficus sp., matapalo	T,E
Maclura (Chlorophora) tinctoria	T
Poulsenia armata	T
Pseudolmedia rigida	T
Sorocea sarcocarpa	T
MUSACEAE	
Heliconia sp.	H
MYRISTICACEAE	
Otoba oblonga aff.	T
Virola reidii	T
Virola sebifera	T
MYRSINACEAE	
Ardisia sp.	S
Stylogyne standleyi cf.	S
MYRTACEAE	
Calyptranthes sp.	T
Eugenia florida	T

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 13

Cerro Mutiles

Eugenia galalonensis	T
Eugenia oerstediana	T
Eugenia sp.	T
Myrcia sp.	T
Psidium friedrichsthalianum cf.	T
NYCTAGINACEAE	
Pisonia aculeata	V
OLACACEAE	
Heisteria acuminata	T
PALMAE	
Astrocaryum standleyanum	T
Bactris sp.	T
Chamaedorea sp.	S
Phytelephas aequatorialis, tagua	T
PASSIFLORACEAE	
Passiflora biflora cf.	V
Passiflora macrophylla	S
PHYTOLACCACEAE	
Petiveria alliacea	S
Trichostigma octandra	V
PIPERACEAE	
Peperomia sp.	E
Piper laevigatum	S
Piper marginatum cf.	S
Piper obliquum	S
Piper scansum	V
Piper tuberculatum	S
Piper sp.	S
Pothomorphe peltata	S
POLYGONACEAE	
Coccoloba sp.	T
Triplaris cumingiana, fernán sánchez, muchín	T

PTERIDOPHYTA	
Adiantum sp.	H
Cyclopeltis semicordata	H
Pteris sp.	H
Tectaria incisa	H
RHAMNACEAE	
Zizyphus thyrsiflora, ébano	T
RUBIACEAE	
Chomelia panamensis cf.	S
Faramea occidentalis	S
Geophila repens cf.	H
Hamelia axillaris	S
Pentagonia brachyotis	S
Psychotria grandis	S
Psychotria horizontalis	S
Randia armata cf.	S
Rudgea sp.	S
? sp.	V
RUTACEAE	
Zanthoxylum setulosum cf.	T
Zanthoxylum sp.	T
SAPINDACEAE	
Allophylus psilospermus	S
Cupania latifolia cf.	T
Paullinia rugosum cf.	V
Paullinia sp.	V
Sapindus saponaria, jaboncillo	T
Serjania circumvallata cf.	V
Serjania glabrata cf.	V
Talisia princeps	T
Thinouia sp.	V
SAPOTACEAE	
Chrysophyllum sp.	T
Pouteria reticulata	T

SIMAROUBACEAE	
Picramnia latifolia	S
SMILACACEAE	
Smilax aequatorialis cf.	V
SOLANACEAE	
Cestrum sp.	S
Solanum sp. 1	V
Solanum sp. 2	S
STERCULIACEAE	
Herrania balaensis cf.	S
THEOPHRASTACEAE	
Clavija eggersii, huevo de tigre	S
Clavija sp., huevo de tigre	S
ULMACEAE	
Ampelocera sp.	T
Celtis iguanea	V
Celtis schippii	T
Trema micrantha, sapán de paloma, muchichilán	T
URTICACEAE	
Urera caracasana	T
VERBENACEAE	
Aegiphila panamensis cf.	T
Citharexylum gentryi	T
VITACEAE	
Cissus sp.	V
ZINGIBERACEAE	
Costus geothyrsus cf.	H

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 14

Plant List: Cabeceras de Bilsa

Robin B. Foster, Alwyn H. Gentry, Carmen Josse

Wet Forest

ACANTHACEAE	
Aphelandra aurantiaca	H
Justicia sp.	H
Mendoncia sp.	V
Ruellia sp.	H
ANACARDIACEAE	
Astronium sp.	T
ANNONACEAE	
Crematosperma sp.	T
Rollinia sp.	T
Unonopsis sp.	T
APOCYNACEAE	
Aspidosperma sp.	T
Laubertia boisieri	V
Prestonia sp.	V
Rauvolfia sp.	T
Tabernaemontana amygdalifolia, lechoso	T
Tabernaemontana sp., lechoso	T
ARACEAE	
Anthurium dolichostachyum	E
Anthurium llanoense	E
Anthurium malacophyllum	H
Anthurium nigropunctatum	E
Anthurium scandens	E
Anthurium tripartitum	E
Anthurium sp. 1	E
Anthurium sp. 2	E
Dieffenbachia seguine cf.	H
Dieffenbachia sp. 1	H
Dieffenbachia sp. 2	H
Homalomena peltata	H
Monstera dubia	E
Monstera lechleriana	E
Philodendron devansayeanum cf.	E
Philodendron inaequilaterum	E
Philodendron verrucosum cf.	E
Philodendron sp. 1	E
Philodendron sp. 2	E
Philodendron sp. 3	E
Philodendron sp. 4	E
Philodendron sp. 5	E
Rhodospatha latifolia cf.	E
Rhodospatha sp. 1	E
Rhodospatha sp. 2	H
Stenospermation sp. nov.	H
Syngonium sp.	E
Xanthosoma sagittifolium	H
ARALIACEAE	
Dendropanax sp.	T
Schefflera sphaerocoma	E
Schefflera sp.	E
ARISTOLOCHIACEAE	
Aristolochia sp.	V
ASCLEPIADACEAE	
Gonolobus sp.	V
Matelea mediocris?	V
Matelea? sp.	V
? sp.	V
BEGONIACEAE	
Begonia glabra	H
Begonia sp.	H
BIGNONIACEAE	
Anemopaegma chrysanthum	V
Arrabidaea verrucosa	V
Exarata chocoensis	T
Schlegelia dressleri	V
Schlegelia sulfurea	V
Tabebuia chrysantha, guayacán	T

BOMBACACEAE	
Ceiba pentandra, ceiba	T
Ochroma pyramidale, balsa	T
Pochota (Bombacopsis) patinoi	T
Pseudobombax septenatum cf.	T
Quararibea grandifolia	T
Quararibea soegenii	T
Quararibea sp. 1	T
Quararibea sp. 2, castaño	T
BORAGINACEAE	
Cordia dwyeri	T
Cordia sp. 1	T
Cordia sp. 2	T
Tournefortia sp.	V
BROMELIACEAE	
Aechmea sp.	E
Tillandsia sp. 1	E
Tillandsia sp. 2	E
BURSERACEAE	
Protium sp. 1	T
Protium sp. 2	T
Tetragastris sp., anime	T
CACTACEAE	
Epiphyllum sp.	E
CAMPANULACEAE	
Burmeistra vulgaris cf.	H
Burmeistra sp.	H
CAPPARIDACEAE	
Podandrogyne brevipedunculata	H
Podandrogyne sp.	S
CARICACEAE	
Carica microcarpa	S
CELASTRACEAE	
Maytenus sp.	T
Perrottetia sp.	T

CHRYSOBALANACEAE	
Hirtella sp.	T
COMMELINACEAE	
Dichorisandra sp.	H
COMPOSITAE	
Adenostemma platyphyllum	H
Ageratum sp.	H
Neurolena lobata	H
Vernonia patens	T
Wulffia baccata	V
CONVOLVULACEAE	
Maripa sp.	V
CUCURBITACEAE	
Cayaponia sp., chia	V
Gurania eggersii	V
Gurania eriantha	V
Gurania megistantha	V
Gurania spinulosa	V
Psiguria sp. 1	V
Psiguria sp. 2	V
Selysia sp.	V
Sicydium sp.	V
? sp. 1	V
? sp. 2	V
? sp. 3	V
CYCADACEAE	
Zamia lindenii	S
CYCLANTHACEAE	
Asplundia sp. 1	E
Asplundia sp. 2	H
Carludovica palmata	H
Cyclanthus bipartitus	H
Dicranopygium sp.	H
Thoracocarpus bissectus	E

