Rapid Assessment Program

RAP

Working

Papers

5

A Biological Assessment of the Kanuku Mountain Region of Southwestern Guyana

CONSERVATION INTERNATIONAL

JULY 1993

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 "mega-diversity" 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 was founded with funding from 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

Adult Harpy Eagle (*Harpia harpyja*) with young at nest, Kanuku Mountains, August, 1991.
Photograph by Neil Rettig.

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Theodore A. Parker, III
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CONSERVATION INTERNATIONAL

JULY 1993

Managing Editor: John L. Carr
Design: KINETIK Communication Graphics, Inc.
Maps: David Lieu, Ali Lankerani, John L. Carr
Cover photograph: Haroldo Castro

Conservation International is a private, nonprofit organization exempt from federal income tax under section 501(c)(3) of the Internal Revenue Code.

ISBN 1-881173-01-1

Suggested citation:
Parker, T.A., III, R.B. Foster, L.H. Emmons, P. Freed, A.B. Forsyth, B. Hoffman, and B.D. Gill. 1993. A biological assessment of the Kanuku Mountain region of southwestern Guyana. Conservation International, RAP Working Papers 5.

Printed on recycled paper in the United States of America

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Acknowledgments

We would like to thank the Guyana Agency for Health Sciences Education, Environment and Food Policy (GAHEF), our national counterpart, for inviting the RAP team to Guyana. At GAHEF, we especially thank Dr. Walter Chin and Mr. Kwesi O. NKofi. We would also like to thank the Ministry of Agriculture - Wildlife Division for arranging our permits, as well as all the other government agencies who helped make this trip possible, including: the Guyana Natural Resource Agency (GNRA), Dr. Navin Chanderpal of the Office of the President - Department of Science and Technology, and Dr. Mike Tamessar, Dr. Ram Dass, and Doorjoohan Gopaul of the Department of Biology, University of Guyana for information and advice. We extend a special thanks to Brigadier Joseph Singh, MSS Chief of Staff of the Guyana Defence Force for providing us with information regarding logistics and study sites.

We thank the Smithsonian Institution's Biological Diversity of the Guianas Program for providing housing in Georgetown, especially Vicki Funk, and for their assistance in plant identification. We thank Dr. A.L. Gardner (US Fish and Wildlife Service, National Museum of Natural History) for help in identifying bats. Dr. Mark Engstrom generously sent us specimen records of Rupununi mammals in the Royal Ontario Museum, and allowed us to publish them in this report. Dr. C.J. McCoy (Carnegie Museum of Natural History) confirmed the identification of the amphibians and reptiles. Dr. Bruce Gill of Canada Agriculture provided scarab determinations.

A number of people helped us in many different ways during our travels in Guyana. We thank George Laurice Franklin for providing transportation in the field, Bonnie Mitsui and Anna for providing gourmet cooking on the trip, and Malcolm and Margaret Chan-A-Sue for air transport throughout the project. We thank Deborah Freed, Joe Furman, Wendy Evans, and Vincent Foo for field assistance. A special thanks to the Macushi Indians at Nappi, especially David Artez for the use of his camp; Godfrey Jonas, Leo da Silva, and Valentine Anton, who were excellent guides up Nappi Mtn.; and Evan Pedro for his expertise in guiding us up the Rewa River.

Finally, we want to thank Mr. John S. McIlhenny, the W. Alton Jones Foundation, the Barker Foundation, Ms. Miranda Smith, and Ms. Bonnie Mitsui; without their financial support this trip would not have been possible. Financial support for the publication of this report comes from grants from the Arcadia Foundation and the John D. and Catherine T. MacArthur Foundation.

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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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GAHEF

The Guyana Agency for Health Sciences Education, Environment, and Food Policy (GAHEF) is an autonomous body that was created under the Public Corporation Act in June 1988. It is charged with the development of the national environmental policy, environmental monitoring and coordination, and training.

With regards to the environment, GAHEF's activities focus on environmental education, pollution monitoring and control, environmental impact assessment, protected areas and biodiversity, environmental health and coastal zone management.

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BIOLOGICAL DIVERSITY OF THE GUIANAS PROGRAM

The Biological Diversity of the Guianas (BDG) is a field-oriented program of the Smithsonian Institution initiated in 1983. The goal of the BDG is to study, document and preserve the biological diversity of the three Guianas (Guyana, Suriname, French Guiana).

The BDG program has produced the first comprehensive checklist of all vascular plants and bryophytes of the Guianas. It has also produced a vegetation map of Guyana, a checklist of lizards, and descriptions of grasses, euphorbs, legumes, and mosses. The Program has produced a list of all known plants in the Kaieteur National Park (Guyana) for use by conservation groups seeking to enlarge the park area.

All plants specimens collected by the Program are maintained in a database that can be used for education and conservation as well as research.

For the past four years, the BDG has worked with the University of Guyana to raise funds for a new building located on campus. This building, based at the University of Guyana, will house collections and has facilities for researchers as well as a library and small exhibition space.

In the future BDG hopes to expand its field work into the entire Guyana Shield area to include the areas of eastern Venezuela and a small part of northern Brazil.

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Overview

INTRODUCTION

Guyana lies within a globally significant region for the conservation of biological diversity. Unlike many Neotropical countries, Guyana has retained the majority of its land surface in a relatively natural state. The human population remains concentrated along the narrow coastal plain and the interior is thinly settled. The relatively low population pressure has allowed most of the rich ecosystems of Guyana to remain intact (Hilty 1982). As a result, opportunities for harmonizing economic development with biodiversity conservation are extremely promising.

The flora of the Guiana region is rich with some 8000 species known; 50% of these are endemic to this biogeographic region. The fauna is also diverse with more than 1000 species of terrestrial vertebrates. Despite this biological richness, there is only one protected area in the country, Kaieteur National Park (11,655 ha). Logging, mining and road building activities are accelerating throughout the country. Clearly, now is the time to begin to plan and implement a comprehensive national protected area system.

To assist with the development of a protected area system, Conservation International, in close collaboration with Guyanese colleagues, organized a rapid assessment of the Kanuku Mountain region in southwestern Guyana. The assessment was at the invitation of GAHEF for the purpose of evaluating the area's biological signif-icance, and to decide if the region was suitable for national park or other protection status. Attention had first been drawn to the Kanukus by the research of Neil Rettig, who in the mid-1970's began studying the ecology and conservation status of the Harpy Eagle. Rettig's results indicated that the Kanuku Mountains support the world's greatest known density of Harpy Eagles, as well as many other endangered species.

Concern for the fate of the wildlife of the Kanukus was raised by the recent completion of the road system linking coastal Guyana with the interior and the Brazilian frontier. The road passes close to the Kanukus and is a potential source of unsustainable resource exploitation.

In February 1993, Conservation International's Rapid Assessment Program team visited several localities in the Kanuku Mountain region of southwestern Guyana. The primary objectives of this expedition were:

- to undertake a rapid biological evaluation of the evergreen forest types and savannah in the western Kanuku Mountains, as well as of forests and other habitats along the Rewa River in the eastern Kanuku region,
- to inventory the flora and fauna of representative examples of these ecosystems, with emphasis on woody plants, birds, mammals, reptiles, amphibians, and select invertebrate groups,
- to determine the conservation status of various species of vertebrates and plants, with emphasis on large mammals, birds, and large trees,
- to identify areas of forest and other habitats that are of conservation value, based on biological criteria such as levels of species diversity, species richness, and endemism,
- to increase public and governmental awareness of the potential value of these areas, especially with respect to opportunities for sustainable development and conservation in the form of ecotourism, watershed protection and maintenance of hydroelectric potential.

This report presents the scientific results and conservation recommendations of the 1993 RAP expedition to the Kanukus.

SUMMARY

During nearly three weeks of fieldwork at several study sites in the western Kanuku Mountains southeast of Nappi Village, and along the Rewa River in the eastern Kanuku region, the RAP team inventoried habitats, plants, birds, mammals, reptiles, and amphibians, and several invertebrate groups.

The results of these surveys indicate that the diverse ecosystems of this relatively small geographic area support a large percentage of Guyana's biodiversity. For example, our bird surveys revealed that 250 species — or about 75% of all forest-based species in the country — occur within a few square kilometers of lowland evergreen forest and edges along Maipaima Creek (east of Nappi Village). About 18 or 7% of these species are endemic to lowland forests in the Guianas. In all, we recorded 350 bird species in the entire region (lowlands to 900 m), which suggests that well over 60% of the country's entire avifauna occurs in the Kanuku Mountains. A review of the results of past mammal surveys, and data obtained on our expedition, further indicate that 80% of the country's mammal fauna also occurs in the Kanuku region. When the flora and invertebrate fauna are more thoroughly studied, it seems likely that levels of species richness in some of those groups (e.g., butterflies) will approach those of birds and mammals.

The apparent high overall biodiversity of the region reflects the unusual diversity of habitats, which range from savannah, gallery forests, and semi-deciduous forests in the lowlands, to lowland and montane evergreen forests within an elevational range of approximately 150-900 m.

We attempted to visit and describe the full range of forest habitats in the region. The alluvial stream floodplains (as along

…surveys indicate that the diverse ecosystems of this relatively small geographic area support a large percentage of Guyana's biodiversity.

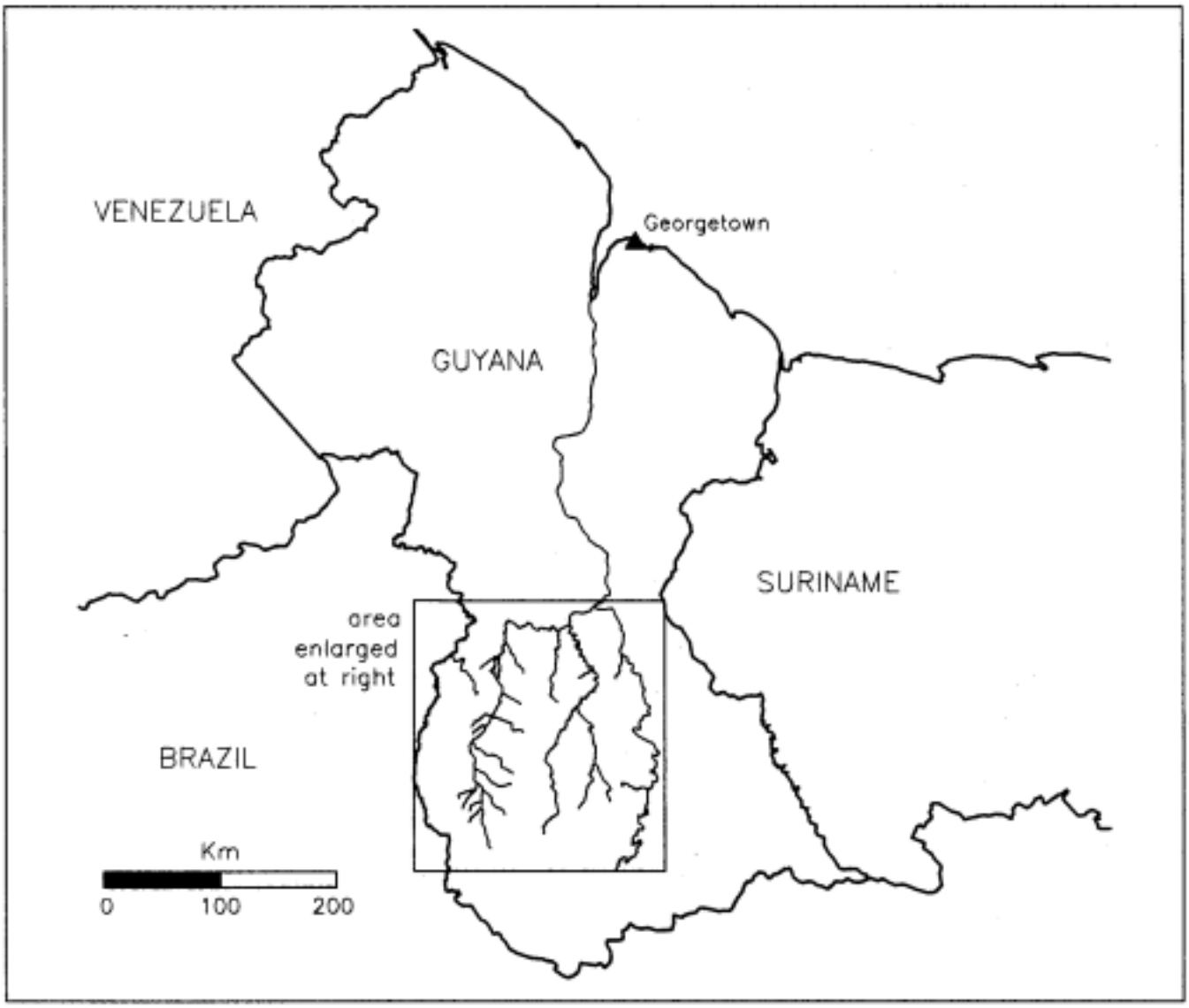

Figure 1. *Map of Guyana showing its position relative to surrounding countries, and indicating the study area in the southwest. The major river nearly bisecting the country is the Essequibo.*

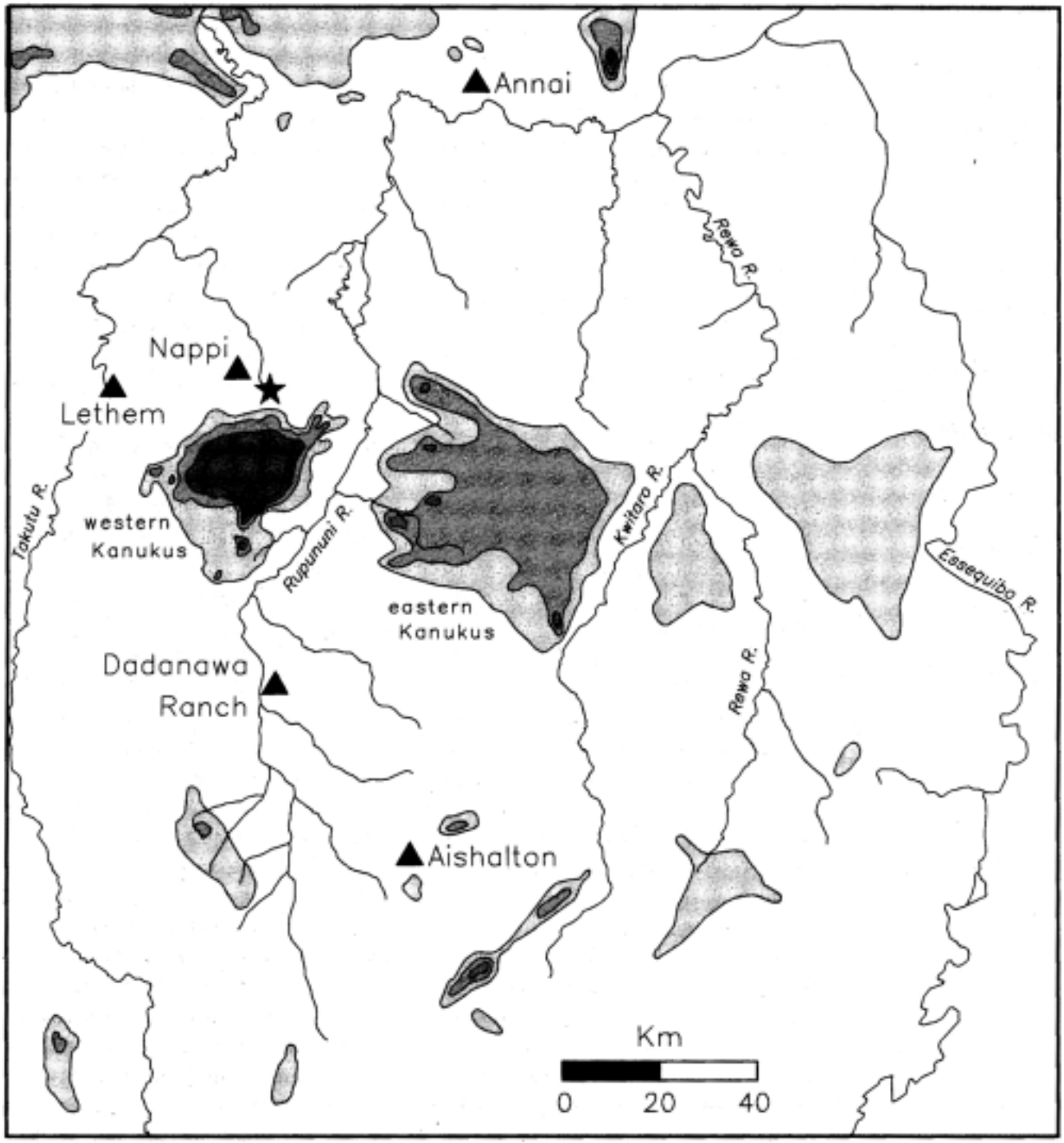

Figure 2. *The Kanuku Mountain region showing the principal rivers and uplifted areas. The lowest shaded contour interval is 1000 ft., with additional contour intervals every 500 ft. The star indicates the campsite on Maipaima Creek.*

This forest is distinguished from other well-studied Neotropical forests in supporting exceptionally large numbers and a high diversity of frugivorous birds...

Maipaima Creek) are heavily dominated by 35-40 m-tall *Mora excelsa* (Leguminosae) in the canopy and *Rinorea pubiflora* (Violaceae) in the understory. The latter type of forest also covers river levees and higher floodplains within approximately 500 m of the Rewa River. There are also areas of seasonally inundated forest with a variety of swamp-dwelling trees such as *Macrolobium acaciafolium* along the Rewa. Additional plant communities on the upper beaches and lower levees bordering the Rewa are described in this report.

The foothills along the northern base of the mountains contain a diverse mixture of successional species with scattered large trees. Stream bottoms and valleys up into the western Kanukus (to ca. 500 m) are covered by a distinctive, low diversity *Mora* forest (40-45 m-tall) which gives way in an explosion of diversity to mixed forest on the adjacent slopes. The most species-rich forest type in this part of Guyana appears to be this mixed forest (20-25 m-tall) on the slopes and ridges of the Kanukus. Dominant trees in this for-est include various species of Chrysobal-anaceae (e.g., *Parinari rodolphii*), Lauraceae, Sapotaceae (esp. *Pouteria* spp.), Apocynaceae (*Aspidosperma* spp.), and Burseraceae (*Trattinickia* spp.). The subcanopy in many areas is dominated by *Rheedia macrophylla* (Guttiferae) and other small trees such as *Rinorea* (4 spp.) and *Amphirrox longifolia* (Violaceae).

The uppermost forest (at 600 to 850 m) had some moss cover on most trees, and was obviously moister than that on slopes lower down. A few tree genera (e.g., *Myrsine*, *Symplocos*, *Ternstroemia*) were seen only at the highest elevations, where patches of mixed, low forest occur along ridges. Epiphytic orchids, ferns, and mistletoes, but not bromeliads, were common in the elfin forest along the ridgecrests. A few additional montane floristic elements, including various epiphytes and a clambering *Chusquea* bamboo, were not seen at lower elevations. The Kanuku montane flora would be much more diverse if the higher peaks were a few hundred meters higher — at the normal lower limit of frequent cloud cover.

The rounded granite domes and steep cliffs of the highest mountain peaks in the western Kanukus, including Mt. Nappi, support a distinctive type of bald vegetation comprised of terrestrial bromeliads, orchids, tough herbs, shrublets, and 3-4 species of *Clusia* (Guttiferae) that form thickets 2-3 m-tall.

The lowland forest avifauna at Maipaima Creek is surprisingly species-rich, with about 220 resident forest species. The richest upper moist and wet Amazonian forests support 180-230 bird species (Parker 1991). This forest is distinguished from other well-studied Neotropical forests in supporting exceptionally large numbers and a high diversity of frugivorous birds (e.g., 12 parrot spp., 10 large cotinga spp.). In contrast, a few insectivore families were poorly represented; for example, there were only 8 species of Furnariidae at Maipaima Creek vs. the usual 18 or more species at most upper Amazonian sites.

There is a distinct (and apparently unreported) montane component in the Kanuku avifauna, including White-tipped Swift (*Aeronautes montivagus*), Sharpbill (*Oxyruncus cristatus*), Golden-crowned Warbler (*Basileuterus culicivorus*), and Hepatic Tanager (*Piranga flava*). In all, 17% (or 123 species) of the total Kanuku avifauna was recorded only in the uppermost forest at 600-900 m. Furthermore, some species — especially frugivores such as parrots and toucans — may undertake seasonal movements to take advantage of patchy fruit resources along

the entire elevational gradient. This underscores the need to include large areas of montane forest within any protected areas established in this region.

Several noteworthy bird species were found at Maipaima Creek, most notably the White-winged Potoo (*Nyctibius leucopterus*), recently rediscovered at Manuas, Brazil, long after the type specimen was collected at an uncertain locality in southeast Brazil (Cohn-Haft 1993). Other first records for Guyana include two migrants from North America, Olive-sided Flycatcher (*Contopus borealis*) and Blackburnian Warbler (*Dendroica fusca*). Previously unreported small, wintering populations of these species may occur in the Kanukus and other Guyana Shield mountains.

As in the case of birds, mammal surveys in the Kanuku Mountain region revealed the presence of 150 mammal species, or about 80% of the 175-190 species known from the country. This high diversity reflects the habitat heterogeneity of the region. We recorded 49 species in the study sites at Maipaima Creek and on the slopes of Mt. Nappi. Among the noteworthy discoveries was one mammal new to the country, a spiny tree rat (*Mesomys hispidus*), and a woolly oppossum (*Caluromys lanatus*) previously known in Guyana from one specimen.

The Maipaima Creek and upper Nappi Creek areas were found to be unusually rich in numbers and species of bats. In contrast, non-flying mammals were not especially diverse or abundant. This undoubtedly reflects — at least in part — hunting pressure by the local Macushi.

We think it probable that the eastern Kanukus (east of the Rupununi River) are somewhat richer in mammal species than the western portion of the range. To date 86 mammal species are known from the west, and 127 have been found in the east (but see below). For example, two monkey species and two tree rats are known only from areas to the east of the Rupununi River. Rupununi savannah mammal communities are also briefly described in this report.

Invertebrate work on coprophagous Scarabaeinae beetles indicates a fauna that is moderately diverse compared to Amazonian faunas, fitting the overall Guianan diversity pattern. The abundance of these beetles indicates that the mammalian fauna, particularly primates, on which these beetles are trophically dependent, remains healthy, as suggested by our visual impressions.

CONSERVATION OPPORTUNITIES

To conserve the biodiversity of the Kanuku Mountain region of southwestern Guyana, we offer the following recommendations:

1 **Establishment of Protected Areas.** The intact ecosystems along the nearly uninhabited Rewa River would best be maintained within a protected area of some type, either a national park or part of a biosphere reserve that should include large areas of all major habitat types in the region: seasonally flooded forest, permanent swamp forest, lowland *terra firme* rain forest on different soil types, upland rain forest, and montane forest on the upper slopes of the adjacent eastern Kanuku Mountains, and wet and dry savannah formations. Such an area could alone include almost all the non-marine, lowland mammal species found in the entire country. A combination of habitats always makes an area more biologically important relative to its size, as well as more scenic, which adds to its tourism potential.

The intact ecosystems along the nearly uninhabited Rewa River would best be maintained within a protected area…

Because there is little or no human settlement, the eastern Kanukus are more appropriate than the western Kanukus for creation of a national park.

Many of Guyana's rivers have been disturbed by mining activities, but the Rewa River has not. Most important, the Rewa River supports populations of a number of large vertebrate species that have been extirpated throughout most of their ranges in the Guianas and Amazonia. These include threatened forms such as the Giant Otter (*Pteronura brasiliensis*), Giant River Turtle (*Podocnemis expansa*), Black Caiman (*Melanosuchus niger*), and the largest Neotropical freshwater fish (*Arapaima gigas*).

Current information shows that for mammals, a reserve in the eastern Kanuku Mountains and associated river basins would protect a larger and more interesting fauna than one in the western Kanukus. Museum records and a limited number of studies such as Muckenhirn et al. (1975) suggest that the eastern Kanukus and the upper Rewa contain the highest diversity of primates, with all eight species from the region co-occurring in high densities. In order to determine whether the most significant biological features found by us in the western Kanukus — such as the high eagle and cotingid populations — are found equally in the eastern range, we recommend that the eastern Kanukus be surveyed in the manner described in this report. Such work is needed before any protected areas are established in the region, and before sound management guidelines are proposed. The most critical areas for which no information is yet available are the slopes and interior of the eastern Kanukus.

Because there is little or no human settlement, the eastern Kanukus are more appropriate than the western Kanukus for creation of a national park. The creation of a national park or strictly protected area in the heavily settled areas of the western Kanukus is not recommended. The western Kanukus are intensively used by the Macushi of the Nappi community (ARU 1989). A biosphere reserve model seems more appropriate for dealing with human needs and pressures on the western Kanukus landscape. In settled areas, the best chance for protecting or maintaining ecosystems in their natural state probably involves the establishment of private reserves and ecotourism initiatives run by local people.

In order for this system to be self-sustaining, a mechanism for capturing a percentage of park-generated funds at the local level through entrance fees and sales would need to be established. Park revenues should be directly reinvested in park management.

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2 **Development of Ecotourism Industry.** There is little doubt that Guyana has tremendous, untapped potential within the area of ecotourism. In recent years, there has been a tremendous growth of that industry in southern Venezuela, where more than a dozen new lodges attract thousands of tourists annually. Similarly, Suriname was a popular natural history destination until political and economic turmoil in the early 1980's almost eliminated that source of foreign exchange.

The accessibility (via Lethem) of the scenic Kanukus, the presence of indigenous people such as the Macushi, as well as the diversity of tropical ecosystems (rain forest, mountain forest, and savannah) within a relatively small geographic area, combine to make the region especially attractive for tourism.

Appropriate development of ecotourism in this region would almost certainly provide greater economic benefits to local communities than unsustainable activities such as the trapping of parrots, turtles, or caiman. The establishment of a national park in this region coupled with training of local people would result in employment for local people, especially through the construction and maintenance of guardposts, tourist facili-

ties, and a scientific research station. Training for local people as park employees involved in ecotourism and interpretive park activities, trail system building, and other park duties could generate sustainable employment.

The Rewa is suited for high-end ecotourism, the market segment of bird watchers and naturalists who are willing to pay a premium for a wilderness experience with abundant wildlife in a scenic setting. This activity could be scheduled throughout the long dry season when fly populations are almost nonexistent, beaches are exposed, and wildlife activities such as turtle nesting occur.

The presence of the large spectacular predators and mass nesting turtles as seen along the Rewa River is increasingly rare in the Neotropics. Wild uninhabited tropical rivers are globally scarce. Accordingly, the Rewa could become a destination for natural history tours, especially those that offer river boat trips and tented camps such as those that are popular in upper Amazonia. During the dry season the Rewa is remarkably free of biting flies and the sugar white sand beaches are ideal for establishment of a series of camps separated by one day of boat travel.

Additional study is needed to determine the full potential for ecotourism in this region, but our preliminary observations suggest that the Rewa River basin may represent a unique opportunity to directly involve local people in the protection of a large percentage of the country's biological diversity. The village of Annai, situated as it is on a bluff above the confluence of the Rupununi and Rewa rivers, is well-positioned to become a control post with lodging, food and handicraft production facilities.

Maipaima Creek near Nappi village has all the characteristics of a typical natural history tour destination in South America: tall, visually attractive rain forest, a good network of trails, healthy populations of large mammals and birds that would quickly become tame if local hunting were stopped, and a special attraction — nesting Harpy Eagles.

The Macushi people of Nappi Village could benefit quickly from tourism on a small scale, such as the 6-10 natural history tour groups that easily be attracted to the region each year if simple, but comfortable accommodations could be provided. The existing camp at Maipaima Creek could be enlarged and improved enough to support small groups of 10-12 birdwatchers, for example. The construction of a canopy tower or an aerial walkway in forest near the camp would greatly enhance its attractiveness as a tourist destination. A fairly large number of local people could be employed (at least on a temporary basis) as guides and workers at such camps.

In many parts of South America, the establishment of low-level, specialized ecotourism has often evolved into a more general type of tourism that attracts a wider segment of that market. Private sector involvement is crucial to the success of ecotourism. An opportunity exists to work with existing tourism sites such as Karanambo and ranches such as Pirara.

Successful ecotourism depends on the availability of a local circuit of destinations. Single destination sites are rarely successful. Thus a regional development strategy including ecotourism development, and zoning and watershed protection in the western Kanukus would fit with the creation of a Rewa-eastern Kanukus park.

A relatively small investment in tourist infrastructure and transportation in Lethem, Nappi Village, and in places like Maipaima Creek, would result in immediate economic benefits to local communities. Increased numbers of tourists also represent a market for locally-made handicrafts such as the *balata* sculptures produced by the Macushi.

…observations suggest that the Rewa River basin may represent a unique opportunity to directly involve local people in the protection of a large percentage of the country's biological diversity.

In order to establish the base for a thriving ecotourism industry in Guyana, we recommend the following actions be taken with regard to:

- identification of the best and most appropriate destinations;
- construction of comfortable accommodations near such sites;
- improvements in transportation to the interior;
- development of infrastructure such as good trail systems and canopy towers;
- international marketing, focused first on the natural history tour industry in the United States and Europe;
- government cooperation and investment in tourism, especially with respect to assuring the smooth entry and exit of tourists at the international airport, and their safety during stays in Georgetown.

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3 **Changing Resource-Use Patterns.** If conservation areas and ecotourism are to be developed in the Kanuku Mountain region, a number of short-term actions need to be taken. There are several activities at work in the area that are not compatible with sustainable use, watershed protection or ecosystem conservation. We recommend the following actions to mitigate the negative consequences of these activities:

a. The Rewa, upper Rewa and Kwitaro Rivers should be immediately closed to all gold-dredging and commercial logging activities. No dredges are currently active in the area, but reportedly one unused system exists in the headwaters.

b. The poaching of jaguar, large river turtles, caiman and otter should be strongly discouraged. We witnessed a pair of poachers collecting large numbers of river turtles. This poaching was not a local subsistence activity, but rather a commercial venture by people from Annai who sell the turtles across the border to Brazil. According to local guides, the identity of the poacher is known but the small penalty for poaching is no deterrent. Increasing fines and perhaps using the proceeds as an incentive for enforcement should be considered. Fines also could be used to cover the costs of poaching control. Similarly the potential for depletion of Arapaima stocks by the salted fish trade to Brazil is great. The Rupununi stocks are severely depressed according to local informants, a situation now widespread throughout the Amazon basin.

c. In the area of the western Kanukus, a community-developed zoning system to separate sustainably used areas from no-hunting, no-farming, no-logging zones should be developed and enforced by the Macushi community. Community economic benefits derived from ecotourism may be the only incentive for such zoning and enforcement, although the community might better ensure its future by establishing guidelines to protect the watershed and forest resources upon which it totally depends. The Macushi people currently have little apparent hunting impact largely because of their inability to buy shotgun shells and shotguns. Any income level growth is certain to lead to increases in hunting pressure unless there is some common agreement regarding zoning and conservation benefits.

d. The uncontrolled and unproductive burning of Kanuku forest and savannah needs to be controlled through a participatory community development process. Maintaining the maximum species richness in savannah ecosystems requires a delicate balance of burning enough to maintain the fire-tolerant vegetation and inhibit takeover by forest, but less than that which would decrease the structural complexity and the plant species diversity of the vegetation. An imbalance among the native grazing mammals, such as can be caused by removing predators or overgrazing by live-

stock, can likewise radically alter the plant communities. Incentives to manage burning and conserve the watershed — such as the generation of hydroelectric power — could be negotiated. Small-scale, low-impact hydroelectricity for the Nappi area and for Lethem could create fees and incentives for watershed conservation.

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4 **Funding and Technical Support.** Guyana is in the relatively unique position of being able to develop a protected area system in advance of land tenure conflicts. This is a significant opportunity, and as shown by other countries such as Costa Rica, the protected areas could become a major earner of foreign exchange with the development of an ecotourism industry.

The prospects for biodiversity conservation and ecotourism development in Guyana could be greatly enhanced with relatively modest investments. Donor agencies such as CIDA, USAID, EC, UNDP, GEF could make a major conservation and development contribution by assisting with the establishment of a protected area system.

Currently, development of protected areas appears to be a low priority of donor agencies. For example, CIDA supported the development of the National Tropical Forestry Action Plan in 1989. The NTFAP recommends more than $70 million of projects, but the proposed allocation for developing a protected area system (project 22) is a meager $1.7 million, with only $0.3 million suggested for a training project with the Amerindians, the very people who are most heavily dependent on forest resources for subsistence (project 29). Nonetheless, the funds could have an impact on changing unsustainable use patterns.

Before a protected area system can be established, clarification of government agency administrative responsibilities and donor coordination needs to be achieved. A protected area system must be based on biodiversity conservation priorities. Before a system of protected areas can be rationally established in Guyana, a rapid countrywide biological assessment is needed to set conservation priorities. The current rationale for proposed park sites is based on very little biological information. The first step in setting up the protected area system is to develop a strong biological inventory program linked to a geographic information system, which will synthesize and display the data collected throughout the country. Without such a system it will be difficult to set investment priorities. For example, any investment in the Kanukus should be weighed against biodiversity and socioeconomic data from other regions of Guyana, many of which are poorly known.

…protected areas could become a major earner of foreign exchange with the development of an ecotourism industry.

Technical Report

METHODS

Field methods varied according to each specialist. Foster and Hoffman collected plants and data on numerous woody species. Voucher specimens are housed in the herbarium of the United States National Museum. Foster made qualitative descriptions of the structure and composition of the major plant communities, and transects in *Mora* forest of the Rewa. Plant identifications were made by Hoffman, Foster, and specialists at the USNM. Emmons identified mammals during day and night walks along forest trails (51.12 hours), and trapped small mammals with Victor, Sherman, and Tomahawk traps (600 trap/nights), and netting with mist nets (4 nights). One rat was shot. Voucher specimens were preserved in fluid, and will be deposited in collections of at the University of Guyana and the United States National Museum. Parker surveyed birds (ca. 104 hours) with the aid of binoculars, tape-recorders, and unidirectional microphones; the majority of all species found at Maipaima Creek and on Mt. Nappi were tape-recorded, and copies of these recordings will be deposited in the Library of Natural Sounds (Cornell University). Mist nets were not used, primarily because they capture only a small percentage of the species and individuals at low levels in a tall forest (especially during brief surveys), and they require large amounts of time to maintain. Parker recorded information on habitat and foraging behavior, height, substrate, and prey type for most of the bird species observed. At Maipaima Creek, he continuously recorded all species found along an approximately 3 km-long transect through tall forest (see below). The herpetologists (P. Freed, D. Freed, J. Furman, and W. Evans) surveyed the Maipaima area by walking forest trails and the creekbed over a period of 22 days (ca. 1000 person/hours), and employed the usual collecting techniques (e.g., raking leaf litter, scanning for eyeshine at night). Nocturnal and diurnal samples of coprophagous Scarabaeinae (Coleoptera: Scarabidae) were collected by Forsyth following the methods of Peck and Forsyth (1982) using baited pitfall traps.

SITE DESCRIPTIONS AND VEGETATION (R. FOSTER)

Appendix 1 contains a list of plant taxa recorded from the Kanuku Mountains and surrounding area (compiled by the Smithsonian). Reports of other botanical collections made in the region also contain much useful information on the flora (Welle et al. 1987, 1990).

Kanuku Mountain Region

Mountain Tops

The tops of Nappi Mountain and the adjacent Moco-Moco Mountain (referred to collectively as "White Horse Mountain" by the Macushi) consist of rounded granite domes with steep bare cliffs on most sides. Nappi Mountain is the taller of the two by a small margin, reaching 960 m. It appears that many other peaks in both the eastern and western Kanukus reach about 800-850 m. The mountains are just below the level where the clouds would touch during most of the day, at least in the dry season. The distinctive granite bald vegetation begins at about 850 m, but may extend lower on the steep rock cliffs. It consists nearly equally of three main elements: exposed granite balds sparsely covered with tough herbs and shrublets; *Clusia* thickets 2-3 m tall; and islands of mixed low wet forest 5-10 m tall. It is assumed that similar plant communities would be found on all the high peaks of the Kanukus.