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 14

Cabeceras de Bilsa

DILLENIACEAE	
Doliocarpus sp.	V
ELAEOCARPACEAE	
Sloanea medusula	T
Sloanea sp.	T
ERICACEAE	
? sp. 1	V
? sp. 2	E
EUPHORBIACEAE	
Acalypha diversifolia	S
Acalypha macrostachya	S
Omphalea diandra	V
Sapium sp.	T
FLACOURTIACEAE	
Banara sp.	S
Casearia arborea	T
Casearia sp.	T
GESNERIACEAE	
Columnea sp. 1	E
Columnea sp. 2	E
Cremosperma sp.	H
Diastema eggersianum	H
Drymonia turrialvae cf.	H
Drymonia sp. 1	E
Drymonia sp. 2	E
Episcia sp.	H
Gasteranthus crispus	H
Gasteranthus oncogastrus	H
Gloxinia dodsonii	H
Nautilocalyx sp.	E
Paradrymonia hypocyrta	E
GRAMINEAE	
Bambusa guadua	T
GUTTIFERAE	
Chrysochlamys sp.	T
Clusia sp.	E
Garcinia (Rheedia) sp.	T
Symphonia globulifera	T
Tovomita weddelliana	T
Tovomita sp. 1	E
Tovomita sp. 2	S
Vismia sp.	S
? sp.	E
HAEMODORACEAE	
Xiphidium caeruleum	H
HERNANDIACEAE	
Hernandia sp.	T
HIPPOCRATEACEAE	
Cheiloclinium sp., comida de loro	S
Salacia sp.	V
? sp.	V
ICACINACEAE	
Discophora guianensis	T
LABIATAE	
Hyptis sp.	H
LAURACEAE	
Caryodaphnopsis theobromifolia	T
Ocotea whitei	T
Ocotea sp.	T
? sp. 1, chimbazo	T
? sp. 2	T
LECYTHIDACEAE	
Eschweilera integrifolia cf.	T
Eschweilera pittieri cf.	T
Eschweilera rimbachii cf.	T
Grias peruviana	T
Gustavia sp.	T
LEGUMINOSAE-CAESALPINIOIDEAE	
Senna (Cassia) sp.	S
Swartzia haughtii	T

LEGUMINOSAE-MIMOSOIDEAE	
Inga pruriens	T
Inga sapindoides	T
Inga sp. 1	T
Inga sp. 2	T
LEGUMINOSAE-PAPILIONOIDEAE	
Desmodium sp.	H
Ormosia amazonica cf.	T
Pterocarpus sp.	T
LOGANIACEAE	
Strychnos sp. 1	V
Strychnos sp. 2	V
Strychnos sp. 3	V
MALPIGHIACEAE	
Bunchosia sp.	S
Hiraea sp.	V
MARANTACEAE	
Calathea inocephala	H
Calathea legrelleana cf.	H
Calathea lutea	H
Calathea similis cf.	H
Calathea sp.	H
MARCGRAVIACEAE	
Marcgravia sp.	V
Norantea sp.	V
MELASTOMATACEAE	
Blakea sp. 1	E
Blakea sp. 2	E
Clidemia sp. 1	S
Clidemia sp. 2	S
Clidemia sp. 3	S
Conostegia sp.	S
Henrietella? sp.	T
Leandra sp.	S
Miconia sp. 1	S
Miconia sp. 2	S
Miconia sp. 3	S
Miconia sp. 4	T
Ossaea sp.	E
Triolena barbeyana cf.	H
? sp. 1	S
? sp. 2	S
MELIACEAE	
Carapa guianensis	T
Guarea sp.	T
Trichilia septentrionalis	T
Trichilia sp.	T
MENISPERMACEAE	
Anomospermum sp.	V
Cissampelos sp.	V
MONIMIACEAE	
Mollinedia sp.	T
Siparuna guianensis	T
MORACEAE	
Brosimum guianense	T
Brosimum utile	T
Brosimum sp.	T
Cecropia arbelaezii, guarumo	T
Cecropia insignis, guarumo	T
Cecropia reticulata, guarumo	T
Cecropia sp. 1, guarumo	T
Cecropia sp. 2, guarumo	T
Coussapoa eggersii (villosa), matapalo	T,E
Coussapoa herthae, matapalo	E
Coussapoa vannifolia, matapalo	E
Ficus macbridei cf.	T
Ficus nymphiifolia, matapalo	E
Ficus tonduzii	T
Ficus trianae	T
Ficus sp.	T

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 14

Cabeceras de Bilsa

Perebea angustifolia (humilis) cf.	S
Poulsenia armata	T
Pourouma bicolor	T
Pourouma cecropiifolia cf.	T
Pseudolmedia rigida	T
MUSACEAE	
Heliconia longa cf.	H
Heliconia marmoliana	H
Heliconia nigripraefixa	H
Heliconia reticulata	H
Heliconia spathocircinnata cf.	H
Heliconia sp.	H
MYRISTICACEAE	
Otoba gordoniifolia	T
Otoba sp.	T
Virola dixonii	T
Virola sp., coco	T
MYRSINACEAE	
Ardisia sp.	S
MYRTACEAE	
Calyptranthes sp.	S
Campomanesia sp.	T
Eugenia sp., guayabo	T
OLACACEAE	
Heisteria sp.	T
ONAGRACEAE	
Ludwigia sp.	H
ORCHIDACEAE	
Erythrodes ecuadorensis cf.	H
Erythrodes maculata	H
Gongora sp.	E
Lepanthes sp.	E
Oncidium sp.	E
Palmorchis sp.	H
Pleurothallis sp.	E

Stigmatostalix adamsii cf.	E
Vanilla sp.	V
? sp. 1	H
? sp. 2	H
? sp. 3	E
? sp. 4	H
OXALIDACEAE	
Oxalis sp.	H
PALMAE	
Aiphanes sp.	S
Astrocaryum standleyanum	T
Bactris sp. 1	T
Bactris sp. 2	S
Catoblastus sp.	T
Desmoncus sp.	V
Geonoma sp. 1	S
Geonoma sp. 2	S
Jessenia batahua	T
Phytelephas aequatorialis, tagua	T
Prestoea sp.	T
Socratea exorrhiza	T
Synechanthus sp.	S
PASSIFLORACEAE	
Passiflora macrophylla	S
Passiflora palenquensis	V
Passiflora sp.	V
PHYTOLACCACEAE	
Phytolacca rivinoides cf.	H
PIPERACEAE	
Peperomia sp. 1	E
Peperomia sp. 2	E
Peperomia sp. 3	E
Piper augustum	S
Piper brachypodum	V
Piper obliquum	S

Piper reticulatum	S
Piper sp. 1	V
Piper sp. 2	S
Piper sp. 3	S
Piper sp. 4	S
Piper sp. 5	S
Pothomorphe peltata	H
Trianaeopiper sp.	H
POLYGALACEAE	
Moutabea sp.	V
POLYGONACEAE	
Coccoloba sp. 1	T
Coccoloba sp. 2	T
PONTEDERIACEAE	
Heteranthera sp.	H
PTERIDOPHYTA	
Adiantum sp. 1	H
Adiantum sp. 2	H
Adiantum sp. 3	H
Adiantum sp. 4	H
Bolbitis pandurifolia	H
Cyathea conjugata	H
Danaea moritziana cf.	H
Danaea sp.	H
Dicranopteris sp.	V
Didymoclaena truncatula	H
Elaphoglossum sp.	H
Hymenophyllum sp.	H
Lomariopsis sp.	E
Olfersia japurensis	E
Polybotrya altescandens	E
Polybotrya polybotryoides	E
Polypodium sp.	E
Pteris sp.	H
Selaginella haematodes	H
Selaginella sp.	H
Tectaria incisa (fuzzy)	H
Tectaria sp.	H
Trichomanes sp. 1	H
Trichomanes sp. 2	E
(Tree Fern) sp.	S
RUBIACEAE	
Alibertia stenantha	S
Amaioua corymbosa	T
Amphidaysa ambigua	H
Borreria laevis cf.	H
Cephaelis sp.	S
Chiococca sp.	S
Coussarea sp.	T
Faramea sp.	S
Genipa sp.	T
Gonzalagunia sessilifolia cf.	S
Guettarda sp.	T
Hamelia calycosa	T
Isertia hypoleuca	T
Ixora? sp.	T
Palicourea sp.	S
Pentagonia macrophylla cf.	S
Pentagonia williamsii	S
Posoqueria maxima	T
Psychotria macrophylla	S
Psychotria uliginosa	S
Psychotria sp. 1	T
Psychotria sp. 2	S
Psychotria sp. 3	S
Rondeletia sp.	T
SAPINDACEAE	
Allophylus psilospermus	S
Matayba sp. 1	T
Matayba sp. 2	T

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 14

Cabeceras de Bilsa

Paullinia sp.	V
Talisia sp. 1	S
Talisia sp. 2	T
SAPOTACEAE	
Micropholis sp.	T
Pouteria capaciflora	T
Pouteria torta cf.	T
Pouteria sp. 1	T
Pouteria sp. 2	T
SIMAROUBACEAE	
Picramnia latifolia	S
SMILACACEAE	
Smilax sp.	V
SOLANACEAE	
Cestrum sp.	S
Cyphomandra hartwegii cf.	S
Lycianthes sp.	V
Solanum styracoides	S
Witheringia sp. 1	S
Witheringia sp. 2	H
STAPHYLEACEAE	
Turpinia occidentalis	T
STERCULIACEAE	
Herrania balaensis cf.	S
THEOPHRASTACEAE	
Clavija sp., huevo de tigre	S
THYMELEACEAE	
? sp.	S
ULMACEAE	
Trema integerrima	T
UMBELLIFERAE	
Hydrocotyle sp.	H
URTICACEAE	
Pilea pubescens cf.	H
Urera baccifera, ortiguilla	S
Urera sp.	S
VERBENACEAE	
Aegiphila alba, savaluca, manteco	T
VIOLACEAE	
Rinorea sp.	T
VITACEAE	
Cissus neei	V
Cissus sp. 1	V
Cissus sp. 2	V
ZINGIBERACEAE	
Costus lima	H
Costus sp. 1	H
Costus sp. 2	H