The patchy nature of the forest (and soil) development on the flatter areas suggests that fire played a role centuries ago in creating the open low vegetation. The clumps of plants on these exposed rocks show every indication of undergoing a slow successional process of soil and root accumulation, and if left alone for a few centuries would all revert to a low mixed forest community except on the steep parts. Some slopes on adjacent ridges are covered with large patches of *Clusia* at lower elevations which are probably in the process of recolonization following a soil slide that exposed bare rock.

The open community on exposed rock is mostly based on a small clumped sedge (an as yet unidentified Cyperaceae) which eventually forms enough of a root/soil mat for other species to colonize. The commonest of the latter are a *Croton* sp. (Euphorbiaceae), the shorter *Macrocentrum cristatum* (Melastomataceae), *Botrychium*? sp. (Pteridophyta), and two low *Clusia* spp. (Guttiferae). Several species of terrestrial bromeliads and orchids are conspicuous including large forms of *Catasetum*, *Brassaia*?, and *Epidendrum.* In the wetter spots, sphagnum develops around the base of many clumps. In the drier spots, two species of fruticose *Cladonia* lichens are common.

Clusia thickets are strongly dominated by as many as 4-5 species of that genus along with rare individuals of the plants mentioned above, and others from the mixed forest community, especially juveniles. It appears that the *Clusia* thicket is inhibitory to coexistence with other herbs and shrubs, but its thick leaves and stems contribute greatly to soil formation.

Mixed elfin forest is probably short due to the combination of very slow growth and constant pruning from the severe winds on these exposed areas. The composition is highly variable from place to place and it would be difficult to pick any species as dominant or very common. It is mostly made up of species from forest at lower elevations, and it is likely that composition is determined by chance arrival and establishment of random species from the high-diversity pool of species available below.

Genera such as *Myrsine* (Myrsinaceae), *Symplocos* (Symplocaceae), and *Ternstroemia* (Theaceae), were not seen at lower elevations

and they probably arrived here from the Pakaraima Mountains to the north. Epiphytic orchids, ferns and mistletoes (Loranthaceae) — but not epiphytic bromeliads — are common on the moss covered stems and low branches here. They might be common in the high treetops down below but it seems more likely that in the Kanukus they are restricted to these areas with some envelopment by clouds at night and in the morning during the dry season. If the mountains were just a few hundred meters higher they would rarely dry out and would probably have a much more distinctive cloud forest flora. As it is, the plants here must tolerate considerable drought stress on a daily basis.

The valleys have radical differences in the plant communities from bottom to top.

The saddle at 850 m between the two peaks endures strong winds and the 5-10 m forest is mostly uniform in height with the crowns wind-sculptured in one direction. However, a few individuals and patches of trees are much taller, 20-25 m, and it appears that this forest was at one time much taller but suffered severe wind erosion, or perhaps a fire swept up the slope during some extremely dry year. The upper slopes below the saddle had a patchy moss cover on most trees, and were obviously moister than slopes on lower ridges. Species such as an epiphytic "birds nest" *Philodendron* (Araceae) and a clambering bamboo, *Chusquea*? sp. (Gramineae), were not seen on the lower slopes.

The combination of the exhilarating view out over the mountains and savannahs with the numerous orchids and other colorful plants on these peaks is a delightful experience for any trekker in reasonably good shape. An improved trail to the top could greatly expand the number of visitors who could appreciate it, but the area is so small that it could be easily stripped of its orchids in a short time without careful supervision and education.

Mountain Valleys

The valleys have radical differences in the plant communities from bottom to top. In the sun-exposed rocky granite streambed is a characteristic community of herbs and shrubs; on the stream bottomlands and up at least 100 m on adjacent slopes is a distinctive, low-diversity *Mora* forest (40-45 m tall), which gives way in what seems an explosion of tree diversity to mixed forest (35-40 m tall) on the slopes and ridges. Probably there is some definable difference between the community on the ridgecrests and that down on the slopes, but in the brief time of the visit I was unable to make a clear distinction.

Where the creeks pass over base rock, several species of Podostemaceae (e.g. *Mourera fluviatilis*) are glued underwater to the rock in the rapids. They have emergent inflorescences and the leaves are exposed only in the driest periods. Boulder-strewn stream beds and banks all have an attractive red-flowered *Ruellia* shrub (Acanthaceae). Other common shrubs are *Ardisia guianensis* (Myrsinaceae), *Aciotis* sp. and *Clidemia* sp. (Melastomataceae), and *Solanum* sp. (Solanaceae). Common herbs are species of *Borreria* (Rubiaceae), *Spigelia* (Loganiaceae), *Sauvagesia* (Ochnaceae), *Blechnum* (Pteridophyta), *Spathiphyllum* (Araceae), *Ludwigia foliobracteolata* (Onagraceae), and *Rhynochospora* (Cyperaceae).

The creek-side forest is probably 80% *Mora excelsa* (Leguminosae) mixed in with *Eschweilera pedicellata* (Lecythidaceae), a scattering of species from mixed forest above, and a few distinctive trees not seen in other *Mora* forest: the understory *Rauia* (Rutaceae), the canopy or subcanopy *Macrolobium* sp. (Leguminosae-Caesalpinoid.) which has a great many juveniles in the understory, and large *Anacardium gigantifolium* (Anacard-

iaceae). Giant boulders frequently encountered on side tributaries are topped with an epiphytic "birdsnest" fern, *Asplenium serratum*, and sometimes patches of *Chrysothemis* sp. (Gesneriaceae).

The habitat that is most species-rich in this part of Guyana appears to be the mixed forest on slopes and ridges. A couple more days of study would have permitted an estimate of which are the most common species. Among the most common canopy trees are *Chimarrhis* (Rubiaceae), *Parinari rodolphii* (Chrysobalanaceae) and several others of that family, several species of *Pouteria* (Sapotaceae), several Lauraceae, several Leguminosae, a couple of *Aspidosperma* (Apocynaceae), and a couple of *Trattinnickia* (Burseraceae).

The subcanopy tree *Rheedia macrophylla* (Guttiferae) was clearly a dominant in that stratum, and small juveniles are common as well. Very common treelets are *Amphirrox longifolia* and *Rinorea* (4 spp.) (Violaceae), and *Bocoa alterna* (Leguminosae-Papilionoid.). *Petrea macrostachya* (Verbenaceae) is perhaps the most common liana and *Ischnosiphon obliquus* (Marantaceae) is among the most common large herbs.

Front Slopes

The steep slopes that rise up closest to the lowlands are subject to fire at infrequent intervals. The last major fire was apparently in 1983 during the year of "El Niño" when a major drought left the forest extremely dry and full of dead plant material. Strong winds swept up fires from the lowland clearings or savannahs and along the front slopes, burning even most of the canopy trees over large areas.

These burned areas are still visible from a distance as disturbed and regenerating forest, with occasional patches of high forest left in what seem to be wetter sites or where the wind led the fire in a different direction. There is a great diversity of typical successional trees (e.g., *Laetia*, *Jacaranda*, *Cecropia*, *Ochroma*) now about 10 m-tall coming up amidst dead snags and occasional survivors of the previous forest.

Foothills

At the base of the mountains the streams flow through low hills and terraces of what looks to be an old lava flow but may be a porous laterite. The thin soils on this rock produce a drier mixed deciduous forest. It appears to be highly unstable forest perhaps due to the considerable mortality of big trees during severe drought. The composition is a diverse mixture of successional species mixed with random big trees. It is difficult to discern a group of species that could be considered dominant. The small savannah island near our camp appears to be on the same substrate. It is likely that this forest is regeneration of what was formerly a savannah on laterite.

The alluvial stream floodplains are heavily dominated by giant *Mora excelsa* (Leguminosae-Caesalpinoideae) in the canopy and *Rinorea pubiflora* (Violaceae) in the understory. There are dense thickets of *Mora* seedlings and saplings around the base of most adults.

The habitat that is most species-rich in this part of Guyana appears to be the mixed forest on slopes and ridges.

Rewa River

Physiography

The riverbed of the Rewa appears to be underlain by Cretaceous? sandstones topped with intermittent outcrops of thick, porous brown laterite, which in turn is covered with recent fluvial material for most of the lower half of the river. The recent material consists

of several meters of hard brownish-white sands with very few discontinuities in vertical profile, and topped by a root-mat of more silty sand. In the upper reaches, before the major falls, the river is underlain by rock of smooth, shiny grey-black volcanic andesite. Most or all the rapids and falls are associated with the laterite and andesite outcrops. The underlying sandstone is only visible in horizontal layers at one hairpin turn near the river's mouth.

Compared to the river meanders of western Amazonia, the meanders on the Rewa seem slow to change — for much of the river one can find high old forest on both sides. This is probably due to the sandy substrate which is more resistant to erosion than silt deposits, and possibly also to the frequent barriers of laterite or rock which slow the speed of the river except in jumps down the rapids.

At the time of low water, the river appears to be cutting through a large, flat terrace about 5-8 m above the water level. This is deceptive. The riverbank is a levee or dike that is a high false-front, shielding a low-lying forest behind it sometimes down to the level of low water in the river bed. In other words, the river is mostly walled-in from the forest around it, not carved out of a forested terrace.

The shallow channels or notches through the levees may be the channels of spillover from the river into the forest behind rather than a drainage into the river from the surrounding forest. The depression behind the levee may be the last to inundate and the last to dry out. Because heavier particles drop out first when water slows down, the spill over during flooding leaves more sand on the levee and finer silt and mud in the depression.

We saw several instances in which erosion has been fast enough to break through the levees, sometimes creating a channel straight through both levees across a narrow meander, and sometimes breaking through one levee creating small bays or lagoons into the depression behind.

Along the length of the river, patches of active meanders and beaches are separated, especially upriver, by long stretches of stable meanders with high green walls of forest on both sides. Cut off meanders and sudden jumps in the river channel create varying sizes and depths of poorly drained habitat ranging from narrow, deep, curved lakes to broad open marshes choked with aquatic vegetation.

River Seasonality

In the wet season the river is 4 m or more above its lowest level and stays high for about three months (Evan Pedro, pers. comm.). Few areas escape the inundation, making it difficult for the Amerindians to settle, and because the area becomes thick with mosquitos. September to May is the dry season, but in two days in February, rains to the south of us raised the river level 1-2 meters, and brought out millions of midge flies at night.

Mora Forest

Along the riverside levee the dominance of *Mora excelsa*, with average heights of 40-45 m, reflects the same dominance by *Mora* in the hidden depression behind. The levee is only 10-30 m wide and the roots of the levee trees can easily penetrate the depression. The understory plants on the levee are much more likely to suffer some drought and not suffer much prolonged inundation, compared to the trees. This probably explains the large difference in understory composition from the levees to the depression. If the levee is wide, the understory plants and some of the trees

are more diverse than in the rest of the forest. If there is a very broad levee with no adjacent depression, *Mora* may be absent altogether. At the other extreme, if a meander narrows to a thin strip with exposed vertical banks on both sides, the *Mora* show increasing discoloration and dieback of many of the upper branches, and finally death. These patterns are easily explained by the need for *Mora* to keep most of their roots touching the water table.

The *Mora* forest qualifies as a monodominant forest. In a transect of about half a kilometer, 78% of the trees greater than 30 cm diameter, and 47% of the trees between 10 and 30 cm diameter are *Mora excelsa*. The *Mora* trees give much evidence of being very long-lived. The forest has very few treefall gaps. The logs remain intact on the ground for many years as the forest fills in above them.

Other trees in the *Mora* forest consist of a small mixed and perhaps random assemblage of the tree species that would occur there if *Mora* was absent. The understory flora of *Mora* forest consists of *Mora* juveniles along with a handful of characteristic understory species such as *Sagotia* (Euphorbiaceae). The shrub layer, while 15% *Mora* saplings, is almost consistently 30-40% stems of *Rinorea pubiflora* (Violaceae). Seedlings of *Mora* were not as dense around the parent trees as in the Nappi floodplain.

Mora trees do not flower every year but probably on alternate years. The flowering is not tightly synchronized within the year, and frequently not completely synchronized among the branches of a single tree. It appeared that nearly half of the trees were in flower this year. A new flush of leaves was mostly visible on trees with no flowers.

Going west from the river, *Mora* becomes less dense, smaller-crowned, and the forest appears more heterogeneous when seen from the air. Upriver, *Mora* populations start to diminish above the main fork and the forest here also becomes more diverse. *Mora* trees are confined to small parts of river margin and small patches along the tributary streams going up into the Kanuku Mountains.

Fruit Resources

Along the Rewa floodplain there are few tree species with soft edible fruits. The most important would probably be *Goupia glabra* (Goupiaceae) for birds, and a few Sapotaceae including *Manilkara* for other vertebrates. There are very few palms, almost no figs, and few other Moraceae except for the small fruited *Brosimum guianense*, and very few Lauraceae — all groups important for fruit eaters. Instead, most of the trees have either explosive, water or wind-dispersal mechanisms. Even *Eschweilera paniculata* may be water dispersed rather than by rodents or larger mammals.

The relative absence of edible fruit may explain the apparent scarcity of monkeys other than leaf-eating *Alouatta*, the scarcity of large rodents other than capybaras, scarcity of large fruit-eating birds, e.g. cracids, other than trumpeters which may rely more heavily on insects, and the scarcity of peccaries except for the lowest part of the river. Most of the large fauna is based on immediate river resources, which may be the situation in virtually all tropical rivers, but is more extreme here.

…Mora forest qualifies as a monodominant forest.

Other Vegetation

Deeply inundated forest, only casually visited, is full of swamp trees such as *Macrolobium acaciafolium* (Leguminosae-Caesalp.) and many large lianas. One liana seen was a giant *Strychnos* (Loganiaceae) with a diameter of approximately 50 cm.

In lagoons there is frequently a mat of the giant water lily (*Victoria amazonica*).

Disturbance

Although not noticeable, according to our guide Evan Pedro, there had been selective logging of the most valuable hardwoods such as cedar (*Cedrela odorata*; Meliaceae), crabwood (*Carapa guianensis*; Meliaceae), and greenheart (*Aniba* sp.; Lauraceae). We saw only a few juveniles of these species. Some adults of "kabakalli" (*Goupia glabra*; Celastraceae) and "silverballi" (Lauraceae) are still occasionally encountered in the Rewa forests. *Mora* is not harvested because it is too heavy, although it is universally acclaimed to be "good for bridges."

As in virtually every moist or wet forest in tropical America, all of the large *balata* trees (*Manilkara*; Sapotaceae) in the area had cuts from *balata*-bleeders on their trunks, no matter how deep the tree was in the forest.

Clearings were only found along the river, with none away from the river except near the mouth and the village of Rewa. Some gold diggings were seen near the sandstone outcrop. Occasional tiny farm clearings are rare upriver. Most disturbance is seen around the camps of major fishing/turtle collecting sites (lagoons, backwaters, tributaries) and around Hunt Oil Co. seismic exploration sites. We saw no recent clearings above the juncture of the Rewa and Kwitaro Rivers during our overflight.

River Meander Succession

The beaches are made up of a slightly brownish-white sand, the upper parts of which are spottily covered with annual herbs. The most common is usually *Cyperus* sp. (Cyperaceae), frequently mixed with two short grasses, two *Borreria* (Rubiaceae), *Ludwigia torulosa* (Onagraceae), a small-flowered *Turnera* (Turneraceae), *Hyptis* sp. (Labiatae), and a prostrate, small-flowered Compositae. Several other herbs found mainly on the silty banks (see below) are present from time to time in the beach flora.

Behind the open beach is usually a solid wall of 1-2 m spiny *Solanum subinerme* (Solanaceae) shrubs, with one of the *Borreria* species usually thick underneath, and intermixed with occasional shrubs of *Croton* sp. (Euphorbiaceae). Intertwined with the *Solanum* hedge are occasional vines of *Cissus* (Vitaceae), *Dalechampia affinis* (Euphorbiaceae), and *Ipomoea* sp. (Convolvulaceae).

In the first swale or depression behind the front levee, the *Solanum* thins out and there appear numerous shrubs of a small-leaved *Casearia* (Flacourtiaceae) and *Tabernaemontana tetrastachya* (Apocynaceae). By the second levee, the fast-growing *Triplaris weigeltiana* (Polygonaceae), and *Cecropia peltata* (Moraceae), though widely scattered, shoot up well above the other vegetation to almost 10 m. These two species are inhabited by only mildly aggressive and mildly stinging ants in comparison to some of their relatives in the Upper Amazon basin, but they seem to be very effective at eliminating vine cover on their host trees. Also occasional at this stage are isolated trees of *Cordia* (Boraginaceae).

In the second swale or depression, trees of *Xylosma* (Flacourtiaceae) with branch-spined trunks, an unidentified Leguminosae, and occasionally the spiny *Astrocaryum vulgare* (Palmae) grow fast, but do not rival in height the *Triplaris* and *Cecropia* at this stage. The cat's claw liana *Uncaria guianensis* (Rubiaceae) becomes more common at this stage. All of this vegetation behind the open beach, with its thorns, ants, and high density of small stems is fairly unpleasant to move through, though it appears from the number of tracks and tunnels, that large mammals such as tapirs find safe haven in such areas. Eventually, a few other trees such as *Ceiba*

pentandra (Bombacaceae) and *Spondias mombin* (Anacardiaceae) emerge in this open forest with thin canopies and thick shrub layer below.

But one does not see a gradual progression to a high, dense *Mora* forest from what develops behind the beach or in the bed of abandoned river channels. If such a transition exists it is not very obvious from the ground, nor from the air in an overflight. It is as if these remain as two distinct and independent habitats and that one does not lead to the other. What may be happening is that *Mora*, with its huge, poorly dispersed seed, only advances very slowly along a front edge of adult trees rather than colonizing over a broad area. Individual *Mora* juveniles, with their head start from the enormous seed reserves, may grow very fast — close by the parent, but not heavily shaded. Thus any transition may appear to be an abrupt discontinuity.