Plant List: Cerro Pata de Pájaro

APPENDIX 15

Robin B. Foster

Wet Forest

ACANTHACEAE	
Pseuderanthemum sp.	S
APOCYNACEAE	
Prestonia sp.	V
ARACEAE	
Anthurium scandens cf.	E
Anthurium sp. 1	E
Anthurium sp. 2	H
Anthurium sp. 3	E
Anthurium sp. 4	E
Anthurium sp. 5	E
Anthurium sp. 6	E
Anthurium sp. 7	H
Anthurium sp. 8	E
Anthurium sp. 9	E
Dieffenbachia sp.	H
Philodendron verrucosum	E
Philodendron sp.	E
Stenospermation sp.	E
Xanthosoma sagittifolium	H
Xanthosoma sp.	H
ARALIACEAE	
Schefflera sp. 1	E
Schefflera sp. 2	E
ASCLEPIADACEAE	
? sp. 1	V
? sp. 2	V
BEGONIACEAE	
Begonia sp.	E
BIGNONIACEAE	
Schlegelia sp.	E
Tabebuia sp.	T
BOMBACACEAE	
Pseudobombax sp.	T
BORAGINACEAE	
Tournefortia gigantifolia	S
Tournefortia sp.	S
BROMELIACEAE	
Guzmania sp.	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
? sp. 4	E
BRUNELLIACEAE	
Brunellia sp.	T
CAMPANULACEAE	
Burmeistra sp.	E
CARICACEAE	
Carica sp.	S
COMPOSITAE	
Wulffia sp.	V
CUCURBITACEAE	
Gurania spinulosa	V
Gurania sp.	V
CYCLANTHACEAE	
Cyclanthus bipartitus	H
? sp.	E
CYPERACEAE	
Rhynchospora sp.	H
DILLENIACEAE	
Saurauia sp.	S
ELAEOCARPACEAE	
Sloanea sp.	T
ERICACEAE	
Sphaerospermum sp.	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
? sp. 4	E

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 15

Cerro Pata de Pájaro

EUPHORBIACEAE	
Hyeronima cf. sp.	T
GESNERIACEAE	
Besleria sp.	S
Columnea sp. 1	E
Columnea sp. 2	E
Monopyle sp.	H
? sp. 1	E
? sp. 2	H
? sp. 3	S
? sp. 4	S
GRAMINEAE	
Panicum maximum	H
GUTTIFERAE	
Clusia sp.	E
Tovomita sp.	T
ICACINACEAE	
Calatola costaricensis cf.	T
LAURACEAE	
? sp.	T
LECYTHIDACEAE	
Eschweilera sp.	T
Gustavia serrata	S
LEGUMINOSAE-CAESALPINIOIDEAE	
Bauhinia sp.	T
Brownea disepala	T
LEGUMINOSAE-MIMOSOIDEAE	
Entada monostachya	V
Inga sp. 1	T
Inga sp. 2	T
Inga sp. 3	T
LOGANIACEAE	
Spigelia sp.	H
MARANTACEAE	
Calathea inocephala	H
Calathea sp.	H
MARCGRAVIACEAE	
Marcgravia sp.	V
MELASTOMATACEAE	
Adelobotrys sp.	E
Blakea sp.	E
Clidemia sp. 1	S
Clidemia sp. 2	S
Conostegia sp.	S
Leandra sp.	S
Triolena sp.	H
MELIACEAE	
Carapa guianensis	T
Guarea glabra cf.	T
Trichilia quadrijuga	T
MENISPERMACEAE	
Cissampelos sp.	V
MORACEAE	
Cecropia sp.	T
Ficus tonduzii	T
Ficus sp. 1	T
Ficus sp. 2	T
Maquira sp.	T
MUSACEAE	
Heliconia curtispatha	H
Heliconia sp.	H
MYRSINACEAE	
Cybianthus sp.	S
? sp.	S
MYRTACEAE	
Myrcia sp.	S
ORCHIDACEAE	
Epidendrum sp. 1	E
Epidendrum sp. 2	E
Epidendrum sp. 3	E

Scaphyglottis sp.	E
Sobralia sp.	E
Stelis sp. 1	E
Stelis sp. 2	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
PALMAE	
Aiphanes sp.	S
Bactris sp.	T
Catoblastus sp.	T
Chamaedorea sp.	S
Geonoma interrupta	S
Geonoma sp.	S
Jessenia bataua	T
PAPAVERACEAE	
Bocconia pearcei	S
PASSIFLORACEAE	
Passiflora macrophylla	S
Passiflora sp.	V
PIPERACEAE	
Peperomia sp. 1	H
Peperomia sp. 2	H
Peperomia sp. 3	S
Peperomia sp. 4	E
Piper obliquum	S
Piper sp.	S
POLYGALACEAE	
Securidaca (possibly new)	S
POLYGONACEAE	
Coccoloba coronata cf.	T
Coccoloba sp.	T
PTERIDOPHYTA	
Adiantum sp.	H
Danaea sp.	H

Elaphoglossum crinitum	E
Elaphoglossum sp. 1	E
Elaphoglossum sp. 2	E
Selaginella sp. 1	H
Selaginella sp. 2	H
Selaginella sp. 3	H
? sp. 1	E
? sp. 2	E
? sp. 3	H
? sp. 4	E
? sp. 5	S
? sp. 6	E
RUBIACEAE	
Cephaelis (Psychotria) sp.	S
Ladenbergia pavonii	T
Palicourea sp.	S
Pentagonia sp.	S
Posoqueria sp.	T
Psychotria macrophylla aff.	S
Rondeletia sp.	T
SABIACEAE	
Meliosma cf. sp.	T
SAPINDACEAE	
Matayba sp.	T
Paullinia sp.	V
SAPOTACEAE	
Pouteria sp.	T
SIMAROUBACEAE	
Picramnia sp.	S
SMILACACEAE	
Smilax sp.	V
SOLANACEAE	
Solanum sp.	S
STAPHYLEACEAE	
Turpinia occidentalis	T

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 15

Cerro Pata de Pájaro

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
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VERBENACEAE	
Aegiphila cf. sp.	T
ZINGIBERACEAE	
Costus pulverulentus	H

Plant List: Tabuga-Río Cuaque

APPENDIX 16

Robin B. Foster

Moist Forest

ACANTHACEAE	
Ruellia sp.	S
ANACARDIACEAE	
Spondias mombin	T
ANNONACEAE	
Annona sp.	S
APOCYNACEAE	
Prestonia sp.	V
ARACEAE	
Anthurium sp. 1	E
Anthurium sp. 2	E
Monstera sp.	E
Philodendron barrosoanum cf.	E
Philodendron sp.	E
Syngonium sp.	E
BOMBACACEAE	
Ochroma pyramidale	T
Pochota (Bombacopsis) trinitensis	T
Pseudobombax millei	T
Quararibea asterolepis	T
BROMELIACEAE	
Tillandsia usneoides	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
CAPPARIDACEAE	
Capparis frondosa	S
Morisonia sp.	T
COCHLOSPERMACEAE	
Cochlospermum vitifolium	T
COMPOSITAE	
Lycoseris trinervis	V
CUCURBITACEAE	
Cayaponia sp.	V
CYCADACEAE	
Zamia lindenii	S
ELAEOCARPACEAE	
Muntingia calabura	T
ERYTHROXYLACEAE	
Erythroxylum patens	S
EUPHORBIACEAE	
Adelia triloba	T
Manihot leptophylla cf.	S
GRAMINEAE	
Rhipidocladum sp.	S
Streptogyne sp.	H
GUTTIFERAE	
Garcinia (Rheedia) intermedia (edulis)	T
LECYTHIDACEAE	
Gustavia pubescens	S
LEGUMINOSAE-CAESALPINIOIDEAE	
Brownea angustiflora	T
Haematoxylon cf. sp.	S
LEGUMINOSAE-MIMOSOIDEAE	
Acacia riparia cf.	V
Inga sp. 1	T
Inga sp. 2	T
Inga sp. 3	T
Inga sp. 4	T
Inga sp. 5	T
LEGUMINOSAE-PAPILIONOIDEAE	
Centrolobium ochroxylum	T
Lonchocarpus cf. sp.	T
Swartzia simplex s.l.	S
MALPIGHIACEAE	
? sp.	V
MALVACEAE	
Malvaviscus sp. 1	V
Malvaviscus sp. 2	S

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 16

Tabuga - Río Cuaque

MARANTACEAE	
Ischnosiphon sp.	H
MELIACEAE	
Guarea glabra	T
Trichilia elegans	T
Trichilia pallida	T
MORACEAE	
Brosimum alicastrum	T
Brosimum guianense	T
Castilla elastica cf.	T
Cecropia peltata cf.	T
Clarisia racemosa	T
Coussapoa eggersii (villosa)	T
Ficus citrifolia cf.	T
Ficus trigonata	T
Ficus sp.	T
Sorocea sarcocarpa cf.	S
MYRSINACEAE	
Stylogyne sp.	S
MYRTACEAE	
Eugenia galalonensis	T
Eugenia sp.	T
NYCTAGINACEAE	
Neea sp.	S
Pisonia aculeata	V
OLACACEAE	
Heisteria sp.	T
ORCHIDACEAE	
Lockhartia sp.	E
PALMAE	
Aiphanes sp.	S
Attalea colenda	T
Syagrus sancona	T
PASSIFLORACEAE	
Passiflora sp. 1	V
Passiflora sp. 2	V
Passiflora sp. 3	V
Passiflora sp. 4	V
PIPERACEAE	
Piper laevigatum	S
Piper sp.	S
POLYGONACEAE	
Coccoloba sp. 1	V
Coccoloba sp. 2	T
PTERIDOPHYTA	
Adiantum sp.	H
Cyclopeltis semicordata	H
Tectaria incisa	H
RHAMNACEAE	
Gouania sp.	V
RUBIACEAE	
Alseis sp.	T
Chomelia sp.	S
Faramea occidentalis	S
Genipa americana	T
Geophila sp.	H
Guettarda sp.	T
Psychotria horizontalis	S
Psychotria sp.	S
Randia sp.	S
Rudgea sp.	S
RUTACEAE	
Zanthoxylum sp.	T
SAPINDACEAE	
Cupania sp.	T
Matayba sp.	T
Paullinia sp. 1	V
Paullinia sp. 2	V
Paullinia sp. 3	V
Talisia setigera	S

SAPOTACEAE	
Pouteria sp.	T
SMILACACEAE	
Smilax sp.	V
STERCULIACEAE	
Byttneria sp.	V
Guazuma pubescens	T
THEOPHRASTACEAE	
Clavija eggersii	S
TURNERACEAE	
Turnera sp.	S
ULMACEAE	
Ampelocera sp.	T
Celtis iguanea cf.	V
Celtis schippii	T
URTICACEAE	
Pilea sp.	H
VIOLACEAE	
Rinorea sp.	S
? sp.	V

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 17

Plant List: Parque Nacional Machalilla

Robin B. Foster, Alwyn H. Gentry, Carmen Josse

Fog Forest

ACANTHACEAE	
Dicliptera sp.	V
Justicia sp.	S
AMARANTHACEAE	
Chamissoa altissima	V
Iresine sp.	V
? sp. 1	H
? sp. 2	H
AMARYLLIDACEAE	
Bomarea obovata cf.	V
ANACARDIACEAE	
Tapirira sp., cativo	T
ANNONACEAE	
Raimondia quinduensis, anonilla	T
APOCYNACEAE	
Aspidosperma sp.	T
Mandevilla veraguasensis	V
Rauvolfia littoralis, contra blanca, muñequito	T
Tabernaemontana sp., lechoso	T
ARACEAE	
Anthurium scandens	E
Anthurium (sect. *Belolonchium*) sp.	E
Anthurium sp. nov. (aff. *ovalifolium*)	E
Anthurium sp. 1	E
Anthurium sp. 2	E
Anthurium sp. 3	E
Dieffenbachia sp. nov.	H
Monstera dubia	E
Monstera lechleriana	E
Philodendron purpureoviride	E
Philodendron sp. 1	E
Philodendron sp. 2	E
Philodendron sp. 3	E
Syngonium macrophyllum	E
Xanthosoma sagittifolium	H
ARALIACEAE	
Dendropanax sp., papayo	T
Schefflera sp.	T
ASCLEPIADACEAE	
Gonolobus sp.	V
? sp.	V
BEGONIACEAE	
Begonia glabra	H
Begonia sp. 1	H
Begonia sp. 2	H
Begonia sp. 3	H
BIGNONIACEAE	
Amphilophium paniculatum	V
Anemopaegma chrysanthum	V
Pithecoctenium crucigerum	V
Tabebuia chrysantha, guayacán	T
BOMBACACEAE	
Ochroma pyramidale, balsa	T
Quararibea grandifolia	T
BORAGINACEAE	
Cordia sp., totumbo	T
Tournefortia sp.	V
BROMELIACEAE	
Guzmania monostachya	E
Guzmania sp.	E
Puya sp.	H
Tillandsia narthecoides	E
Tillandsia usneoides	E
Vriesia sp.	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
? sp. 4	E

? sp. 5	E
CAMPANULACEAE	
Burmeistra sp. 1	H
Burmeistra sp. 2	E
CAPPARIDACEAE	
Capparis sp.	T
Morisonia sp., sapote	T
Podandrogyne brevipedunculata	H
Podandrogyne sp.	H
CAPRIFOLIACEAE	
Viburnum sp.	V
CARICACEAE	
Carica sp.	S
CARYOPHYLLACEAE	
Drymaria cordata	H
CELASTRACEAE	
Perrottetia sessiliflora	T
COMBRETACEAE	
Combretum sp.	V
COMMELINACEAE	
Phyodinia? gracilis	H
COMPOSITAE	
Baccharis trinervis	S
Eupatorium sp., negrito	T
Hebeclinium macrophyllum	S
Hidalgoa ternata	V
Liabum sp.	S
Mikania sp.	V
Vernonia? sp.	T
Wulffia sp.	V
? sp. 1	H
? sp. 2	S
? sp. 3	H
CONVOLVULACEAE	
Ipomoea sp.	V

CUCURBITACEAE	
Gurania spinulosa	V
Melothria sp.	V
? sp. 1	V
? sp. 2	V
CYCLANTHACEAE	
Asplundia sp.	H
Sphaeradenia sp.	H
DIOSCOREACEAE	
Dioscorea sp.	V
ERICACEAE	
Sphaerospermum sp.	E
EUPHORBIACEAE	
Acalypha diversifolia	S
Alchornea iracurana	T
Margaritaria nobilis	T
Phyllanthus sp.	H
Sapium sp.	T
Tetrorchidium sp.	T
FLACOURTIACEAE	
Casearia mariquitensis cf., chirimoyo de monte	T
GESNERIACEAE	
Alloplectus dodsonii cf.	H
Columnea sp. 1	H
Columnea sp. 2	E
Columnea sp. 3	E
Drymonia sp. 1	H
Drymonia sp. 2	E
GRAMINEAE	
Guadua sp.	T
? sp. 1	H
? sp. 2	H
? sp. 3	H

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 17

Machalilla

GUTTIFERAE	
Clusia sp.	E
Garcinia (Rheedia) sp.	T
HERNANDIACEAE	
Hernandia sp.	T
HIPPOCRATEACEAE	
Salacia sp., pomarrosa de monte	V
LABIATAE	
Hyptis sp.	H
Salvia alvajaca	H
LAURACEAE	
Endlicheria sp., jigua blanca	T
Ocotea cernua, jigua menuda	T
Ocotea sp. 1, cedro	T
Ocotea sp. 2, jigua prieta	T
Ocotea sp. 3	T
Ocotea sp. 4	T
Phoebe? sp., jigua blanca	T
? sp. 1	T
? sp. 2, maría aguatilla	T
LECYTHIDACEAE	
Grias peruviana	T
LEGUMINOSAE-CAESALPINIOIDEAE	
Bauhinia sp.	T
Senna (Cassia) sp.	S
LEGUMINOSAE-MIMOSOIDEAE	
Inga chartacea	T
Inga corruscans	T
Inga leiocalycina	T
Inga punctata cf.	T
Inga sp. 1	T
Inga sp. 2	T
Inga sp. 3	T
LEGUMINOSAE-PAPILIONOIDEAE	
Canavalia sp.	V
Dioclea sp.	V
Dussia sp.	T
Erythrina megistophylla	S
Ormosia sp.	T
Phaseolus sp.	V
? sp.	V
LOGANIACEAE	
Buddleja americana	S
LORANTHACEAE	
Oryctanthus sp.	E
LYTHRACEAE	
Cuphea sp.	H
MALPIGHIACEAE	
Bunchosia sp., jobo fraile	T
Hiraea sp.	V
Mascagnia nervosa	V
MALVACEAE	
Pavonia rosea	H
Sida sp.	H
MARANTACEAE	
Calathea insignis	H
Calathea sp.	H
Maranta sp.	H
MARCGRAVIACEAE	
Marcgravia sp.	V
MELASTOMATACEAE	
Arthrostemma sp.	V
Blakea subconnata	E
Miconia sp.	T
Ossaea micrantha	S
Ossaea sp.	S
Topobea sp.	V
MELIACEAE	
Carapa guianensis	T
Cedrela sp.	T