The transition probably occurs on the front levee along the sides of the expanding beach. As yearly deposits are added to the expanding river edge (and sand deposits drop out rapidly leaving very little to deposit in the inner levees), the front levee continues to grow and finally reaches the height of the rest of the bank, while the central area remains a series of swales and low levees. This central low area could be gradually colonized by the *Mora* along a front from the sides, unless it is so low as to be inundated too much of the year, in which case a much more swampy forest or open lagoon remains in the central depression.

River Banks

Where the river bank is gradually eroding there is a steep wall of hardened sand that is nearly free of vegetation. Perhaps as much as half of the banks of the Rewa River are in this condition. But there are semi-stable, sloping banks along the river that support a distinct community of plants. These banks are either: 1) along the back sides of beaches where they are not actively expanding but are continuing to grow in height from sand and silt deposits; 2) along trivial meanders of a river straightaway where there is some deposition, usually occasioned by fallen trees stuck in the bank on one side causing a slight deviation in the force of the river; or 3) on low mud flats where the river is cutting into an old depression, swamp or oxbow lake.

On the slowly growing banks the characteristic small tree is *Inga* cf. *meissneriana* (Leguminosae-Mimosoid.), which grows nearly horizontally or with its trunk in the main branches usually angled downward out over the water, then turning upward on the youngest branchlets. On the stable, lower mud flats the characteristic tree is water-guava, *Psidium* sp. (Myrtaceae). Steeper banks are frequently covered with tangles of long, crawling shrubs, especially *Vasivea alchorniodes* (Tiliaceae) and *Dalbergia monetaria* (Leguminosae-Papilionoid.).

Recently exposed banks with silt are often colonized by herbs such as those found on the beach as well as others such as *Gnaphalium* (Compositae), *Phyllanthus* (Euphorbiaceae), an unidentified Melastomataceae, *Hybanthus oppositifolius* (Violaceae), *Lindernia* (Scrophulariaceae), and sometimes shrubs of an orange-flowered *Turnera* (Turneraceae). These same species can sometimes be found on the open beaches as well.

On the *Mora* forest edges where the river is not cutting too fast, certain conspicuous small trees manage to survive for many years without falling in and without penetrating the forest interior. These include *Jacaranda obtusifolia* (Bignoniaceae), *Toulicia* cf. *pulvinata* (Sapindaceae), and two Caesalpinoid legumes, one with large yellow flow-

ers, *Martiodendron excelsum*, and the other with large, dark-red "bat-visited" flowers, *Elizabetha coccinea*. Lianas sometimes form a curtain of leaves along such areas and include a few species of Bignoniaceae, Leguminosae, Malpighiaceae, *Connarus* (Connaracceae), and *Combretum* (Combretaceae), perhaps all species which also occur occasionally throughout the forest canopy.

AVIFAUNA (T. PARKER)

Birds of the Western Kanuku Mountains and Adjacent Lowland Forest and Savannah

The avifauna of the Kanuku Mountains of southwestern Guyana is poorly known, despite the fact that naturalists have made occasional visits to the region since the mid-1800's. The western Kanukus are best known in ornithological circles for field studies of two spectacular species: Guianan Cock-of-the-Rock (*Rupicola rupicola*) and Harpy Eagle (*Harpia harpyja*). Cock-of-the-rocks were studied in these mountains in 1961 (Gilliard 1962), and the breeding behavior of Harpy Eagles was first investigated here by Fowler and Cope (1964), and on-and-off for the past 18 years by Neil Rettig and his co-workers (Rettig 1977, 1978; unpubl. data). In recent years, the latter researcher and his field assistants have located 17 active nests of this magnificent raptor in forest at the base and on the lower slopes of the Kanukus.

During the period 3-17 February 1993, we surveyed birds in the western Kanuku Mountains. Most of our effort was concentrated in tall evergreen forest along Maipaima Creek, a small watercourse that flows off the north slope of the western Kanukus about 20 km east of Nappi Village. We also made an excursion to the highest point in the mountains, Mt. Nappi (approximately 950 m), and spent parts of several days in the Rupununi savannah in the vicinity of Nappi Village and Lethem. Near the latter town we briefly visited some degraded gallery forest along the Rio Takutu. Our total bird list for these areas was 349 species (Appendix 2), which represent 47% of the 740 species reported from the country (Parker and Stotz, ms). Excluding about 40 species confined to the northern coast and offshore waters from the latter total, it is apparent that at least 50% of Guyana's bird species occur within the small geographic area that encompasses the above study sites. More importantly, the approximately 250 forest-based species found at Maipaima Creek and on the slopes of Mt. Nappi represent about 75% of the 330 species confined to the country's tall evergreen forests below 1000 m.

The majority of the bird species found by us in the Kanuku region are widespread in Amazonia and the Guianas, but about 18 (of 250), or 7%, are endemic to that part of South America lying east of the Rio Negro and north of the Rio Amazonas (see Cracraft 1985).

At Maipaima Creek, I surveyed birds along about 8 kms of trails through tall evergreen forest. The main study area consisted of a north-south transect through about 3 km of tall *Mora*-dominated forest with moderate to open undergrowth on level ground that is (in part) seasonally inundated by overflow from the creek, and about 2 km through a lower, denser forest on undulating *terra firme*. The forest avifauna at this site was comprised of 220 species, most of which occurred in both types of forest. A few species that dwell in dense vine tangles were found only in the latter forest type. At the southern end of the study area, along the entrance road

that leads west to Nappi Village, there were several small (<1 ha) manioc gardens surrounded by tall, viny forest that has been disturbed by selective logging. From the edges of these clearings, I identified numerous canopy species (e.g., hummingbirds, small tyrannids) that were very difficult to see from inside tall forest.

The resident forest avifauna (ca. 220 species) at Maipaima Creek is similar to those of the most species-rich Amazonian forests to the south. The most diverse Neotropical bird communities range from approximately 180 to 230 species (Parker 1991). As usual, the most diverse families inside tall forest at Maipaima Creek were Formicariidae (32 spp.), Tyrannidae (30 spp.), Thraupinae (18 spp.), and Dendrocolaptidae (12 spp.) (Appendix 2). The usual understory mixed-species flocks (led by two species of *Thamnomanes* anthrikes, with 4-5 species of *Myrmotherula* antwrens, *Xiphorhynchus pardalotus*, and *Automolus infuscatus*) were numerous, especially in viny forest on the slopes. Forest-dwelling furnariids were poorly represented, with only 8 species (vs. the usual ca. 18 in upper Amazonian forests).

An ornithological feature that distinguishes the Maipaima Creek avifauna from that of any Amazonian forest that I have surveyed is the presence of an unusually diverse guild (and large numbers) of large, canopy frugivores. The family Cotingidae was represented by at least ten species — almost certainly a Neotropical record for one small area — including large numbers of several of its largest members (e.g., *Gymnoderus foetidus*, *Querula purpurata*, *Perissocephalus tricolor*, and *Procnias alba*). Screaming Pihas (*Lipaugus vociferans*) were so abundant that it was often difficult to determine where one large lek ended and another began. I have personally never been in a forest where large cotingas were so conspicuous. In contrast, small frugivorous birds (e.g., manakins, *Tangara* tanagers, and honeycreepers) of the canopy and middlestory were scarce by Amazonian standards. Similarly, the large canopy mixed-species flocks typically comprised of numerous flycatchers, furnariids, formicariids, and insectivorous emberizids were small and widely spaced.

Parrots (12 spp.), pigeons and doves (5 spp.), and toucans (esp. 2 *Ramphastos* spp.) were also numerous and conspicuous. Despite the presence of a large Amerindian population in the nearby savannah around Nappi Village, and a growing number of hunters in the forest, vulnerable gamebirds such as Black Curassow (C*rax alector*), Marail Guan (*Penelope marail*), and Gray-winged Trumpeter (*Psophia crepitans*) were still common (although shy and most easily recorded by voice at dawn and during the night). Trumpeters were exceptionally numerous, and up to five groups (of ca. 4 to 12 individuals) were noted in a morning along about 3 km of trail.

The presence of large numbers of Scarlet Macaw (*Ara macao*), Mealy Parrot (*Amazona farinosa*), and Red-fan Parrot (*Deroptyus accipitrinus*) would seem to indicate that trapping of forest-dwelling psittacids has been limited. In contrast, those parrot species that live primarily in forests bordering the savannah and rivers in the region (e.g., Yellow-crowned Parrot *Amazona ochrocephala*, Orange-winged Parrot *Amazona amazonica*) were notably rare, probably as a result of over-trapping. Interviews with local people further suggest that the Sun Parakeet (*Aratinga solstitialis*), once presumably common in the Rupununi Savannahs, may now be locally extinct. A moratorium on the trapping and export of this threatened species is urgently needed (see below).

The resident forest avifauna…at Maipaima Creek is similar to those of the most species-rich Amazonian forests to the south.

Further evidence of the relatively undisturbed nature of the tall forests along Maipaima Creek is the much heralded presence of several pairs of Harpy Eagles (*Harpyja harpia*), which have been intensively studied by Neil Rettig and his Macushi and Guyanese field assistants (Rettig 1977, 1978). These workers have located 17 Harpy Eagle nests in forests around the base of the western Kanukus, an amazing feat by any standard. Whereas one can state unequivocally that this is the highest density of this species yet reported, it can also be assumed that similar numbers will eventually be found in at least a few of the many remote and largely uninhabited parts of Amazonian South America that remain unexplored. We can only hope that the wealth of Harpy Eagle knowledge obtained in this region — especially on nest site preferences and food habits — will be put to use in other parts of the Neotropics.

In addition to the widespread and expected bird species found by us at Maipaima Creek, a few more noteworthy species were also recorded. The most interesting of these is the White-winged Potoo (*Nyctibius leucopterus*), which was heard on numerous occasions during the brightly lit first few nights of our stay. At least two individuals sang regularly (especially between about 21:00-23:00) from the canopy of 40 m-tall *Mora* dominated forest along the stream near camp. This little-known species was recently rediscovered near Manaus, Brazil, long after being first reported from a locality in the Atlantic Forest of southern Bahia (Cohn-Haft 1993). It seems likely that the specimens from Manaus and Bahia, which differ in several morphological characters, represent two biological species (see Cohn-Haft 1993). Our records from Maipaima Creek undoubtedly represent the population discovered at Manaus, for our tape-recordings (of song) closely match those obtained in that region. Tape-recordings of this species from both areas are housed in the Library of Natural Sounds, Cornell University.

At least two additional species found at Maipaima Creek — Barred Forest-Falcon (*Micrastur ruficollis*) and Tawny-bellied Screech-Owl (*Otus watsonii*) — did not appear on published lists of Guyanese birds, but both of these are common and widespread in surrounding countries.

A few species of Neotropical migrants from North America were found in forests near Maipaima Creek and in nearby areas. Blackpoll Warblers (*Dendroica striata*) were surprisingly numerous in the canopy of tall forests on the slopes and along the northern base of the Kanuku Mountains. They were usually noted singly and in association with canopy flocks comprised of other small insectivores (especially *Hylophilus muscicapinus*, *Tangara punctata*, and *Tachyphonus cristatus*), both along forest borders and in the interior of tall forest up to 5 km from clearing-edges or savannah. A few individuals were also observed in the canopy of lower montane forest on the upper slopes of Nappi Mountain at 600-850 m. In upper Amazonian Peru, this species occurs almost exclusively in young river-edge forests dominated by leguminous trees (*Albizia*, *Caesalpinia*, *Cassia*) and *Cecropia* spp., or in structurally similar second-growth forests near human settlements (pers. obs.). The above (early February) records of Blackpoll Warbler suggest that a fairly large population of this species winters — at least in some years — in the Kanuku Mountain region.

Red-eyed Vireos (*Vireo olivaceus*) were fairly common in the areas surveyed, especially along the edges of tall forest or in lower second-growth forest close to savannah. On 17 February we observed large numbers of this species feeding on the arillate, red fruits of *Curatella americana* trees along the banks of

the Rio Takutu at Lethem. All of these birds appeared to be of the migratory form (*Vireo o. olivaceaus*), which is reported to be fairly common in nearby areas in Brazil (Stotz et al. 1992). A few Summer Tanagers (*Piranga rubra*) were also found in forest-edges near Maipaima Creek.

The Avifauna of Montane Forests on the Slopes of the Western Kanuku Mountains

The slopes of Mt. Nappi at 600-850 m are covered by a 25-30 m-tall forest of epiphyte-laden trees. The ridgecrests are covered by a stunted forest of small trees (mainly *Clusia* spp.) and — on the granitic balds — shrubby vegetation. These habitats support avifaunas that are distinctly different from those of the lowlands around the base of the mountains, as at Maipaima Creek.

Twenty-one, or 17%, of the 123 bird species recorded above approximately 600 m on Mt. Nappi were not found at lower elevations. A few of these are known to be montane species throughout most of their ranges (e.g., *Aeronautes montivagus*, *Oxyruncus cristatus*, *Basileuterus culicivorus*), whereas most of the others occur in wet lowland forests in other parts of the Guianas and adjacent northern Brazil. For example, several species that were common at upper elevations on Mt. Nappi (e.g., *Pipra serena*, *Mionectes macconnelli*, *Microcerculus bambla*), were not found in the nearby lowlands at Maipaima Creek. All of these occur in lowland *terra firme* forests (at ca. 100 m) near Manaus, Brazil (Stotz and Bierregaard 1989), which suggests that their distributions may be correlated with higher rainfall. The abundances and microhabitat preferences of many additional species also varied considerably with elevation. For example, *Ara chloroptera* was common only at upper elevations on Mt. Nappi during our visit, whereas *Ara macao* was the common lowland species. Similarly, the parrot *Pionopsitta caica* was fairly common in forest on the slopes, but was quite scarce in the lowlands. Whether such distributional differences reflect seasonal changes in fruit abundance remains to be determined. A few insectivorous species, such as the foliage-gleaner *Automolus ochrolaemus,* undergo habitat shifts along the same elevational gradient. The latter was patchily distributed in the lowlands, occurring mainly in large, overgrown treefall gaps or in old second-growth forest, but was uniformly distributed in the understory of forest higher up on the slopes of the Kanukus. The common and more widespread lowland foliage-gleaner (at Maipaima Creek) was *Automolus infuscatus*.

A small number of interesting bird species were found in the uppermost (mainly *Clusia*) forest on Mt. Nappi. Apparently small and isolated populations of Golden-crowned Warbler (*Basileuterus culicivorus*) and Hepatic Tanager (*Piranga flava*) were discovered, along with a greenlet tentatively identified as *Hylophilus brunneiceps.* This species has not been previously reported from Guyana. Also new to the country were two Neotropical migrants found in the same habitat, Olive-sided Flycatcher (*Contopus borealis*) and Blackburnian Warbler (*Dendroica fusca*). My observation of several individuals of the latter species in montane forest on Mt. Nappi suggest that a small wintering population of this species occurs in the Kanukus, and probably on other Guiana shield mountains from southern Venezuela to Suriname. Both *Contopus borealis* and *Dendroica fusca* are known to winter primarily in montane forests on the eastern slopes of the Andes, but both have recently been found to occasionally reach southeastern Brazil (Parker 1983, Willis et al. 1993).

These habitats support avifaunas that are distinctly different from those of the lowlands around the base of the mountains...

The granite cliffs of Mt. Nappi serve as habitat for several rock-dwelling bird species. Populations of the montane White-tipped Swift (*Aeronautes montivagus*) and Cliff Flycatcher (*Hirundinea ferruginea*) have apparently colonized this mountain range. One or two individuals of the rare and local Orange-breasted Falcon (*Falco deiroleucus*) were also observed flying back and forth past the south face of Mt. Nappi.

The Rupununi savannah north of the Kanukus, as along the road from Nappi Village to Lethem, has apparently been degraded by at least two centuries of uncontrolled burning and over-grazing by cattle. Many of the endemic plant and animal species of this region have undoubtedly declined as a result of these activities, and some may have disappeared altogether. The Sun Parakeet (*Aratinga solstitialis*) is one of several potentially endangered bird species that inhabit patches of woods and gallery forest in the savannah.

Most of the species observed during my brief excursions into savannah east of Maipaima Creek and southeast of Nappi Village are widespread in South American grasslands. A smaller number (e.g., Crested Bobwhite *Colinus cristatus*, Eastern Meadowlark *Sturnella magna*) are more northerly species that reach their southernmost distributional limits in this region.

MAMMALS (L.H. EMMONS)

The Kanuku Mountains were scientifically explored as early as 1900, when J. J. Quelch collected 28 mammal species during a three-month expedition, including seven species described as new (Thomas 1901; four of these are currently regarded as valid). In the mid-1960's, S. E. Brock made large collections for the Royal Ontario Museum and the United States National Museum, on the Kwitaro River, Rewa River, and the Dadanawa Ranch and to its east and south; subsequently, the Royal Ontario Museum made several other collecting trips to the region (Mark Engstrom, pers. comm.). The Kanuku Mountains and surrounding region include two ecosystems with distinct mammal faunas: forest and savannah.

Mammal surveys on this expedition were confined to the western Kanuku Mountains, but considerable data from earlier inventories can be combined to give a good idea of the fauna in the region from Lethem to the Kwitaro River, and from the Kanuku Mountains south to Aishalton. The combined records from this small area of about 150 x 100 km include a total of 150 species of mammals (Appendix 3). As the total mammal fauna of Guyana is about 175-190 species, this area possesses at least 80% of the mammal species of the entire country. The list for the region is still incomplete. Groups such as small rodents are under-represented and more species are certain to be identified when efforts are focused toward finding them. On our brief expedition we recorded one new species for the fauna of the country, a spiny tree rat, *Mesomys hispidus*. Certain localities remain to be explored, and many others need further survey. The most critical areas for which no information is available are the slopes and interior of the eastern range of the Kanukus.

If the region is considered as eastern and western units split by the Rupununi River, to date 86 mammal species have been recorded from the west, and 127 species from the eastern side (Appendix 3). Much of the difference between the two sides is due to a greater amount of survey effort in the east, but we think it probable that the eastern side is in fact richer in mammals. For example, two monkey species and two tree rats found east of the river are not recorded from the west side.

The combination of savannahs and semi-deciduous to evergreen forest together accounts for the great richness of the mammal fauna of this important region. To preserve the entire regional species complement, a reserve must include large representatives of each habitat type. From a global perspective, the Giant Otter, Black Caiman, Giant River Turtle, and *Arapaima* populations of the Rewa are part of a complete riverine ecosystem long gone from all but a few remote areas in Amazonia, where some of these species are protected in reserves, but where all are rarely found together. Thus, this Rewa riverine ecosystem is of global conservation importance

Western Kanuku Mountains

The lowland rain forest harbors most of the mammal species of the Kanuku Mountains and Guyana in general. On this expedition we did not collect mammals on the peaks of the mountains, but their low average and maximum elevations and small higher elevation surface area makes it unlikely that any montane mammals occur there. All of the mammals thus far recorded from high on the mountains (Thomas 1901) are lowland species. An intense trapping effort on the upper slopes should be included in a future biological inventory both to establish whether any montane mammals do occupy this massif, and because the wetter peaks may support lowland species rare or absent in more drought-prone forests below.

We recorded 52 species of mammals during our expedition, 49 species in the western Kanuku Mountains. and three additional species on the Rewa River. When added to those recorded by earlier expeditions, a total of 86 species is now known from the western Kanukus and adjacent savannahs. The lists of bats and small rodents still appear largely incomplete, and local Macushi Indians knew of four more large species not on our list. We recorded one species that is a new record for Guyana: a spiny tree rat (*Mesomys hispidus*). Another species, the woolly opossum (*Caluromys lanatus*) was known from one specimen. The latter was seen clearly at close range by LHE, but unfortunately was not collected.

The Maipaima and Nappi Creek basins of the western Kanuku Mountains, where our mammal surveys were concentrated, are rich in numbers of individuals and species of all types of bats (frugivores and insectivores). The steep hills may be particularly favorable habitat: giant tumbled boulders that fill many ravines provide roosts for cave-loving species such as *Peropteryx* and *Pteronotus*, while slopes and landslides encourage development of a species-rich understory, due to increased undergrowth light penetration. Fresh weathering yields young, nutrient-rich montane soils.

In contrast to the bats, non-flying mammals were neither especially diverse nor abundant. Only a few species seemed to have high populations, including Red Brocket Deer (*Mazama americana*), which are probably favored by the local swidden agriculture, and acouchys (*Myoprocta acouchy*) in the *Mora* forests. Kinkajous (*Potos flavus*) and all of the monkey species present had good populations. Agoutis (*Dasyprocta aguti*) and Collared Peccaries were scarce to almost absent in the heavily exploited flatland forests at the mountain base, but both are more abundant along less frequented tracks above 400 m elevation, where there were also more signs of tapir activity. We saw no evidence of White-lipped Peccaries, and our Macushi guides stated that they had been overhunted and only a few persisted in the mountains. There was a striking scarcity of all carnivores apart from Kinkajous; only two sets of unidentifiable big cat scrapes and some otter

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…the impact of subsistence hunting has been surprisingly small, evidently strongly affecting only peccaries and agoutis among the larger mammals.

(*Lutra*) tracks along the stream were recorded during our stay at Maipaima Creek.

The small mammal trapping success-rate was extremely low (<1%) in the one habitat that we were able to sample. Likewise, only a few small mammals were seen during nocturnal observation walks. The Guiana Region experienced an exceptionally dry year in 1992 (R. Voss, pers. comm.), and low rodent densities may have resulted from poor reproduction in the previous year; but rodents may always be relatively scarce in this forest (M. Engstrom pers. comm.). The rodents and small marsupials are the least-known sector of the regional fauna, and a special effort should be devoted to inventory them. These groups are the most likely to yield unknown or endemic species.

The Macushi people of Nappi and surrounding communities depend for their livelihood on the moist forest skirt at the northern base of the western Kanukus. Virtually all of the zones of flat arable soil in the forested area have been used for rotating swidden agriculture. The significant areas of mature forest that remain only on rocky outcrops, steep slopes and seasonally-flooded depressions, are exploited for game and plant products such as construction materials, *balata* (*Manilkara* latex), and lumber for commercial markets. Despite constant use of the forest by Macushi (they must daily pass through belts of forest on rocky and badly drained substrates to reach farm plots), the impact of subsistence hunting has been surprisingly small, evidently strongly affecting only peccaries and agoutis among the larger mammals. Most hunting seems to be by bow and arrow because economic constraints apparently severely limit firearm use. Hunting would seem to be an occasional activity focused on a few, preferred species. Many species (e.g. primates, trumpeters) that are usually intensely pursued for meat by other indigenous groups are rarely taken. At our camp at 450 m at the headwaters of Nappi Creek, the creek boulders have a fine series of stone-axe grinding grooves: evidence that human exploitation of the West Kanukus has a long history.

Areas East of the Rupununi River

Although we did not explore the eastern Kanuku Mountains, existing collections from south and east of the Dadanawa Ranch, and from the Kwitaro and Rewa Rivers, all situated east of the Rupununi River, include a mammal fauna of 127 species, or 41 more than are known from the western Kanukus. This difference partly reflects a much greater historical collecting effort on the eastern side, but it is nonetheless likely that more species occur there. The eastern list is also incomplete and lacks common species such as agoutis and peccaries, that are certainly there, as well as a number of small rodents. The collections from Dadanawa and Kwitaro River were made in the 1960's and they include series of large mammals of current conservation concern. In contrast to the western Kanukus, forests east of the Rupununi support all eight species of monkeys known from Guyana. They also include all six species of cats, Giant Otters, Giant Anteaters, and Grisons. Specimen numbers suggest that at least in the 1960's, carnivores were abundant, generally a sign of high mammal densities overall. On our trip up the Rewa, Giant Otters were sighted three times in four days (1, 1, and 8 individuals).

Savannahs

The chain of savannahs on the northern fringe of the Amazon rainforest from Colombia to French Guiana, including those of the Rupununi, are in general extremely species-poor when compared to similar wooded grasslands south of the rainforest in cerrado and

chaco habitats of Brazil and Bolivia. There are only nine species of non-flying (non-bat) mammals, six of them endemics, entirely restricted to the savannah vegetation of these northern savannahs. Of these, only three have been recorded in the Rupununi/Rio Branco savannah formations (Voss 1991). More are likely to be found with a greater collecting effort. Of the larger mammals, all but one (*Dasypus sabanicola*, not known from Rupununi) are also found in rainforest, woodland, or montane habitats. The dominant small terrestrial mammals of the Rupununi savannahs, such as the rats *Sigmodon alstoni* and *Zygodontomys brevicauda*, are widespread across similar habitats from Colombia to Suriname (Voss 1991).

Nonetheless, the presence of the savannahs greatly augments the regional species diversity of mammals by adding perhaps 10-20 species not found elsewhere locally. Equally or more important from a conservation perspective, savannahs provide more optimal habitat with increased densities of some rare, endangered species that when undisturbed reach higher numbers in savannah than in forest formations. These include Giant Anteaters, Giant Armadillos and some other armadillos, and the small cat, *Felis tigrina*. Savannah-forest ecotones also appear favorable for Bush Dogs, Grisons, all other cats (especially jaguarundis), foxes, racoons, deer, and tapirs.

Voss (1991) has shown that within the savannah formations, arbustal (wooded) zones include more than twice as many species of small mammals than do pure grasslands where all trees have been destroyed to create pasture, or by otherwise excessive burning. As few as three species of small rodents and marsupials may be found in some of the latter, while seven occupy adjacent, more shrubby grasslands. Small mammals should in this case be good indicators of the overall faunal diversity of the ecosystem. Rodents, for example, are the chief prey of all small cats and many other predators. As high biomass grazers, rodents may also strongly influence the diversity of the plant community.

HERPETOFAUNA (P. FREED)

The herpetofauna of the Kanuku Mountain region is poorly known. Two distinct biomes (savannah and rain forest) contribute to the overall species richness of reptiles and amphibians in this region. The western portion (from Nappi Village to Lethem along the northern base of the Kanukus) is characterized by seasonally wet, open grasslands that support large populations of a few species of lizards (e.g., *Ameiva ameiva*, *Cnemidophorus lemniscatus*, and *Tropidurus torquatus*). Adjacent evergreen forest, as around our primary study site at Maipaima Creek, supports a much more diverse but rather typical rain forest herpetofauna.

Although we were there during the "dry" season, we nonetheless experienced several days of hard, steady rains. This, together with the fact that four to six collectors were searching continuously for reptiles and amphibians over a period of 23 days (approximately 18 hours/day x 5 people), contributed to the relatively large numbers of species and specimens collected: 20 species of amphibians and 26 species of reptiles (13 lizards, 11 snakes, 2 turtles; Appendix 4).

Since our campsite was situated next to a small creek, we were able to collect species that were aquatic and semi-aquatic, such as *Neusticurus rudis*, as well as those that utilized the water or over-hanging vegetation for foraging. This was especially evident for diurnal species whose detection during the day was almost impossible (e.g., *Anolis chrysolepis*, *Uranoscodon superciliosa* and *Corallus enydris*). Nocturnal forays in the creek also

enabled us to collect species such as *Hyla boans*, *Bufo guttatus*, *Bufo typhonius*, *Leptodactylus ocellatus*, and *Hyla megapodia*.

The majority of the daylight hours were spent walking through the forest and turning over dead and rotten logs. This yielded only a few snakes (two *Atractus torquatus*) and several frogs (*Phyllobates femoralis*, *P. trivittatus*, and *Leptodactylus rugosus*). Considerable time was also spent raking and painstakingly combing through leaf litter on the forest floor. Several forest floor lizards were collected in this manner, including *Leposoma guianense*, *Ameiva ameiva*, *Kentropyx calcaratus*, *Mabuya mabouia*, and *Cercosaura ocellata*. Of the dozen or so species of geckos known to occur in Guyana, only two were collected in our survey area, *Thecadactylus rapicaudus* and *Gonatodes humeralis*.

The majority of the 21 individual snakes were found at night, either sleeping on tree branches (*Oxybelis argenteus* and *Chironius fuscus*), or actively searching for prey (*Dipsas variegata*, *Imantodes cenchoa*, and *Corallus enydris*). Of the four *Bothrops atrox* specimens collected, two were active at night and two were found during the day, one basking, the other apparently foraging.

Easily identifiable species that were not collected include the lizard *Tupinambis nigropunctatus*, several large tortoises (*Geochelone carbonaria*) that Macushi hunters brought into camp, and the boa (*Corallus caninus*), which was seen high in the trees at night (by L. Emmons). The hylid frog *Scinops rubra* was photographed, and one very large (20+ cm) *Bufo marinus* and several large *Leptodactylus pentadactylus* were captured and released.

Because we visited Maipaima Creek during the dry season, few amphibian species were breeding. One notable exception was the large hylid frog *Hyla boans*. Following several hard rains that fell during the first days of our visit, large numbers of males began vocalizing from vegetation overhanging the creek, and soon thereafter many nest sites were excavated in the sandy beaches and thousands of eggs were deposited. Equal numbers of tadpoles and newly metamorphosed young frogs were seen during the latter days of our stay. The nearly deafening chorus of these frogs was heard on most nights, from just after sundown until 3:00 or 4:00 in the morning. Another frog species that was quite vocal and common in leaf litter throughout the low-lying *Mora* forest was the dendrobatid frog *Phyllobates trivittatus*. Although large numbers of this species were heard daily, they were difficult to locate and only five individuals were collected, two of which had tadpoles on their backs (one with six tadpoles, the other with eight). One or more species of terrestrial *Eleutherodactylus* frogs were also common and vocal in forest around the camp.

To obtain a clearer understanding of the local amphibian fauna, additional surveys should be undertaken during the rainy season. Additional, intensive collecting efforts in this area will probably reveal a fairly diverse herpetofauna similar to those of well-studied sites elsewhere in the Guianas and adjacent Amazonia (Hoogmoed 1979). A special effort should be made to obtain collections from forests at upper elevations in the Kanukus, where localized populations of poorly known (and possibly undescribed, endemic) species may occur.

INVERTEBRATE INDICATORS (A. FORSYTH AND B. GILL)

Until 1993 RAP methodology had not used invertebrate sampling. Several focal indicator taxa are now under study. Of interest are taxa that can be sampled with a consistent methodology, for which a systematic identification capacity is available, with perennial

availability, and from which meaningful biogeographic and ecological information can be derived.

Coprophagous scarabs are an appropriate taxon because they fulfill the above criteria. The global fauna of some 6000 species in 200 genera has been reasonably well sampled. Moreover the Scarabaeinae are sensitive to the effects of forest clearing and fragmentation (Howden and Nealis 1975, Klein 1989, Halffter et al. 1992). In addition, they appear to be important indicators of mammalian biomass (Forsyth, pers. obs.) and are significant in nutrient recycling.

One of the initial questions to be determined was the issue of adequate sampling time. RAP trips are indeed rapid and often intensive sampling is not possible. The Guyana sampling was a test of this issue. The results appear to support the efficacy of this method. Five days of trapping by one person at the Maipaima Creek locality yielded a total of 932 specimens representing 12 genera and 24 species (Appendix 5). Loss of intercept trap material prevented use of this trapping method which would have potentially doubled the species count.

The scarab fauna recorded at Maipaima Creek is moderately diverse and showed much overlap with collections made in Venezuelan areas. More intensively sampled mesic forest sites in Amazonia yield roughly twice as many species (Halffter 1991, Halffter et al. 1992). However, this relatively modest sampling effort yielded a fauna as diverse as those sampled more intensively in tropical forest areas of Mexico. More significantly, the numerical abundance matched our impression of high vertebrate biomass, particularly the primates on which these beetles depend for much of their trophic requirements.

Literature Cited

Amerindian Research Unit (ARU). 1989. The material culture of the Wapishana people of the south Rupunini savannahs in 1989. OCCPUBARU, Occ. Pub. Amerindian Res. Unit, Univ. of Guyana.

Boggan, J., V. Funk, C. Kelloff, M. Hoff, G. Cremers, and C. Feuillet. 1993. Checklist of the Plants of Guyana. Biological Diversity of the Guianas Program, Smithsonian Inst., Washington, DC.

Cohn-Haft, M. 1993. Rediscovery of the White-winged Potoo (*Nyctibius leucopterus*). Auk 110:391-394.

Cracraft, J. 1985. Historical biogeography and patterns of differentiation within the South American avifauna: areas of endemism. Pp. 49-84. In: Neotropical Ornithology, P.A. Buckley et al. (eds). Ornithol. Monogr. No. 36.

Fowler, J.M. and J.B. Cope. 1964. Notes on the Harpy Eagle in British Guiana. Auk 81:257-273.

Gilliard, E.T. 1962. Strange courtship of the Cock-of-the-Rock. Nat. Geog. 121(1):134-140.

Halffter, G. 1991. Historical and ecological factors determining the geographical distribution of beetles (Coleoptera: Scarabidae: Scarabaeinae). Folia Entomologica Mexicana 82:195-238.

Halffter, G., M.E. Favalia, and V. Halffter. 1992. A comparative study of the structure of the scarab guild in Mexican tropical rain forests and derived ecosystems. Folia Entomologica Mexicana 84:131-156.

Hilty, S.L. 1982. Environmental Profile on Guyana. Univ. of Arizona.

Hoogmoed, M.S. 1979. The herpetofauna of the Guianan region. Pp. 241-279 In: The South American Herpetofauna: Its Origin, Evolution, and Dispersal, W.E. Duellman (ed). Mus. Nat. Hist., Univ. Kansas, Monog. No. 7.

Howden, H.F. and V.G. Nealis. 1975. Effects of clearing in a tropical rain forest on the composition of the coprophagous beetle fauna (Coleoptera). Biotropica 7:77-83.

Klein, B. C. 1989. Effects of forest fragmentation on dung and carrion beetle communities in central Amazonia. Ecology 70:1715-1725.

Muckenhirn, N.A., B.K. Mortensen, S. Vessey, C.E.O. Fraser, and B. Singh. 1975. Report on a primate survey in Guyana. Pan American Health Organization, unpublished report.

Parker, T.A., III. 1983. A record of Blackburnian Warbler *Dendroica fusca* for southeastern Brazil. Amer. Birds 37:254.

Parker, T.A., III. 1991. Birds of Alto Madidi. Pp. 21-23. In: A biological assessment of the Alto Madidi region and adjacent areas of northwest Bolivia; T.A. Parker, III and B. Bailey (eds). Conservation International, RAP Working Pap. 1.

Parker, T.A., III and D.F. Stotz. MS. Ecological distribution of Neotropical birds. In: Neotropical Birds: Ecology and Conservation, D.F. Stotz, J. Fitzpatrick, T.A. Parker, III, D. Moskovitz.

Peck, S.B. and A. Forsyth. 1982. Composition structure and competitive behavior in a guild of Ecuadorian rain forest dung beetles (Coleoptera: Scarabae-idae). Canadian J. of Zool. 60:1624-1634.

Rettig, N.L. 1977. In quest of the snatcher. Audubon 79(11):26-49.

Rettig, N.L. 1978. Breeding behavior of the Harpy Eagle (*Harpia harpyja*). Auk 95:629-643.

Stotz, D.F. and R.O. Bierregaard, Jr. 1989. The birds of the Fazendas Porto Alegre, Esteio and Dimona north of Manaus, Amazonas, Brazil. Rev. Brasil. Biol. 49:861-872.

Stotz, D.F., R.O. Bierregaard, M. Cohn-Haft, P. Petermann, J. Smith, A. Whittaker, and S.V. Wilson. 1992. The status of North American migrants in central Amazonian Brazil. The Condor 94:608-621.

Thomas, O. 1901. On a collection of mammals from the Kanuku Mountains, British Guiana. Ann. Mag. Nat. Hist., Ser. 7, 7:139-154.

Voss, R. S. 1991. An introduction to the Neotropical rodent genus *Zygodontomys*. Bull. Am. Mus. Nat. Hist. No. 210. 113 pp.