Guarea guidonia	T
Guarea sp. 1	T
Guarea sp. 2	T
Ruagea sp. 1	T
Ruagea sp. 2	T
Trichilia solitudinus	T
Trichilia sp. 1	T
Trichilia sp. 2	T
MENISPERMACEAE	
Cissampelos sp.	V
? sp.	V
MONIMIACEAE	
Siparuna sp.	S
MORACEAE	
Cecropia angustifolia, guarumo	T
Cecropia insignis, guarumo	T
Cecropia obtusifolia ssp. *burriada,* guarumo	T
Ficus cuatrecasana, matapalo	T,E
Ficus maxima, higuerón tostada	T
Ficus sp., matapalo	T,E
Poulsenia armata	T
MUSACEAE	
Heliconia latispatha	H
Heliconia sp.	H
MYRSINACEAE	
Ardisia longistaminea	S
Ardisia sp. 1	T
Ardisia sp. 2	S
Cybianthus sp.	S
Parathesis? sp.	T
Stylogyne standleyi cf.	S
MYRTACEAE	
Calyptranthes sp.	S
Eugenia fallax	T
Eugenia sp.	T
Psidium acutangulum cf.	T
ORCHIDACEAE	
Erythrodes sp.	H
Oncidium sp. 1	E
Oncidium sp. 2	E
Oncidium sp. 3	E
Pleurothallis sp.	E
Sobralia sp.	E
Stelis sp.	E
? sp.	E
PALMAE	
Astrocaryum standleyanum	T
Bactris sp.	T
Chamaedorea polyclada	S
Chamaedorea sp.	S
Geonoma sp.	T
Phytelephas aequatorialis, tagua	T
Prestoea sp.	T
PASSIFLORACEAE	
Passiflora capsularis	V
Passiflora macrophylla	S
Passiflora sp. 1	V
Passiflora sp. 2	V
PHYTOLACCACEAE	
Petiveria alliacea	H
Phytolacca sp.	T
Schindleria? sp.	H
Trichostigma octandra	V
PIPERACEAE	
Peperomia sp. 1	E
Peperomia sp. 2	E
Peperomia sp. 3	E
Peperomia sp. 4	H
Peperomia sp. 5	E

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 17

Machalilla

Peperomia sp. 6	E
Piper obliquum	S
Piper sp. 1	S
Piper sp. 2	S
Piper sp. 3	S
Pothomorphe umbellata	H
POLYGALACEAE	
Securidaca sp.	V
POLYGONACEAE	
Triplaris cumingiana, fernán sánchez, muchín	T
PONTEDERIACEAE	
Heteranthera sp.	H
PTERIDOPHYTA	
Adiantum sp.	H
Asplenium serratum	H
Asplenium sp.	H
Microgramma fuscopunctata	E
Nephrolepis sp.	E
Polypodium sp.	E
Selaginella sp.	H
Tectaria incisa (fuzzy)	H
(Tree Fern) sp.	H
RANUNCULACEAE	
Clematis sp.	V
ROSACEAE	
Prunus subcorymbosa, mamecillo	T
RUBIACEAE	
Borojoa clavifera	T
Hillia parasitica	E
Hoffmannia sp.	S
Isertia hypoleuca	T
Palicourea sp.	S
Pentagonia macrophylla cf.	S
Psychotria macrophylla	S
Psychotria sp. 1	S
Psychotria sp. 2	S
Randia sp. 1	T
Randia sp. 2	S
RUTACEAE	
Zanthoxylum sp. 1	T
Zanthoxylum sp. 2, piñuelo	T
SAPINDACEAE	
Allophylus sp., contra, castaño	T
Cupania sp., maría macho	T
Matayba sp.	T
Paullinia sp. 1	V
Paullinia sp. 2	V
Talisia setigera	S
SAPOTACEAE	
Chrysophyllum argenteum	T
Pouteria sp.	T
SCROPHULARIACEAE	
Scoparia dulcis	H
SIMAROUBACEAE	
? sp., jobero	T
SOLANACEAE	
Browallia sp.	H
Cestrum sp.	T
Cuatrecasia sp.	S
Cyphomandra sp.	S
Lycianthes sp. 1	H
Lycianthes sp. 2	V
Lycianthes sp. 3	S
Markea sp.	E
Solanum lanciifolium	V
Witheringia sp.	S
STAPHYLEACEAE	
Turpinia occidentalis	T

STERCULIACEAE	
Guazuma ulmifolia, guasmo	T
THEOPHRASTACEAE	
Clavija eggersii, huevo de tigre	T
TILIACEAE	
Heliocarpus americanus	T
TROPAEOLACEAE	
Tropaeolum repandum	V
ULMACEAE	
Celtis iguanea	T
URTICACEAE	
Myriocarpa stipitata	T
Pilea sp. 1	H
Pilea sp. 2	H
Urera caracasana	S
? sp.	H
VERBENACEAE	
Aegiphila alba, savaluca, manteco	T
Cornutia microcalycina	T
Vitex gigantea, pechiche	T
VITACEAE	
Cissus sp. 1	V
Cissus sp. 2	V
Vitis tiliifolia	V
ZINGIBERACEAE	
Costus sp.	H
Renealmia oligosperma	H
Renealmia sp.	H

Dry Forest

AGAVACEAE	
Furcraea sp.	H
AMARANTHACEAE	
Chamissoa altissima	V
Iresine sp., bejuco negra	V
ANACARDIACEAE	
Loxopterygium huasango, huasango	T
Tapirira sp. 1	T
Tapirira sp. 2	T
ANNONACEAE	
Annona sp.	S
Raimondia quinduensis, anonilla	T
APOCYNACEAE	
Prestonia mollis	V
Rauvolfia littoralis, contra blanca, muñequito	T
Tabernaemontana amygdalifolia, lechoso	T
Vallesia sp., perlilla	S
ARACEAE	
Anthurium interruptum	E
Anthurium napaeum	H
Anthurium sp.	H
ASCLEPIADACEAE	
Asclepias curassavica	H
BIGNONIACEAE	
Amphilophium ecuadorense	V
Anemopaegma chrysanthum	V
Clytostoma sp. 1	V
Clytostoma sp. 2	V
Cydista decora	V
Delostoma gracile	S
Macfadyena unguis-cati	V
Macranthisiphon longiflorus	V
Mansoa hymenaea	V
Mansoa verrucifera	V
Paragonia pyramidata	V
Tabebuia chrysantha, guayacán	T
BOMBACACEAE	
Ceiba trichistandra, ceibo	T

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 17

Machalilla

Eriotheca ruizii, jaile, chirigua	T
Pachira sp.	T
Pochota (Bombacopsis) trinitensis, jolote	T
BORAGINACEAE	
Cordia alliodora, laurel	T
Cordia lutea, muyuyo	S
Cordia sp. 1	T
Cordia sp. 2	T
Cordia sp. 3	T
Tournefortia microcalyx	V
Tournefortia sp. 1	V
Tournefortia sp. 2	S
BROMELIACEAE	
Aechmea magdalenae	H
Bromelia sp.	H
Tillandsia usneoides	E
Tillandsia sp. 1	E
Tillandsia sp. 2	E
Tillandsia sp. 3	E
Tillandsia sp. 4	E
? sp. 1	E
? sp. 2	E
CACTACEAE	
Hylocereus sp.	V
Opuntia sp.	S
? sp. 1	V
? sp. 2	S
? sp. 3	E
CAPPARIDACEAE	
Capparis ecuadorica	S
Capparis heterophylla	S
Capparis sp. 1	T
Capparis sp. 2	T
Capparis sp. 3	S
Capparis sp. 4	S
Capparis sp. 5	T
Morisonia americana, sapote	T
CARICACEAE	
Carica parviflora, rabo de gallo	S
Carica sp.	S
CELASTRACEAE	
Maytenus sp., morito	T
COCHLOSPERMACEAE	
Cochlospermum vitifolium, botitillo	T
COMMELINACEAE	
? sp.	H
COMPOSITAE	
Baccharis trinervis	V
Barnadesia? sp., sobretana	S
Clibadium sp.	S
Mikania sp.	V
Tessaria integrifolia	S
Vernonia sp., chirca	S
Vernonia? sp., chilca blanca	T
? sp.	H
EBENACEAE	
Diospyros sp.	T
ERYTHROXYLACEAE	
Erythroxylum patens	S
Erythroxylum sp.	T
EUPHORBIACEAE	
Adelia triloba	S
Croton sp. 1	S
Croton sp. 2	T
Euphorbia sp.	S
Jatropha curcas, piñón	S
? sp.	T
FLACOURTIACEAE	
Casearia sylvestris	T