Welle, B.J.H. ter, M.J. Jansen-Jacobs, A.R.A. Gorts-van Rijn, and R.C. Ek. 1987. Botanical Exploration in the Northern Part of the Western Kanuku Mountains (Guyana). Inst. of Systematic Botany, Utrecht Univ., The Netherlands.

Welle, B.J.H. ter, M.J. Jansen-Jacobs, A.R.A. Gorts-van Rijn, and R.C. Ek. 1990. Botanical Exploration in the Northern Part of the Western Kanuku Mountains (Guyana). Annex: Identifications. Inst. of Systematic Botany, Utrecht Univ., The Netherlands.

Willis, E.O., D.F. Stotz, D. Snow, and T.A. Parker, III. 1993. Olive-sided Flycatchers in southeastern Brazil. Wilson Bull. 105:193-194.

Gazetteer

GUYANA, KANUKU MOUNTAINS, FEBRUARY 1993

Annai

3° 57' N, 59° 8' W. El. 180 m. Amerindian village on a hill near Rupununi River; starting point for trip up the Rewa River.

Lethem

3°23' N, 59° 48' W. Largest town in the Kanukus region on the east bank of the Takutu River; point of access to Brazil.

Maipaima Creek

3° 22' 52" N, 59° 30' 21" W. El. 120 m. Base camp at shelter belonging to David Artez on creek ca. 1 km south of road, ca. 1.5 km downstream from highest farm habitations on creek. We worked on trails: a) 4 km SW skirting foothills to a small, forest enriched savanna at 160 m el.; b) upstream; following the course of the SE branch of Maipaima Creek from the highest farm hut to 500 m el. (the trail continues up and down for several km with 500 m as the highest point reached; c) the main road to Nappi Village, from David's camp to the savannah edge; d) many smaller local access trails to tapped *Manilkara* trees, logging sites, etc.

Nappi Head

3° 21' 31" N, 59° 33' 47" W. El. 140 m. House at the end of the road from Nappi Village to Nappi Creek. From here we followed a trail up Nappi Creek to its headwaters; about 6 km (4 h) climb to a campsite on the creek below the N face of Nappi Mt. then about 1 km up the creek to saddle between Nappi Mt. and Moco-Moco Mt.; thence up the E ridge to the rock summit of Nappi Mt. (3° 18' N, 59° 33' N) (RF, BH, TP, LE and Macushi guides 7-8 Feb.).

Nappi Village

3° 25' N, 59° 34' W. A small Macushi village east of Lethem in the Rupununi savannah, north of the Kanukus.

Rewa River

Travelled from the mouth at the Rupununi upstream as far as 3° 27' N, 58° 35', el. 82 m. (RF, AF 12-16 Feb.).

Appendices

Appendix 1	Plant List: Kanuku Mountains and Surrounding Area	*(B. Hoffman)*
Appendix 2	Bird Species Recorded in the Kanuku Mountain Region	*(T.A. Parker, III)*
Appendix 3	Mammal List: Kanuku Mountain Region	*(L.H. Emmons)*
Appendix 4	Amphibians and Reptiles	*(P. Freed)*
Appendix 5	Scarabaeine Beetles (Coleoptera: Scarabidae)	*(A.B. Forsyth and B.D. Gill)*

APPENDIX 1

Plant List: Kanuku Mountains and Surrounding Area

Bruce Hoffman

Plant specimens collected and identified from the Kanuku Mountains and surrounding area on this and previous expeditions by Smithsonian Institution staff. The University of Utrecht has also collected botanical specimens in the area in recent years and has published a report of the expedition and an extensive plant list (Welle et al. 1987, 1990). These are included in the Guyana plant checklist (Boggan et al. 1993).

	Collection Numbers
ACANTHACEAE	
Aphelandra sp.	BH3515
ADIANTACEAE	
Adiantopsis radiata (L.) Fée	LG1885
Adiantum dolosum Kunze	LG1807b,1883
Adiantum latifolium Lam.	LG2031
Adiantum latifolium x *serrato-dentatum*	LG1884
Adiantum pulverulentum L.	LG1899
Adiantum pulverulentum L.	BH315
Adiantum serrato-dentatum Willd.	LG1865
AKEETINACEAE	
Akeetina sp.	observed
ANACARDIACEAE	
Anacardium sp.	observed
ANNONACEAE	
Anaxagorea sp.	BH451
Duguetia sp.	EH1122, BH335
Guatteria sp.	BH3525
APOCYNACEAE	BH3786,3808
Aspidosperma sp.	EH1099
Lacmellea sp.	observed
Plumeria sp.	BH3650
ARACEAE	
Anthurium sp.	observed
ARECACEAE	
Astrocaryum gynacanthum Mart.	LG2041
Attalea regia (Mart.) W. Boer	EH1094

APPENDIX 1

	Collection Numbers
Bactris sp.	BH3729
Desmoncus sp.	BH3844
Geonoma sp.	BH3686
ASCLEPIADACEAE	
Matelea sp.	LG1834
ASPLENIACEAE	BH389
ASTERACEAE	
Ichthyothere terminalis (Spreng.) Blake	LG2020
Lepidaploa gracilis (H.B.K.) H. Robinson	BH406
Piptocarpha sp.	BH3576
Pollalesta schomburgkii (Schultz Bip.) Aristeg.	BH441
Wulffia baccata (L.f.) Kuntze	LG2035
BALANOPHORACEAE	
Helosis cayennensis (Swartz) Spreng.	LG1805
BIGNONIACEAE	
Arrabidaea cinerea Bur. & Schum.	BH402
Arrabidaea grosourdyana (Baill.) Sandw.	BH467
Jacaranda obtusifolia Humb. & Bonpl.	BH359
BOMBACACEAE	
Bombax nervosum	BH433
BORAGINACEAE	BH3743
Cordia sp.	observed
BROMELIACEAE	
Brocchinia sp.	BH3606
BRYOPHYTA	LG1906,1907,1908,1925, 2038,2039, BH487,488, 3601,3603,3604,3605,3781
BURSERACEAE	BH3598
Bursera sp.	observed
Protium sp.	observed
Trattinickia sp.	observed
CACTACEAE	LG1898
CAMPANULACEAE	
Centropogon sp.	observed

Collection Information	
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EH	Elizabeth Harris, Smithsonian Institution (all collections are from SE Kanuku Mtns.).
LG	Lynn Gillespie, Smithsonian Institution (collections from SE Kanuku Mtns., adjacent southern Rupununi savannah and tributaries of the Rupununi River).
PP	Paul Peterson, Smithsonian Institution (same locality as Lynn Gillespie).

APPENDIX 1

	Collection Numbers
CECROPIACEAE	
Cecropia sp.	EH1150
Coussapoa sp.	EH3587
CHRYSOBALANACEAE	
Couepia sp.	BH3584
Hirtella racemosa Lam.	LG1862, BH353
Licania sp.	BH3717
CLUSIACEAE	
Clusia sp.	EH1086, LG1859, BH403,423,428,3565, 3566,3567,3568
Rheedia sp.	BH339,3843
Tovomita sp.	BH3594
Vismia sp.	LG1836, BH3581
COMBRETACEAE	
Buchenavia sp.	BH3716
Terminalia sp.	BH3591
COMMELINACEAE	BH393
CONNARACEAE	
Connarus sp.	LG1854, 1860a
CONVOLVULACEAE	LG1812,1900, BH360,3657
COSTACEAE	
Costus sp.	BH3736
Costus spiralis (Jacq.) Roscoe	LG1877
CYPERACEAE	
Bulbostylis conifera (Kunth) C.B. Clarke	LG1867
Bulbostylis paradoxa (Spreng.) Lindm.	LG1841
Eleocharis fistulosa (Poir.) Link	LG1846
Rhynchospora cephalotes (L.) Vahl	LG2027, BH485
Rhynchospora comata (Link) Roem. & Schult.	BH3573, LG1819
Rhynchospora podosperma C. Wright	LG1868
Rhynchospora reptans (L.C. Rich.) Kuekenth.	BH373
Rhynchospora subplumosa C.B. Clarke	LG1842
Rhynchospora tenuis Link	LG1866

APPENDIX 1

	Collection Numbers
Scleria cyperina Willd. ex Kunth	LG1840
Scleria latifolia Swartz	BH471
Trilepis kanukuensis Gilly	BH3570
DENNSTAEDTIACEAE	BH387,388
DICHAPETALACEAE	
Tapura guianensis Aubl.	BH472
DILLENIACEAE	
Davilla sp.	LG1830
Dillenia sp.	observed
Doliocarpus spraguei Cheesm.	LG1850
EBENACEAE	BH3586
ELEOCARPACEAE	
Sloanea sp.	BH3556
ERYTHROXYLACEAE	
Erythroxylum sp.	BH3609,3620,3712
EUPHORBIACEAE	
Croton sp.	BH3547
Dalechampia sp.	LG1832
Mabea sp.	observed
Manihot tristis Muell. Arg.	LG1833,2025
Margaritaria sp.	observed
Omphalea sp.	observed
Pera glabrata (Schott) Baill.	LG1856
FABACEAE-CAESAL.	
Bauhinia scala-simiae Sandw.	EH1087
Lecointea sp.	BH3683
Mora sp.	observed
Peltogyne venosa (Vahl.) Benth.	EH1098
Swartzia apiculata Cowan	LG1838, BH344
Tachigali sp.	observed
FABACEAE-MIMOS.	
Anadenanthera peregrina (L.) Speg.	BH3754
Clitoria sp.	BH3666
Inga ingoides (Rich.) Willd.	EH1093, BH312

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APPENDIX 1

	Collection Numbers
Mimosa microcephala Willd.	BH410
Zygia latifolia (L.) Fawc. & Rendle	EH1082, BH327,340
FABACEAE-PAPIL.	
Centrolobium paraense Tul.	EH1088
Centrosema angustifolium (H.B.K.) Benth.	LG1847
Dioclea guianensis Benth.	BH362,429
Indigofera lespedezioides H.B.K.	LG1849
Ormosia sp.	BH3579,3697
Stylosanthes hispida A. Rich.	LG1844
FLACOURTIACEAE	
Casearia sp.	BH3621
GENTIANACEAE	
Coutoubea spicata Aubl.	LG1904
Irlbachia sp.	BH3538
Voyria caerulea Aubl.	LG1818
GESNERIACEAE	
Chrysothemis sp.	BH3559
HAEMODORACEAE	
Xiphidium caeruleum Aubl.	BH334
HELICONIACEAE	
Heliconia bihai (L.) L.	LG1811
Heliconia chartacea Lane ex Barreiros	LG1897, BH3735
Heliconia hirsuta L.f.	LG1848
Heliconia spathocircinata Aristeguieta	LG1871
Heliconia stricta Huber	LG1872
HUMIRIACEAE	
Humiria sp.	BH3669
HYMENOPHYLLACEAE	
Trichomanes pinnatum Hedw.	LG1926
IRIDACEAE	LG1922
LAMIACEAE	
Hyptis lantanifolia Poit.	LG1914
LAURACEAE	
Endlicheria reflectens (Nees) Mez	LG1851
Ocotea sp.	BH446

APPENDIX 1

	Collection Numbers
LECYTHIDACEAE	
Couratari sp.	observed
Eschweilera sp.	observed
Gustavia angusta L.	LG1881
LENTIBULARIACEAE	
Utricularia hispida Lam.	LG1909
LILIACEAE	
Bomarea sp.	LG1890
LORANTHACEAE	
Phthirusa stelis (L.) Kuijt, comb. nov. ined.	BH439
LYGODIACEAE	
Lygodium sp.	LG1879
MALPIGHIACEAE	
Byrsonima sp.	BH3590,3660
MALVACEAE	BH3692
MARANTACEAE	
Calathea elliptica (Roscoe) Schum.	LG1875,2032
Calathea polytricha Baker	LG1929
Calathea variegata Linden ex Koern.	BH348
Ischnosiphon obliquus (Rudge) Koern.	LG1896
MELASTOMATACEAE	
Clidemia octona (Bonpl.) L. Wms.	LG1816,1891
Clidemia pustulata DC.	LG1853
Henriettia sp.	BH3555,3622
Miconia brevipes Benth.	LG1823
Miconia ciliata (L.C. Rich.) DC.	LG1828a
Miconia fallax DC.	LG1827
Miconia holosericea (L.) DC.	LG1822
MELIACEAE	
Cedrela odorata	EH1168, BH401
Guarea sp.	observed
Trichilia sp.	observed
MENDONCIACEAE	
Mendoncia sp.	LG1878

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	Collection Numbers
MENISPERMACEAE	
Cissampelos ovalifolia DC.	LG2021
Cissampelos pareira L.	LG1831
MORACEAE	
Ficus albert-smithii Standl.	BH3583
Sorocea sp.	observed
MYRSINACEAE	
Myrsine sp.	BH3577
MYRTACEAE	
Calyptranthes fasciculata O. Berg	EH1064,1067, BH320
Eugenia eurycheila O. Berg	BH367,405
Eugenia lambertiana DC.	BH422
Eugenia tapacumensis O. Berg	EH1119, BH391
Myrcia guianensis (Aubl.) DC.	LG1829
Myrcia inaequiloba (DC.) Legrand	EH1167
Myrciaria floribunda (Willd.) O. Berg	BH420
OCHNACEAE	LG1869, BH3803
ORCHIDACEAE	
Aspasia variegata Lindl.	BH349
Campylocentrum poeppigii (Reichb.f.) Rolfe	BH369
Catasetum sp.	BH3537
Cyrtopodium sp.	BH407
Epidendron sp.	BH3536
Galeandra stillomisantha (Vell.) Hoehne	LG1920
Habenaria pauciflora (Lindl.) Rchb.f.	LG1903
Jacquiniella globosa (Jacq.) Schlechter	BH443
Lockhartia imbricata (Lam.) Hoehne	BH400
Maxillaria sp.	BH3531,3544
Pleurothallus sp.	BH3633
Scaphyglottis graminifolia (R. & P.) P. & E.	BH444
Trigonidium obtusum Lindl.	BH454
OXALIDACEAE	BH3698
PASSIFLORACEAE	
Passiflora sp.	LG2033,2040, BH379,380,3632

APPENDIX 1

	Collection Numbers
PINACEAE	BH3627
PIPERACEAE	
Piper sp.	LG1820,1843,2024, BH3687
POACEAE	
Acroceras zizanioides (H.B.K.) Dandy	PP7609
Andropogon bicornis L.	PP7620,7643
Aristida recurvata H.B.K.	PP7628
Aristida torta (Nees) Kunth	PP7617
Arundinella hispida (Willd.) Kuntze	PP7613,7639
Axonopus anceps (Mez) Hitchc.	PP7604,7645
Axonopus canescens (Nees) Pilger	PP7626
Echinolaena inflexa (Poir.) Chase	PP7602,7612,7623
Guadua latifolia (Humb. & Bonpl.) Kunth	BH343, PP7629
Homolepis isocalycia (G. Mey.) Chase	PP7603
Ichnanthus dasycoleus Tutin	PP7636
Ichnanthus nemoralis (Schrad.) Hitchc.	PP7633
Ischaemum guianense Kunth	PP7640
Lasiacis anomola Hitchc.	PP7632,7635,7637
Lasiacis sorghoidea (Desv.) Hitchc.	BH409
Mesosetum loliiforme (Steud.) Chase	PP7627
Olyra ciliatifolia Raddi	BH317b,319
Olyra latifolia L.	PP7624,7630,7631, LG2026, BH306,307,478
Oplismenus hirtellus (L.) Beauv.	PP7638, BH318
Orthoclada laxa (Rich.) Beauv.	BH473,386
Panicum cyanescens Nees	PP7641
Panicum micranthum H.B.K.	PP7608
Panicum pilosum Sw.	BH317a
Panicum rudgei Roth ex Roem. & Schult.	PP7644
Parodiolyra luetzelbergii (Pilger) Soderstrom & Zuloaga	PP7646
Paspalum gardnerianum Nees	PP7611
Paspalum lanciflorum Trin.	PP7622
Paspalum pectinatum Nees	PP7607
Paspalum plicatulum Michx.	PP7614,7642

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	Collection Numbers
Pharus latifolius L.	BH395
Rehia nervata (Swallen) Fijten	PP7634
Rhipidocladum racemiflorum (Steud.) McClure,vel aff.	BH314,463
Schizachyrium maclaudii (Jacques-Felix) S.T. Blake	PP7610
Schizachyrium sanguineum (Retz.) Alston	PP7618
Sorghastrum stipoides (H.B.K.) Nash	PP7615
Thrasya petrosa (Trin.) Chase	PP7616,7619
Trachypogon spicatus (L.f.) Kuntze	PP7605,7606
PODOSTEMACEAE	
Mourera sp.	BH357,358
POLYGALACEAE	
Coccoloba sp.	BH3720
POLYPODIACEAE	
Pecluma plumula (Humb. & Bonpl. ex Willd.) M.G. Price	LG1858
Polypodium polypodioides (L.) Watt	LG1807a,1889
PROTEACEAE	
Roupala sp.	BH3575
PTERIDACEAE	
Hemionitis palmata L.	LG1886
RHAMNACEAE	
Ziziphus cinnamonum Triana & Planch.	EH1095
RUBIACEAE	
Amaioua guianensis Aubl.	BH366
Bertiera guianensis Aubl.	LG2029
Faramea sessifolia (H.B.K.) A. DC.	BH482
Gonzalagunia sp.	BH3616
Guettarda sprucei Muell. Arg.	LG2030
Hillia parasitica Jacq.	BH427
Isertia parviflora Vahl	LG1808, BH324,355
Ixora ulei K. Krause	LG1855
Morinda tenuiflora (Benth.) Steyerm.	EH1111
Oldenlandia lancifolia (Schumach.) DC.	BH372
Palicourea riparia Benth.	BH412,453
Psychotria bahiensis A. DC.	BH383
Psychotria brachybotrya Muell. Arg.	BH338

APPENDIX 1

	Collection Numbers
Psychotria bracteocardia (DC.) Muell. Arg.	LG1927
Psychotria racemosa (Aubl.) Raeusch.	BH397
Psychotria rosea Muell. Arg.	LG2028
RUTACEAE	BH3624,3756,3802
SAPINDACEAE	
Allophylus racemosus Sw.	EH1158
Cupania sp.	BH3599
Pseudima frutescens (Aubl.) Radlk.	BH462
Toulicia patentinervis Radlk.	BH418
SAPOTACEAE	
Manilkara sp.	EH1100
SCHIZAEACEAE	
Anemia hirta (L.) Swartz	LG1887
SELAGINELLACEAE	BH3848
SMILACACEAE	
Smilax sp.	LG1930, BH415,3715
SOLANACEAE	
Solanum stramoniifolium Jacq.	LG1928
Solanum velutinum Dunal	LG1892
SPHAGNACEAE	
Sphagnum	BH3569
STRELITZIACEAE	
Phenakospermum guyannense (L.C. Rich.) Endl. ex Miq.	LG1870
SYMPLOCACEAE	
Symplocos sp.	BH3582,3595
THEACEAE	
Ternstroemia sp.	BH3588
THELYPTERIDACEAE	
Thelypteris galanderi (Hieron.) Abbiatti vel aff.	LG1923
THEOPHRASTACEAE	
Clavija sp.	observed
THYMELAEACEAE	LG1806
TILIACEAE	
Apeiba sp.	BH3788

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	Collection Numbers
TURNERACEAE	
Turnera sp.	BH3533,3651
ULMACEAE	
Ampelocera sp.	observed
Celtis sp.	BH3682
Trema sp.	BH3738
URTICACEAE	LG1924
VERBENACEAE	
Lantana sp.	BH3520
Petrea sp.	observed
VIOLACEAE	
Rinorea sp.	BH3618,3684,3816
VISCACEAE	
Phoradendron crassifolium (Pohl ex DC.) Eichl.	LG1837
VITACEAE	
Cissus sp.	LG1825,1894
VOCHYSIACEAE	
Vochysia sp.	BH3593
XYRIDACEAE	
Abolboda pulchella Humb. & Bonpl.	LG1911
Xyris fallax Malme	LG1913b
Xyris jupicai L.C. Rich.	LG1913a
ZINGIBERACEAE	
Renealmia alpinia (Rottb.) Maas	LG1873
Renealmia aromatica (Aubl.) Griseb.	LG1874,2034

Bird Species Recorded in the Kanuku Mountain Region

APPENDIX 2

T.A. Parker, III

The following list includes bird species recorded from 3-17 February 1993, at Maipaima Creek, on Nappi Mountain, in the adjacent Rupununi savannah, and along the Rio Takutu at Lethem.

	MC	NM	RS	Habitat
TINAMIDAE (6)				
Tinamus major	F	-	-	Fh
Tinamus sp.	-	U	-	Fh,Fm
Crypturellus cinereus	R	-	-	Ft
Crypturellus soui	F	-	-	Fh
Crypturellus erythropus	U	-	-	Fh
Crypturellus variegatus	F	U	-	Fh
ARDEIDAE (5)				
Pilherodias pileatus	U	-	-	Sm
Ardea cocoi	-	-	X	Rm
Casmerodius albus	-	-	X	Rm
Bubulcus ibis	-	-	X	Sg
Cochlearius cochlearius	U	-	-	Sm
CATHARTIDAE (5)				
Coragyps atratus	-	-	C	Sg
Cathartes aura	-	F	F	Fh,Sg
Cathartes burrovianus	-	-	F	Gs
Cathartes melambrotus	F	-	-	Fh
Sarcoramphus papa	U	U	-	Fh
ANATIDAE (1)				
Cairina moschata	R	-	-	S
ACCIPITRIDAE (18)				
Pandion haliaetus	-	-	X	Rm
Elanoides forficatus	F	F	-	Fh
Rostrhamus sociabilis	-	-	X	Rm
Harpagus bidentatus	U	-	-	Fh
Ictinia plumbea	R	-	-	Fe
Leucopternis melanops	R	-	-	Fh
Leucopternis albicollis	-	X	-	Fh
Asturina nitida	F	-	-	Fe

Localities

MC	Maipaima Camp
NM	Nappi Mountain
RS	Rupununi Savannah between Nappi Village and Lethem, and gallery forest along the Rio Takutu at Lethem

Abundance

C	Common
F	Fairly common
U	Uncommon
R	Rare
X	Recorded

Habitats

Fh	Mature evergreen forest
Ft	Seasonally inundated forest
Fm	Montane evergreen forest
Fg	Gallery forest
Gs	Grassland
Sg	Second growth forest
Rm	River margins
Sm	Stream margins
S	Stream

APPENDIX 2

	MC	NM	RS	Habitat
Buteogallus urubitinga	X	-	-	Sm
Buteogallus meridionalis	-	-	F	Gs
Busarellus nigricollis	-	-	X	Sm
Buteo magnirostris	?	-	-	Fe
Buteo brachyurus	-	X	-	Fh
Buteo albicaudatus	-	-	F	Gs
Morphnus guianensis	X	-	-	Fh
Harpia harpyja	X	X	-	Fh
Spizaetus tyrannus	F	X	-	Fh
Spizaetus ornatus	X	-	-	Fh
FALCONIDAE (11)				
Daptrius ater	X	-	-	Fe
Daptrius americanus	F	-	-	Fh
Polyborus plancus	-	-	X	Gs
Milvago chimachima	-	-	X	Gs
Herpetotheres cachinnans	F	-	-	Fh
Micrastur ruficollis	F	X	-	Fh
Micrastur gilvicollis	U	-	-	Fh
Micrastur semitorquatus	R	-	-	Fh
Falco sparverius	-	-	F	Gs
Falco rufigularis	?	-	-	Fe
Falco deiroleucus	-	X	-	Fe
CRACIDAE (3)				
Penelope marail	F	-	-	Fh
Penelope jacquacu	U	-	-	Fh
Crax alector	F	X	-	Fh
PHASIANIDAE (2)				
Odontophorus gujanensis	F	X	-	Fh
Colinus cristatus	-	-	X	Gs
RALLIDAE (2)				
Aramides cajanea	U	-	-	Sm
Laterallus viridis	-	-	X	Gs
EURYPYGIDAE (1)				
Eurypyga helias	U	-	-	Sm

APPENDIX 2

	MC	NM	RS	Habitat
PSOPHIIDAE (1)				
Psophia crepitans	C	-	-	Fh
CHARADRIIDAE (2)				
Hoploxypterus cayanus	-	-	X	Rm
Vanellus chilensis	-	-	C	Gs
JACANIDAE (1)				
Jacana jacana	-	-	X	Rm
SCOLOPACIDAE (1)				
Tringa solitaria	-	-	X	Rm
COLUMBIDAE (10)				
Columba speciosa	U	-	-	Fh
Columba cayennensis	-	-	C	Fg
Columba plumbea	C	-	-	Fh
Columba subvinacea	F	-	-	Fh
Columbina passerina	-	-	C	Gs,Sg
Columbina talpacoti	-	-	F	Sg
Claravis pretiosa	X	-	-	Fe
Leptotila verreauxi	-	-	F	Fg
Leptotila rufaxilla	F	-	-	Fe
Geotrygon montana	U	-	-	Fh
PSITTACIDAE (15)				
Ara ararauna	X	-	-	Fh
Ara macao	C	U	-	Fh
Ara chloroptera	R	F	-	Fh
Ara manilata	-	-	X	Fg
Aratinga pertinax	X	-	C	Fg
Pyrrhura picta	F	F	-	Fh
Brotogeris chrysopterus	F	-	-	Fh
Pionites melanocephala	F	-	-	Fh
Pionopsitta caica	U	F	-	Fh
Pionus menstruus	C	U	-	Fh
Pionus fuscus	U	F	-	Fh
Amazona ochrocephala	R	-	-	Fe
Amazona amazonica	R	-	-	Fe

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	MC	NM	RS	Habitat
Amazona farinosa	C	-	-	Fh
Deroptyus accipitrinus	C	-	-	Fh
CUCULIDAE (5)				
Piaya cayana	F	F	-	Fh
Piaya minuta	X	-	-	Sg
Crotophaga ani	-	-	F	Sg
Tapera naevia	-	-	X	Sg
Neomorphus rufipennis	R	-	-	Fh
TYTONIDAE (1)				
Tyto alba	X	-	X	Gs
STRIGIDAE (5)				
Otus watsonii	C	-	-	Fh
Lophostrix cristata	F	-	-	Fh
Pulsatrix perspicillata	U	-	-	Fh
Glaucidium hardyi	F	-	-	Fh
Ciccaba huhula	X	-	-	Fh
NYCTIBIIDAE (4)				
Nyctibius grandis	F	-	-	Fh
Nyctibius aethereus	R	-	-	Fh
Nyctibius griseus	F	-	-	Fe
Nyctibius leucopterus	U	-	-	Fh
CAPRIMULGIDAE (3)				
Lurocalis semitorquatus	U	-	-	Fh
Chordeiles pusillus	-	-	F	Gs
Nyctidromus albicollis	C	-	-	Fe
APODIDAE (5)				
Cypseloides cryptus	X	U	-	Fh
Streptoprocne zonaris	X	F	-	Fh
Chaetura spinicauda	C	U	-	Fh,Fe
Chaetura sp.	X	-	-	Fe
Aeronautes montivagus	-	C	-	Fm
TROCHILIDAE (18)				
Threnetes leucurus	F	-	-	Fh
Phaethornis superciliosus	C	F	-	Fh
Phaethornis bourcieri	F	X	-	Fh

APPENDIX 2

	MC	NM	RS	Habitat
Phaethornis squalidus	?	-	-	Fh
Phaethornis ruber	F	F	-	Fh
Phaethornis (augusti)	-	F	-	Fm
Campylopterus largipennis	U	U	-	Fh
Florisuga mellivora	U	-	-	Fh,Fe
Lophornis ornatus	R	-	-	Fe
Discosura longicauda	R	-	-	Fe
Chlorostilbon mellisugus	U	-	-	Fe,Sg
Thalurania furcata	F	-	-	Fh
Hylocharis sapphirina	F	X	-	Fh,Fe
Amazilia versicolor	U	-	-	Fe
Amazilia fimbriata	-	-	X	Sg
Topaza pella	X	X	-	Fh
Heliothryx aurita	F	-	-	Fh
Heliomaster longirostris	U	-	-	Fe
TROGONIDAE (4)				
Trogon melanurus	C	F	-	Fh
Trogon viridis	C	F	-	Fh
Trogon rufus	U	U	-	Fh
Trogon violaceus	U	U	-	Fh
MOMOTIDAE (1)				
Momotus momota	F	F	-	Fh
ALCEDINIDAE (3)				
Ceryle torquata	X	-	X	Rm,Sm
Chloroceryle americana	F	-	-	Sm
Chloroceryle inda	U	F	-	Sm
BUCCONIDAE (5)				
Notharchus macrorhynchos	U	-	-	Fh
Notharchus tectus	U	-	-	Fh,Fe
Bucco capensis	F	-	-	Fh
Malacoptila fusca	U	U	-	Fh
Monasa atra	C	-	-	Fh
GALBULIDAE (2)				
Galbula sp.	X	-	-	Fh
Jacamerops aurea	U	U	-	Fh

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APPENDIX 2

	MC	NM	RS	Habitat
CAPITONIDAE (1)				
Capito niger	F	-	-	Fh
RAMPHASTIDAE (4)				
Pteroglossus aracari	U	-	-	Fh,Fe
Selenidera culik	-	X	-	Fm
Ramphastos tucanus	C	C	-	Fh
Ramphastos vitellinus	C	F	-	Fh
PICIDAE (11)				
Picumnus (spilogaster)	-	-	X	Fg
Veniliornis cassini	F	X	-	Fh
Piculus flavigula	F	-	-	Fh
Piculus rubiginosus	-	X	-	Fm
Celeus undatus	F	F	-	Fh
Celeus elegans	C	U	-	Fh
Celeus flavus	R	-	-	Fe
Celeus torquatus	U	-	-	Fh
Dryocopus lineatus	F	-	-	Fe
Campephilus melanoleucos	U	-	-	Fe,Fh
Campephilus rubricollis	F	F	-	Fh
DENDROCOLAPTIDAE (13)				
Dendrocincla fuliginosa	F	-	-	Fh
Dendrocincla merula	X	-	-	Fh
Deconychura stictolaema	?	-	-	Fh
Glyphorynchus spirurus	C	F	-	Fh
Dendrexetastes rufigula	U	-	-	Fe
Hylexetastes perrotii	U	-	-	Fh
Xiphocolaptes promeropirhynchus	R	-	-	Fh
Dendrocolaptes certhia	F	-	-	Fh
Dendrocolaptes picumnus	F	-	-	Fh
Xiphorhynchus pardalotus	C	-	-	Fh
Xiphorhynchus guttatus	C	F	-	Fh,Fe
Lepidocolaptes albolineatus	F	X	-	Fh
Lepidocolaptes souleyetii	-	-	F	Fg
FURNARIIDAE (9)				
Furnarius leucopus	-	-	F	Fg,Rm

APPENDIX 2

	MC	NM	RS	Habitat
Philydor (ruficaudatus)	U	-	-	Fh
Automolus ochrolaemus	F	F	-	Fh
Automolus infuscatus	C	-	-	Fh
Xenops minutus	F	F	-	Fh
Xenops (tenuirostris)	U	-	-	Fh
Sclerurus mexicanus	U	U	-	Fh
Sclerurus rufigularis	F	-	-	Fh
Sclerurus caudacutus	?	-	-	Fh
FORMICARIIDAE (35)				
Cymbilaimus lineatus	U	-	-	Fh
Frederickena viridis	U	-	-	Fh
Taraba major	F	-	C	Fe,Sg
Sakesphorus canadensis	-	-	F	Fg
Thamnophilus murinus	F	F	-	Fh
Thamnophilus punctatus	U	-	-	Fe
Thamnophilus amazonicus	F	-	-	Fe,Fh
Thamnomanes ardesiacus	C	X	-	Fh
Thamnomanes caesius	C	-	-	Fh
Myrmotherula brachyura	F	F	-	Fh
Myrmotherula guttata	F	-	-	Fh
Myrmotherula gutturalis	F	F	-	Fh
Myrmotherula axillaris	C	F	-	Fh
Myrmotherula longipennis	F	F	-	Fh
Myrmotherula menetriesii	C	F	-	Fh
Herpsilochmus (sticturus)	U	U	-	Fh
Microrhopias quixensis	U	-	-	Fe,Fh
Terenura spodioptila	U	U	-	Fh
Cercomacra cinerascens	C	F	-	Fh
Cercomacra tyrannina	F	-	-	Fe
Myrmoborus leucophrys	R	-	-	Fh,Fe
Hypocnemis cantator	C	F	-	Fh,Fe
Percnostola rufifrons	C	-	-	Fh
Percnostola leucostigma	R	-	-	Fh
Myrmeciza longipes	F	F	-	Fe
Myrmeciza ferruginea	F	-	-	Fh

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Habitats

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	MC	NM	RS	Habitat
Pithys albifrons	C	F	-	Fh
Gymnopithys rufigula	F	F	-	Fh
Hylophylax naevia	-	F	-	Fh,Fm
Hylophylax poecilinota	F	-	-	Fh
Formicarius colma	F	-	-	Fh
Formicarius analis	C	F	-	Fh
Myrmornis torquata	U	-	-	Fh
Hylopezus macularius	F	-	-	Fh
Myrmothera campanisona	U	U	-	Fh,Fm
TYRANNIDAE (49)				
Zimmerius gracilipes	F	F	-	Fh,Fe
Ornithion inerme	F	F	-	Fh
Camptostoma obsoletum	-	-	F	Sg,Fg
Phaeomyias murina	-	-	F	Sg,Fg
Sublegatus modestus	-	-	F	Fg,Sg
Tyrannulus elatus	F	-	-	Fe
Myiopagis gaimardii	C	F	-	Fh
Myiopagis caniceps	R	-	-	Fh
Myiopagis flavivertex	U	-	-	Fh,Sm
Elaenia flavogaster	-	-	C	Fg,Sg
Elaenia chiriquensis	-	-	F	Sg,Gs
Mionectes oleaginea	F	-	-	Fh
Mionectes macconnelli	-	F	-	Fh,Fm
Corythopis torquata	F	F	-	Fh
Myiornis ecaudatus	F	U	-	Fh
Hemitriccus galeatus	C	F	-	Fh
Hemitriccus sp.	R	-	-	Fe
Todirostrum cinereum	-	-	F	Fg,Sg
Todirostrum pictum	F	-	-	Fh,Fe
Tolmomyias assimilis	F	F	-	Fh
Tolmomyias poliocephalus	C	-	-	Fe,Fh
Tolmomyias flaviventris	-	-	F	Fg,Sg
Platyrinchus coronatus	F	U	-	Fh
Platyrinchus saturatus	R	-	-	Fh

APPENDIX 2

	MC	NM	RS	Habitat
Platyrinchus platyrhynchos	U	U	-	Fh
Terenotriccus erythrurus	U	U	-	Fh
Myiobius barbatus	F	F	-	Fh,Fm
Contopus borealis	-	R	-	Fm
Pyrocephalus rubinus	-	-	F	Sg
Arundinicola leucocephala	-	-	F	Sg,Sm
Hirundinea ferruginea	-	F	-	Sg
Attila spadiceus	F	F	-	Fh
Rhytipterna simplex	F	-	-	Fh
Sirystes sibilator	U	U	-	Fh
Myiarchus tuberculifer	F	-	-	Fe,Fh
Myiarchus ferox	-	-	F	Sg,Fe
Myiarchus tyrannulus	-	-	F	Fg,Sg
Pitangus sulphuratus	-	-	C	Sg,Rm
Megarynchus pitangua	F	-	-	Fe
Myiozetetes cayanensis	-	-	C	Sg,Fe
Conopias albovittata	F	-	-	Fh
Legatus leucophaius	U	-	-	Fe
Tyrannus melancholicus	-	-	C	Sg,Rm
Tyrannus savana	-	-	C	Gs,Sg
Pachyramphus polychopterus	U	-	-	Fe,Fh
Pachyramphus marginatus	F	U	-	Fh
Pachyramphus minor	U	-	-	Fh
Tityra cayana	F	-	-	Fh
Tityra sp.	X	X	-	Fh
COTINGIDAE (11)				
Phoenicircus carnifex	F	U	-	Fh,Fm
Lipaugus vociferans	C	C	-	Fh
Cotinga cayana	F	-	-	Fh
Cotinga cotinga	U	-	-	Fh
Xipholena punicea	F	-	-	Fh
Gymnoderus foetidus	F	-	-	Fh
Querula purpurata	C	U	-	Fh
Perissocephalus tricolor	F	-	-	Fh