Casearia sp.	T
Xylosma sp., negrito	T
GRAMINEAE	
Bambusa angustifolia	T
Gynerium sagittifolium	S
GUTTIFERAE	
Clusia sp. 1	E
Clusia sp. 2	S
HIPPOCRATEACEAE	
Salacia sp.	V
LAURACEAE	
Ocotea cernua, jigua menuda	T
? sp., jigua prieta	T
LECYTHIDACEAE	
Gustavia pubescens, membrillo	S
LEGUMINOSAE-CAESALPINIOIDEAE	
Caesalpinia sp. 1	T
Caesalpinia sp. 2	T
Cynometra sp., cocobolo colorado	T
Senna (Cassia) sp.	S
LEGUMINOSAE-MIMOSOIDEAE	
Acacia sp. 1	T
Acacia sp. 2	T
Albizia guachapele, guachapelí	T
Inga acrocephala	T
Inga chartacea	T
Inga corruscans	T
Inga lindeniana, guabo sambo	T
Inga sapindoides	T
Inga sp. 1	T
Inga sp. 2	T
Leucaena? sp., mihán	T
Mimosa pigra	S
Pithecellobium paucipinnata, dormilón	T
Pithecellobium rufescens, vaina roja	T
Pithecellobium sp., porotillo	T
Prosopis juliflora, algarrobo	T
LEGUMINOSAE-PAPILIONOIDEAE	
Geoffroea sp., seca	T
Lonchocarpus? sp.	T
Machaerium millei, cabo de hacha	V
Machaerium sp.	V
Mucuna sp.	V
Myroxylon balsamum, bálsamo	T
Platymiscium sp.	T
Pterocarpus? sp., palo sangre	T
LOGANIACEAE	
Buddleja americana	S
MALPIGHIACEAE	
Heteropsis sp.	V
Mascagnia nervosa	V
Stigmaphyllon sp., bejuco de hueso	V
? sp.	V
MALVACEAE	
? sp.	S
MARANTACEAE	
Maranta gibba	H
MARCGRAVIACEAE	
Souroubea sp.	V
MELIACEAE	
Guarea sp.	T
Trichilia elegans	T
Trichilia hirta	T
Trichilia pallida	T
Trichilia pleeana cf.	T
Trichilia sp. 1, canelo	T
Trichilia sp. 2, canelo	T
MENISPERMACEAE	
? sp.	V

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 17

Machalilla

MORACEAE	
Brosimum alicastrum, tillo blanco	T
Castilla elastica	T
Cecropia obtusifolia ssp. *burriada,* guarumo	T
Cecropia sp., guarumo	T
Ficus cuatrecasana, matapalo	T,E
Ficus obtusifolia, matapalo	T,E
Ficus trigonata, matapalo	T,E
Ficus yoponensis	T
Ficus sp. 1	T
Ficus sp. 2, matapalo	T,E
Maclura (Chlorophora) tinctoria	T
MUSACEAE	
Heliconia latispatha	H
MYRTACEAE	
Eugenia sp.	T
Myrcia fallax cf., arrayán	T
Myrcia sp.	T
? sp. 1, guayabo blanco	T
? sp. 2, guayabo sabanero	S
? sp. 3	T
? sp. 4, arrayán	T
NYCTAGINACEAE	
Guapira sp. 1	T
Guapira sp. 2, negrito	T
Neea sp.	S
Pisonia aculeata	V
OLACACEAE	
Ximenia sp.	S
? sp., limoncillo	T
OLEACEAE	
Chionanthus sp., francisco	T
ORCHIDACEAE	
Oncidium obryzatum cf.	E
Pleurothallis sp.	E
PALMAE	
Phytelephas aequatorialis, tagua	T
PASSIFLORACEAE	
Passiflora macrophylla	S
PHYTOLACCACEAE	
Gallesia integrifolia, ajo	T
Phytolacca sp.	T
PIPERACEAE	
Pothomorphe peltata	H
PLUMBAGINACEAE	
Plumbago scandens	V
POLYGALACEAE	
Securidaca sp.	V
POLYGONACEAE	
Coccoloba sp. 1, licuanco	T
Coccoloba sp. 2, licuanco blanco	T
Triplaris cumingiana, fernán sánchez, muchín	T
PONTEDERIACEAE	
Eichornia sp.	H
RHAMNACEAE	
Gouania sp., bejuco menthol	V
Zizyphus thyrsiflora, ébano	T
RUBIACEAE	
Alseis sp., palo de vaca de montaña	T
Simira sp., colorado	T
? sp.	T
RUTACEAE	
Amyris sp., chiquinay	T
Zanthoxylum sp. 1	T
Zanthoxylum sp. 2	T
SAPINDACEAE	
Allophylus sp.	S
Allophylus? sp., contra	T

Cupania sp. 1	T
Cupania sp. 2	T
Paullinia alata	V
Paullinia sp. 1	V
Paullinia sp. 2	V
Sapindus saponaria, jaboncillo	T
Talisia sp.	T
Thinouia sp.	V
SAPOTACEAE	
Pouteria sp. 1, caimitillo	T
Pouteria sp. 2, naranja de vaca	T
Pradosia sp., paipay	T
SMILACACEAE	
Smilax febrifuga	V
SOLANACEAE	
Acnistis frutescens	S
Cestrum sp.	S
Cuatrecasia sp.	S
Cyphomandra sp.	S
Lycianthes sp.	V
Nicotiana sp.	H
Solanum caricaefolium	S
? sp.	E
STERCULIACEAE	
Guazuma tomentosa	T
THEOPHRASTACEAE	
Clavija eggersii, huevo de tigre	S
Clavija sp., huevo de tigre	S
Jacquinia pubescens, barbasco	S
ULMACEAE	
Ampelocera sp., camarón	T
Celtis iguanea	V
Celtis sp.	T
UMBELLIFERAE	
Hydrocotyle sp.	H
URTICACEAE	
Myriocarpa stipitata	T
Urera sp., pachón hoja ancha	S
VERBENACEAE	
Aegiphila alba, savaluca, manteco	T
Vitex gigantea, pechiche	T
VIOLACEAE	
Rinorea sp.	S
VITACEAE	
Cissus sp., rasca mano	V

Coastal Scrub

APOCYNACEAE	
Vallesia sp.	S
CAPPARIDACEAE	
Capparis angulata	T
Capparis avicennifolia	S
Capparis crotonoides	S
Capparis sp., sebastián	T
EUPHORBIACEAE	
Hippomane mancinella	T
GOODENIACEAE	
Scaevola plumieri	S
LEGUMINOSAE-MIMOSOIDEAE	
? sp.	T
NYCTAGINACEAE	
Cryptocarpa pyriformis	S
PORTULACACEAE	
Portulaca sp.	H
RHAMNACEAE	
Scutia sp.	S

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 18

Plant List: Cerro Blanco

Robin B. Foster, Alwyn H. Gentry, Carmen Josse

Dry Forest

ACANTHACEAE	
Aphelandra sp.	S
Dicliptera sp.	V
? sp.	H
ANACARDIACEAE	
Spondias mombin, jobo	T
Tapirira sp.	T
ANNONACEAE	
Anaxagorea sp.	S
Annona sp.	S
APOCYNACEAE	
Aspidosperma jaunechense	T
Stemmadenia obovata	S
ARACEAE	
Monstera dilacerata	E
Philodendron sp.	V
ARISTOLOCHIACEAE	
Aristolochia pilosa cf.	V
BIGNONIACEAE	
Anemopaegma puberulum	V
Arrabidaea corallina	V
Macfadyena unguis-cati	V
Mansoa hymenaea	V
Mansoa verrucifera	V
Pithecoctenium crucigerum	V
Tabebuia billbergii, madero negro	T
Tabebuia chrysantha, guayacán	T
BOMBACACEAE	
Cavanillesia platanifolia, pigio	T
Ceiba trichistandra, ceibo	T
Eriotheca ruizii, jaile, chirigua	T
Ochroma pyramidale, balsa	T
Pseudobombax milleii, beldaco	T
BORAGINACEAE	
Cordia sp. 1	T
Cordia sp. 2	T
Cordia sp. 3	T
BROMELIACEAE	
Tillandsia usneoides	E
CAPPARIDACEAE	
Capparis ecuadorica	S
Capparis frondosa	S
Capparis heterophylla	S
Cleome sp.	S
CARICACEAE	
Carica parviflora, rabo de gallo	S
COMBRETACEAE	
Combretum sp.	V
COMPOSITAE	
Adenostemma platyphyllum	H
Pseudogynoxys sp.	V
CUCURBITACEAE	
Cucurbita sp.	V
Luffa operculata	V
ELAEOCARPACEAE	
Muntingia calabura, niguito, frutillo	T
EUPHORBIACEAE	
Sapium utile	T
HIPPOCRATEACEAE	
Salacia sp.	S
? sp.	V
LAURACEAE	
Ocotea sp.	T
LECYTHIDACEAE	
Gustavia pubescens, membrillo	S
LEGUMINOSAE-CAESALPINIOIDEAE	
Bauhinia sp.	S
Cassia oxyphylla, vainillo	T

Senna (Cassia) sp.	S
LEGUMINOSAE-MIMOSOIDEAE	
Inga sp. 1	T
Inga sp. 2	T
LEGUMINOSAE-PAPILIONOIDEAE	
Canavalia sp.	V
Centrolobium ochroxylum	T
Clitoria sp.	V
Desmodium sp.	H
Erythrina sp.	T
MALPIGHIACEAE	
Mascagnia sp.	V
MELIACEAE	
Guarea sp.	T
Trichilia elegans	S
MORACEAE	
Brosimum alicastrum, tillo blanco	T
Castilla elastica	T
Cecropia sp., guarumo	T
Ficus glabrata cf.	T
Ficus obtusifolia, matapalo	T,E
Ficus trigonata, matapalo	T,E
Ficus yoponensis	T
Ficus sp. 1, matapalo	T,E
Ficus sp. 2, matapalo	T,E
MUSACEAE	
Heliconia sp.	H
MYRTACEAE	
? sp.	T
NYCTAGINACEAE	
Neea sp.	S
Pisonia aculeata	V
ORCHIDACEAE	
Cattleya sp.	E
PASSIFLORACEAE	
Passiflora macrophylla	S
Passiflora sprucei	V
Passiflora sp.	V
PIPERACEAE	
Piper arboreum	S
Piper sp. 1	S
Piper sp. 2	S
Pothomorphe peltata	S
Pothomorphe umbellata	S
POLYGONACEAE	
Triplaris cumingiana, fernán sánchez, muchín	T
PTERIDOPHYTA	
Adiantum sp. 1	H
Adiantum sp. 2	H
? sp.	H
RUBIACEAE	
Pogonopus speciosus	T
Psychotria carthaginensis cf.	S
Psychotria sp.	S
Randia sp., crucita	S
SAPINDACEAE	
Cupania sp.	T
Paullinia sp. 1	V
Paullinia sp. 2	V
Sapindus saponaria, jaboncillo	T
Serjania sp.	V
SAPOTACEAE	
Chrysophyllum argenteum	T
SOLANACEAE	
Acnistis arborescens, cojojo	S
Lycianthes sp.	S
Lycopersicon sp.	H
Solanum sp. 1	H

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 18

Cerro Blanco

Solanum sp. 2	H
STERCULIACEAE	
Byttneria catalpifolia	V
Guazuma tomentosa	T
ULMACEAE	
Celtis iguanea	V
Trema micrantha sapán de paloma, muchichilán	T
URTICACEAE	
Urera baccifera, ortiguilla	S
? sp.	S
VERBENACEAE	
Vitex gigantea, pechiche	T
VIOLACEAE	
Rinorea deflexa	S
VITACEAE	
Cissus sp.	V
ZINGIBERACEAE	
Costus sp. 1	H
Costus sp. 2	H

Plant List: Manta Real

APPENDIX 19

Robin B. Foster, Patricio Yanez

Wet and Cloud Forest

ACANTHACEAE	
Pseuderanthemum sp.	S
AMARYLLIDACEAE	
Bomarea sp.	V
APOCYNACEAE	
Mandevilla veraguasensis	V
Prestonia sp.	V
Tabernaemontana sp.	S
ARACEAE	
Anthurium sp. 1	E
Anthurium sp. 2	E
Anthurium sp. 3	H
Anthurium sp. 4	E
Anthurium sp. 5	E
Anthurium sp. 6	E
Anthurium sp. 7	E
Anthurium sp. 8	E
Anthurium sp. 9	E
Anthurium sp. 10	E
Anthurium sp. 11	E
Anthurium sp. 12	E
Anthurium sp. 13	E
Anthurium sp. 14	E
Anthurium sp. 15	E
Anthurium sp. 16	E
Anthurium sp. 17	E
Anthurium sp. 18	E
Anthurium sp. 19	E
Anthurium sp. 20	E
Anthurium sp. 21	E
Heteropsis integerrima	E
Monstera spruceana	E
Philodendron verrucosum	E
Philodendron sp. 1	E
Philodendron sp. 2	E
Rhodospatha latifolia cf.	E
Spathiphyllum sp.	H
Stenospermation longipetiolatum cf.	E
Stenospermation sp.	H
Syngonium sp. 1	E
Syngonium sp. 2	E
Xanthosoma sagittifolium	H
ARALIACEAE	
Schefflera sp.	E
ASCLEPIADACEAE	
Matelea sp.	V
BALANOPHORACEAE	
Helosis cayennensis	H
BEGONIACEAE	
Begonia glabra	H
BIGNONIACEAE	
Amphilophium paniculatum	V
Schlegelia darienensis cf.	V
Tabebuia chrysantha cf.	T
? sp.	V
BOMBACACEAE	
Ochroma pyramidale	T
Pseudobombax sp.	T
Quararibea asterolepis	T
Quararibea coloradorum	T
Quararibea cordata	T
Quararibea sp. 1	T
Quararibea sp. 2	E
BORAGINACEAE	
Cordia alliodora	T
Cordia sp. 1	T
Cordia sp. 2	T
Tournefortia sp. 1	S
Tournefortia sp. 2	E

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 19

Manta Real

Tournefortia sp. 3	V
BROMELIACEAE	
Billbergia sp.	E
Guzmania melinonis	E
Guzmania sp. 1	E
Guzmania sp. 2	E
Pitcairnea sp. 1	E
Pitcairnea sp. 2	E
Pitcairnea sp. 3	H
Tillandsia anceps	E
Tillandsia monadelpha cf.	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
? sp. 4	E
BURSERACEAE	
Tetragastris sp.	T
CAMPANULACEAE	
Burmeistra sp.	H
CAPPARIDACEAE	
Podandrogyne sp. 1	S
Podandrogyne sp. 2	S
CARICACEAE	
Carica sp. 1	S
Carica sp. 2	S
Jacaratia spinosa cf.	T
CELASTRACEAE	
Perrottetia sessiliflora	T
CHLORANTHACEAE	
Hedyosmum sp.	T
CHRYSOBALANACEAE	
Hirtella sp.	T
COMMELINACEAE	
Campelia zanonia	H

COMPOSITAE	
Clibadium grandifolium cf.	S
Mikania sp. 1	V
Mikania sp. 2	V
CONVOLVULACEAE	
Maripa sp.	V
CUCURBITACEAE	
Cayaponia sp.	V
Gurania spinulosa	V
Gurania sp. 1	V
Gurania sp. 2	V
CYCLANTHACEAE	
Asplundia sp. 1	E
Asplundia sp. 2	H
Cyclanthus bipartitus	H
? sp. 1	E
? sp. 2	E
? sp. 3	E
CYPERACEAE	
? sp. 1	H
? sp. 2	H
ELAEOCARPACEAE	
Sloanea meianthera cf.	T
ERICACEAE	
Psammisia cf. sp.	E
? sp. 1	V
? sp. 2	E
? sp. 3	E
EUPHORBIACEAE	
Acalypha diversifolia	S
Acalypha macrostachya cf.	S
Alchornea glandulosa cf.	T
Alchornea sp. 1	T
Alchornea sp. 2	T
Sapium peruvianum cf.	T

Sapium sp. 1	T
Sapium sp. 2	T
Tetrorchidium sp.	T
? sp.	T
FLACOURTIACEAE	
Casearia sp. 1	T
Casearia sp. 2	T
Lozania sp.	T
Pleuranthodendron lindenii	T
? sp.	T
GESNERIACEAE	
Alloplectus dodsonii	H
Alloplectus sp. 1	H
Alloplectus sp. 2	H
Besleria sp.	S
Columnea minor	E
Columnea sp. 1	S
Columnea sp. 2	H
Columnea sp. 3	E
Columnea sp. 4	E
Columnea sp. 5	H
Diastema sp. 1	H
Diastema sp. 2	H
Drymonia rhodoloma	E
Drymonia sp.	S
Gasteranthus sp.	H
Monopyle sp. 1	H
Monopyle sp. 2	H
? sp. 1	H
? sp. 2	S
? sp. 3	H
? sp. 4	S
GRAMINEAE	
Chusquea sp.	S
? sp.	H

GUTTIFERAE	
Calophyllum brasiliense	T
Calophyllum longifolium	T
Clusia venusta	E
Clusia sp. 1	T
Clusia sp. 2	T
Clusia sp. 3	E
Clusia sp. 4	V
Mammea cf. sp.	T
Marila cf. sp.	T
Tovomita sp. 1	T
Tovomita sp. 2	T
Vismia sp. 1	T
Vismia sp. 2	S
? sp. 1	S
? sp. 2	T
HAEMODORACEAE	
Xiphidium coeruleum	H
ICACINACEAE	
Citronella incarum	S
Metteniusa nucifera	T
LAURACEAE	
Aniba cf. sp.	T
Endlicheria sp.	T
Nectandra sp. 1	T
Nectandra sp. 2	T
Nectandra sp. 3	T
Ocotea cernua cf.	T
Pleurothyrium trianae	T
? sp. 1	T
? sp. 2	T
? sp. 3	T
? sp. 4	T
? sp. 5	T
? sp. 6	T