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Procnias alba	F	F	-	Fh
Rupicola rupicola	R	U	-	Fh
Oxyruncus cristatus	-	U	-	Fm
PIPRIDAE (6)				
Schiffornis turdinus	U	-	-	Fh
Piprites chloris	U	U	-	Fh
Tyranneutes virescens	F	-	-	Fh
Chiroxiphia pareola	R	-	-	Fe
Pipra serena	-	C	-	Fh,Fe
Pipra erythrocephala	C	F	-	Fh
HIRUNDINIDAE (3)				
Phaeoprogne tapera	-	-	F	Rm
Progne chalybea	-	-	C	Sg
Hirundo rustica	-	-	F	Gs,Sg
TROGLODYTIDAE (6)				
Campylorhynchus griseus	-	-	F	Fg,Sg
Thryothorus coraya	C	-	-	Fe,Fh
Thryothorus leucotis	-	-	C	Fg,Sg
Troglodytes aedon	-	-	F	Sg
Henicorhina leucosticta	-	F	-	Fm
Microcerculus bambla	-	F	-	Fh,Fm
SYLVIINAE (4)				
Microbates collaris	F	U	-	Fh
Ramphocaenus melanurus	U	-	-	Fe,Fh
Polioptila plumbea	-	-	C	Fg,Sg
Polioptila guianensis	U	-	-	Fh
TURDINAE (4)				
Turdus leucomelas	-	-	F	Fg,Sg
Turdus fumigatus	F	-	-	Fh
Turdus nudigenis	-	-	F	Fg
Turdus albicollis	F	F	-	Fh,Fm
MIMIDAE (1)				
Mimus gilvus	-	-	C	Sg,Gs
CORVIDAE (1)				
Cyanocorax cayanus	F	-	-	Fh,Fe

APPENDIX 2

	MC	NM	RS	Habitat
VIREONIDAE (7)				
Cyclarhis gujanensis	-	F	F	Fg,Fm
Vireolanius leucotis	F	F	-	Fh
Vireo olivaceus	F	-	C	Fg,Fe
Hylophilus pectoralis	-	-	F	Fg
Hylophilus (brunneiceps)	-	F	-	Fm
Hylophilus muscicapinus	C	F	-	Fh
Hylophilus ochraceiceps	C	F	-	Fh
EMBERIZINAE (4)				
Ammodramus humeralis	-	-	C	Gs
Volatinia jacarina	-	-	C	Sg
Arremon taciturnus	F	U	-	Fh
Paroaria gularis	-	-	F	Fg,Sg
CARDINALINAE (2)				
Pitylus grossus	F	U	-	Fh
Cyanocompsa cyanoides	U	-	-	Fe
THRAUPINAE (26)				
Lamprospiza melanoleuca	F	F	-	Fh
Hemithraupis guira	F	-	-	Fh
Hemithraupis flavicollis	?	?	-	Fh
Nemosia pileata	-	-	C	Fg,Sg
Lanio fulvus	F	U	-	Fh
Tachyphonus cristatus	F	-	-	Fh
Tachyphonus surinamus	U	-	-	Fh
Tachyphonus luctuosus	C	-	-	Fh
Piranga rubra	U	-	-	Fe,Fh
Piranga flava	-	F	-	Fm
Ramphocelus carbo	-	-	C	Sg,Fe
Thraupis episcopus	-	-	C	Fe,Sg
Thraupis palmarum	C	-	F	Fe,Fh
Cyanicterus cyanicterus	F	-	-	Fh
Euphonia chlorotica	-	-	C	Fg,Sg
Euphonia violacea	F	U	-	Fe
Euphonia chrysopasta	F	-	-	Fe,Fh
Euphonia cayennensis	U	U	-	Fh

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	MC	NM	RS	Habitat
Tangara mexicana	U	-	-	Fe,Fh
Tangara chilensis	R	-	-	Fh
Tangara punctata	C	C	-	Fh,Fm
Tangara velia	R	-	-	Fh
Dacnis lineata	C	F	-	Fh,Fm
Dacnis cayana	F	F	-	Fh,Fm
Cyanerpes sp.	X	X	-	Fh,Fm
Coereba flaveola	U	U	-	Fe,Sg
PARULIDAE (7)				
Parula pitiayumi	-	F	-	Fm
Dendroica petechia	-	-	C	Fg
Dendroica fusca	-	U	-	Fm
Dendroica striata	F	U	-	Fh,Fm
Basileuterus culicivorus	-	C	-	Fm
Phaeothlypis rivularis	F	F	-	Fh,Sm
Conirostrum speciosum	-	-	X	Fg
ICTERIDAE (6)				
Psarocolius decumanus	F	-	-	Fe,Fh
Psarocolius viridis	F	U	-	Fh
Cacicus haemorrhous	C	-	-	Fh
Cacicus cela	U	-	-	Fe,Fh
Icterus nigrogularis	-	-	F	Fg,Sg
Scaphidura oryzivora	R	-	-	Fe

Total: 349 spp.

Total forest birds at Maipaima: 220 spp.

Abundance Codes	
C	Common; more than 10 individuals recorded (by sight or sound) daily within small areas surveyed (generally < 2 km of trail)
F	Fairly common; less than 10 individuals recorded daily
U	Uncommon; small numbers recorded, not daily
R	Rare; very scarce, fewer than 5 individuals recorded during survey
X	Species recorded, status uncertain

Mammal List: Kanuku Mountain Region

APPENDIX 3

Louise H. Emmons

The following list includes mammals identified from tracks, observations, and specimens (*) by RAP team members 3-16 February, 1993; and those collected by earlier expeditions and represented by specimens in the British Museum of Natural History (BMNH), the United States National Museum (USNM), and the Royal Ontario Museum (ROM). Dr. Mark Engstrom kindly provided us with the latter list.

	West	East	Savannah	Source
Didelphidae (opossums)				
Caluromys lanatus	X			1
Caluromys philander		X?		3
Didelphis marsupialis	X	X		2, 4
Didelphis albiventris		X	X	3
Philander opossum	X	X		1, 2, 3
Marmosa murina	X	X		1, 3
Marmosops parvidens	X	X		1*, 3
Metachirus nudicaudatus	X	X		2, 3
Micoureus demararae		X		3
Monodelphis brevicaudata		X		3
Myrmecophagidae (anteaters)				
Myrmecophaga tridactyla		X		4
Tamandua tetradactyla	X	X		4, 5
Bradypodidae (three-toed sloths)				
Bradypus tridactylus	X	X		1, 4
Megalonychidae (two-toed sloths)				
Choloepus didactylus	X	X		1, 4
Dasypodidae (armadillos)				
Dasypus novemcinctus	X	X		1, 4
Priodontes maximus	X			3
Emballonuridae (sheath-tailed bats)				
Cormura brevirostris	X	X		3, 4
Diclidurus scutatus		X?		3
Peropteryx macrotis	X	X		2, 3, 4
Rhynchonycteris naso	X	X		2, 3, 4

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APPENDIX 3

	West	East	Savannah	Source
Saccopteryx bilineata	X	X		2, 3, 4
Saccopteryx canescens		X		3
Saccopteryx leptura	X	X		1*, 2, 3, 4
Noctilionidae (bulldog bats)				
Noctilio albiventris		X		2, 3
Noctilio leporinus	X	X		1*, 3
Mormoopidae (mustached bats)				
Pteronotus gymnonotus	X			1*
Pteronotus parnellii	X	X		1*, 3
Phyllostomidae (leaf-nosed bats)				
Ametrida centurio	X	X	X	3
Anoura caudifer		X		3
Artibeus amplus	X	X		1*, 3
Artibeus cinereus	X	X	X?	3
Artibeus concolor	X			3
Artibeus glaucus bogotensis	X			2
Artibeus gnomus		X		3
Artibeus jamaicensis	X	X		1*, 2, 3
Artibeus lituratus	X	X		1*, 3
Artibeus obscurus	X	X		1*, 3
Carollia brevicauda	X	X		1*, 2, 3
Carollia perspicillata	X	X	X	1*, 3, 4
Chiroderma salvini		X?		3
Chiroderma villosum		X		3
Choeroniscus godmani		X		3
Chrotopterus auritus		X		3
Desmodus rotundus	X	X		1*, 3
Diaemus youngi	X	X		3
Glossophaga longirostris	X	X	X	3, 4
Glossophaga soricina	X	X		2, 3
Lionycteris spurrelli		X		3
Lonchophylla thomasi	X	X		1*, 3, 4
Macrophyllum macrophyllum		X		3
Mesophylla macconnelli	X			2

APPENDIX 3

	West	East	Savannah	Source
Micronycteris megalotis	X	X		2, 3, 4
Micronycteris minuta		X		3
Micronycteris nicefori		X		3
Micronycteris sylvestris		X		3
Mimon crenulatum	X	X		1*, 3
Phylloderma stenops		X		3
Phyllostomus discolor		X		3
Phyllostomus elongatus	X	X		1*, 3
Phyllostomus hastatus		X		3
Phyllostomus latifolius	X			2
Platyrrhinus helleri	X	X		1*, 3
Rhinophylla pumilio		X		3
Sturnira lilium	X	X		1*, 3
Sturnira tildae	X	X		1*, 3
Tonatia bidens	X			3
Tonatia brasiliense	X			3
Tonatia silvicola	X	X		1*, 3
Trachops cirrhosus	X	X		3, 4
Uroderma bilobatum	X	X		1*, 3
Uroderma magnirostrum		X		3
Vampyressa bidens	X	X		1*, 3
Vampyressa brocki		X?		3
Natalidae (funnel-eared bats)				
Natalus tumidirostris		X		3
Furipteridae (thumbless bats)				
Furipterus horrens		X		3
Thyropteridae (sucker-footed bats)				
Thyroptera discifera	X			3
Thyroptera tricolor		X		3
Vespertilionidae (verspertilionid bats)				
Eptesicus brasiliensis		X		3, 4
Eptesicus furinalis		X		3
Lasiurus ega		X		3

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	West	East	Savannah	Source
Lasiurus blossovillei [*borealis*]	X	X		1*, 3
Myotis albescens	X	X		1*, 3, 4
Myotis nigricans		X		3, 4
Rhogeesa tumida		X		3
Molossidae (free-tailed bats)				
Cynomops paranus	X		X?	3
Cynomops planirostris		X	X	3
Eumops auripendulus		X	X	3
Eumops bonariensis	X	X	X	3
Eumops glaucinus		X	X	3
Eumops hansae		X		3
Eumops maurus	X			2
Eumops perotis		X		3
Eumops trumbulli		X		3
Molossops temminckii		X	X	3
Molossus coibensis		X		3
Molossus molossus		X?		3, 4
Molossus rufus	X	X		3
Nyctinomops macrotis		X	X	3
Nyctinomops laticaudata		X		3, 4
Neoplatymops mattogrossensis		X	X	3
Promops nasutus		X		3
Callithrichidae (tamarins)				
Saguinus midas		X		4
Cebidae (monkeys)				
Alouatta seniculus	X	X		1, 4
Ateles paniscus	X	X		1, 4
Cebus apella	X	X		1, 4
Cebus olivaceus	X	X		3, 4
Chiropotes satanus		X		4
Pithecia pithecia	X	X		1, 4
Saimiri sciureus	X	X		1, 4

APPENDIX 3

	West	East	Savannah	Source
Canidae (dogs)				
Dusicyon thous		X	X	2, 3, 4
Speothos venaticus				3 no loc.
Procyonidae (racoon family)				
Nasua nasua	X	X		4, 5
Potos flavus	X			1
Mustelidae (weasel family)				
Eira barbara	X	X		3, 4, 5
Galictis vittata		X	X	4
Lutra longicaudis	X			1
Pteronura brasiliensis		X		1, 4
Felidae (cats)				
Felis concolor		X	X	4
Felis pardalis		X		4
Felis wiedii		X		4
Felis tigrina		X	X?	4
Felis yagouaroundi		X		4
Panthera onca		X		4
Tapiridae (tapirs)				
Tapirus terrestris	X	X		1, 4
Tayassuidae (peccaries)				
Tayassu tajacu	X			1
Tayassu pecari		X		1
Cervidae (deer)				
Mazama americana	X	X		1, 3, 4
Mazama gouazoubira	X	X		1, 3, 4
Odocoileus virginiana		X	X	4
Sciuridae (squirrels)				
Sciurus aestuans	X			1, 2
Muridae (rats)				
Holochilus guianae	X		X?	2
Neacomys guianae	X			3
Nectomys squamipes	X	X		1, 3
Oecomys bicolor		X		3

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Oligoryzomys fulvescens	X	X		2, 3
Oryzomys capito	X	X		1*, 3
Rhipidomys nitela	X	X		2, 3
Sigmodon alstoni	X	X	X	2, 3
Zygodontomys brevicauda	X	X	X	2, 3
Erethizontidae (porcupines)				
Coendou prehensilis	X	X		4, 5
Caviidae (cavies)				
Cavia aperea	X	X	X	2, 3
Hydrochaeridae (capybara)				
Hydrochaeris hydrochaeris		X		1, 4
Agoutidae (paca)				
Agouti paca	X			1
Dasyproctidae (agoutis)				
Dasyprocta aguti	X			1
Myoprocta acouchy	X	X		1, 3
Echimyidae (spiny rats)				
Echimys chrysurus		X		3
Echimys didelphoides		X		3
Mesomys hispidus	X			1*
Proechimys sp.	X	X		1, 2, 3

Amphibians and Reptiles

APPENDIX 4

Paul Freed

The following is a list of the species collected during our stay in the Kanuku Mountains region, February 3-25, 1993.

	MC	Notes
Amphibia		
ANURA		
Bufonidae		
Bufo granulosus merianae	+	in savannah
Bufo guttatus	+	
Bufo marinus	+	
Bufo typhonius	+	
Dendrobatidae		
Phyllobates femoralis	+	
Phyllobates trivittatus	+	
Hylidae		
Hyla albopunctata multifasciata	+	
Hyla boans	+	
Hyla crepitans	+	
Hyla megapodia	+	
Osteocephalus taurinus	+	
Phyllomedusa hypochondrialis	+	
Scinops rubra	*	
Leptodactylidae		
Eleutherodactylus guntheri	+	
Eleutherodactylus sp. "A"	+	
Eleutherodactylus sp.	+	
Leptodactylus ocellatus	+	
Leptodactylus pentadactylus	*	
Leptodactylus podicipinus	+	
Leptodactylus rugosus	+	

MC	in or around our main camp on Maipaima Creek; rain forest habitat unless noted otherwise
+	specimen(s) deposited in the collections of the Carnegie Museum of Natural History, Pittsburgh, or University of Guyana, Georgetown
*	observed, but not collected

APPENDIX 4

	MC	Notes
Reptilia		
SAURIA		
Gekkonidae		
Gonatodes humeralis	+	
Hemidactylus mabouia		observed in Lethem
Thecadactylus rapicaudus	+	
Iguanidae		
Anolis chrysolepis	+	
Plica umbra	+	
Tropidurus torquatus	+	in savannah
Uranoscodon superciliosa	+	
Scincidae		
Mabuya mabouia	+	
Teiidae		
Ameiva ameiva	+	in savannah
Cercosaura o. ocellata	+	
Kentropyx calcaratus	+	
Leposoma guianense	+	
Neusticurus rudis	+	
SERPENTES		
Boidae		
Boa constrictor		observed near Lethem
Corallus caninus	*	
Corallus enydris	+	
Colubridae		
Atractus torquatus	+	
Chironius fuscus	+	
Dipsas variegata	+	
Imantodes cenchoa	+	
Liophis typhlus	+	
Oxybelis argenteus	+	
Spilotes pullatus	*	

APPENDIX 4

	MC	Notes
Viperidae		
Bothrops atrox	+	
TESTUDINES		
Testudinidae		
Geochelone carbonaria	*	
Chelidae		
Chelus fimbriatus		observed near Lethem

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APPENDIX 5

Scarabaeine Beetles (Coleoptera: Scarabidae)

Adrian B. Forsyth and Bruce D. Gill

Specimens collected in February, 1993 by ABF using dung baited pitfall traps; determinations by B.D. Gill, Agriculture Canada.

Ateuchus connexus (Preud.)
Ateuchus pauki (Balth.)
Ateuchus pygidialis (Har.)
Ateuchus setulosus (Balth.)
Canthidium gerstaeckeri Har.
Canthidium near *guyanense* Bouc.
Canthidium nitidum group
Canthon bicolor Castel.
Canthon triangularis (Drury)
Coprophanaeus dardanus (MacL.)
Deltochilum gibbosum (Fabr.)
Dichotomius boreus (Oliv.)
Dichotomius lucasi (Har.)
Eurysternus caribaeus Herbst
Eurysternus velutinus Bates
Hansreia affinis (Fabr.)
Ontherus suclator (Fabr.)
Onthophagus clypeatus Blanch.
Onthophagus haematopus group
Onthophagus onthochromus Arrow
Oxysternon festivum (L.)
Sulcophaneus faunus (Fabr.)
Sylvicanthon bridarollii Martínez
Uroxys near *micros* Bates

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#4 The lowland dry forests of Santa Cruz, Bolivia: a global conservation priority. T.A. Parker, III, A.H. Gentry, R.B. Foster, L.H. Emmons, and J.V. Remsen, Jr. 1993. ca. 96 pp. $7

#5 A biological assessment of the Kanuku Mountain region of southwestern Guyana. T.A. Parker, III, R.B. Foster, L.H. Emmons, P. Freed, A.B. Forsyth, B. Hoffman, and B.D. Gill. 1993. 70 pp. $7

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ISBN 1-881173-01-1