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 19

Manta Real

LECYTHIDACEAE	
Eschweilera sp. 1	T
Eschweilera sp. 2	T
Grias peruviana	T
LEGUMINOSAE-CAESALPINIOIDEAE	
Bauhinia sp. 1	T
Bauhinia sp. 2	V
Browneopsis sp. (sp. nov.?)	T
Schizolobium parahybum	T
LEGUMINOSAE-MIMOSOIDEAE	
Inga punctata cf.	T
Inga quaternata	T
Inga sp. 1	T
Inga sp. 2	T
LEGUMINOSAE-PAPILIONOIDEAE	
Erythrina smithiana	S
Mucuna rostrata	V
? sp. 1	V
? sp. 2	T
? sp. 3	T
LOGANIACEAE	
Strychnos sp.	V
MALPIGHIACEAE	
? sp.	T
MALVACEAE	
Pavonia rosea	H
MARANTACEAE	
Calathea inocephala	H
Calathea insignis	H
Calathea lutea	H
Calathea sp. 1	H
Calathea sp. 2	H
Calathea sp. 3	H
Pleiostachya morlei	H
? sp.	H

MARCGRAVIACEAE	
Souroubea cf. sp.	V
MELASTOMATACEAE	
Blakea sp.	E
Clidemia sp. 1	S
Clidemia sp. 2	S
Conostegia cf. sp. 1	T
Conostegia cf. sp. 2	T
Miconia sp. 1	S
Miconia sp. 2	S
Miconia sp. 3	S
Triolena pustulata	H
Triolena sp. 1	H
Triolena sp. 2	H
? sp. 1	S
? sp. 2	H
? sp. 3	S
? sp. 4	E
? sp. 5	T
? sp. 6	S
? sp. 7	S
MELIACEAE	
Carapa guianensis	T
Guarea kunthiana	S
Guarea pterorhachis	T
Guarea sp. 1	T
Guarea sp. 2	T
Guarea sp. 3	T
Trichilia sp. 1	T
Trichilia sp. 2	T
Trichilia sp. 3	T
MONIMIACEAE	
Siparuna sp.	S
MORACEAE	
Brosimum guianense	T

Cecropia insignis	T
Cecropia sp. 1	T
Cecropia sp. 2	T
Cecropia sp. 3	T
Cecropia sp. 4	T
Cecropia sp. 5	T
Clarisia biflora	T
Coussapoa eggersii (villosa)	T
Coussapoa sp.	E
Ficus tonduzii	T
Ficus sp. 1	T
Ficus sp. 2	T
Ficus sp. 3	T
Ficus sp. 4	T
Maquira sp.	T
Poulsenia armata	T
Pourouma bicolor	T
Pseudolmedia rigida	T
Sorocea sarcocarpa cf.	T
MUSACEAE	
Heliconia curtispatha cf.	H
Heliconia sp. 1	H
Heliconia sp. 2	H
MYRISTICACEAE	
Otoba sp. 1	T
Otoba sp. 2	T
Otoba sp. 3	T
Virola koschnyi	T
Virola sebifera	T
Virola sp.	T
MYRSINACEAE	
Ardisia sp.	S
Cybianthus sp.	S
? sp.	S

MYRTACEAE	
Calyptranthes sp.	T
? sp. 1	T
? sp. 2	T
NYCTAGINACEAE	
Pisonia sp.	V
ORCHIDACEAE	
Epidendrum sp.	E
Erythrodes sp.	H
Maxillaria sp. 1	E
Maxillaria sp. 2	E
Pleurothallis sp.	E
Stelis sp. 1	E
Stelis sp. 2	E
Vanilla sp.	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
? sp. 4	E
? sp. 5	E
PALMAE	
Bactris sp. 1	T
Bactris sp. 2	S
Catoblastus velutinus cf.	T
Chamaedorea sp.	S
Geonoma cuneata cf.	S
Geonoma interrupta	S
Jessenia bataua	T
Pholidostachys dactyloides	S
Prestoea sp.	T
Synechanthus sp.	S
PASSIFLORACEAE	
Passiflora macrophylla	S
Passiflora sp.	V

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 19

Manta Real

PHYTOLACCACEAE	
Phytolacca rivinoides	S
PIPERACEAE	
Peperomia rotundifolia	E
Peperomia sp. 1	H
Peperomia sp. 2	H
Peperomia sp. 3	H
Peperomia sp. 4	H
Peperomia sp. 5	E
Peperomia sp. 6	H
Peperomia sp. 7	H
Peperomia sp. 8	H
Peperomia sp. 9	H
Peperomia sp. 10	H
Peperomia sp. 11	H
Piper multiplinervium cf.	S
Piper obliquum	S
Piper reticulatum	S
Piper sp. 1	S
Piper sp. 2	S
Piper sp. 3	S
Piper sp. 4	S
Piper sp. 5	S
Piper sp. 6	E
Piper sp. 7	S
Piper sp. 8	S
Piper sp. 9	S
Piper sp. 10	S
POLYGALACEAE	
Monnina sp.	S
? sp.	S
PTERIDOPHYTA	
Asplenium serratum	H
Didymoclaena truncatula	H
Diplazium sp.	H
Lomariopsis japurensis	E
Saccoloma elegans	H
Salpichlaena (Bolbitis) volubilis	V
Selaginella sp. 1	H
Selaginella sp. 2	H
Selaginella sp. 3	H
Tectaria nicotianifolia	H
Trichomanes sp.	E
? sp. 1	E
? sp. 2	E
? sp. 3	E
? sp. 4	H
? sp. 5	E
? sp. 6	S
? sp. 7	S
RUBIACEAE	
Bertiera sp.	S
Coussarea sp.	S
Faramea sp. 1	S
Faramea sp. 2	S
Faramea sp. 3	S
Gonzalagunia sp.	S
Guettarda sp.	T
Hamelia macrantha	S
Hoffmannia sp.	S
Isertia sp.	T
Ladenbergia pavonii	T
Palicourea sp. 1	S
Palicourea sp. 2	S
Palicourea sp. 3	S
Pentagonia sp.	S
Psychotria brachiata	S
Psychotria grandis	S
Psychotria macrophylla	S
Psychotria macrophylla aff.	S

Psychotria marginata	S
Psychotria sp. 1	S
Psychotria sp. 2	S
Psychotria sp. 3	S
Psychotria sp. 4	S
Psychotria sp. 5	S
Psychotria sp. 6	S
Psychotria sp. 7	T
Psychotria sp. 8	S
? sp.	T
RUTACEAE	
Zanthoxylum sp.	T
SAPINDACEAE	
Allophylus sp. 1	T
Allophylus sp. 2	T
Paullinia bracteosa	V
Talisia sp.	S
? sp. 1	T
? sp. 2	T
SAPOTACEAE	
Pouteria sp. 1	T
Pouteria sp. 2	T
Pouteria sp. 3	T
SCROPHULARIACEAE	
Castilleja sp.	H
SIMAROUBACEAE	
Simarouba amara	T
SOLANACEAE	
Cestrum sp. 1	S
Cestrum sp. 2	S
Cestrum sp. 3	S
Cyphomandra sp.	S
Lycianthes sp. 1	S
Lycianthes sp. 2	S
Markea pavonii	E
Solanum sp. 1	V
Solanum sp. 2	S
Witheringia sp. 1	S
Witheringia sp. 2	S
? sp. 1	H
? sp. 2	V
STAPHYLEACEAE	
Huertea glandulosa	T
Turpinia occidentalis	T
STERCULIACEAE	
Sterculia sp. 1	T
Sterculia sp. 2	T
TILIACEAE	
Heliocarpus americanus	T
TROPAEOLACEAE	
Tropaeolum repandum	V
ULMACEAE	
Trema micrantha	T
UMBELLIFERAE	
Hydrocotyle sp.	H
URTICACEAE	
Pilea sp. 1	E
Pilea sp. 2	H
Pilea sp. 3	H
VERBENACEAE	
Aegiphila sp.	V
VIOLACEAE	
Gloeospermum falcatum	T
VITACEAE	
Cissus sicyoides	V
Cissus sp.	V
ZINGIBERACEAE	
Costus sp. 1	H
Costus sp. 2	H
Costus sp. 3	H

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

APPENDIX 19

Manta Real

T	Tree (dbh 10 cm, height 5 m)
S	Shrub
V	Climber
H	Herb
E	Epiphyte

Costus sp. 4	H
Renealmia sp. 1	H
Renealmia sp. 2	H
Renealmia sp. 3	H

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Conservation International (CI) is a private, nonprofit organization dedicated to the conservation of tropical and temperate ecosystems and the species that rely on these habitats for their survival.

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