CHAPTER ONE

Overview of the Mesoamerican Primate Fauna, Primate Studies, and Conservation Concerns

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INTRODUCTION

Mesoamerica's unique biological heritage comprises five southern states of Mexico (Chiapas, Tabasco, Yucatan, Campeche, and Quintana Roo) and the Central American countries of Guatemala, Belize, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. These countries encompass an area of approximately 750,000 km^2 (Figure 1). Mesoamerica's natural ecosystems range

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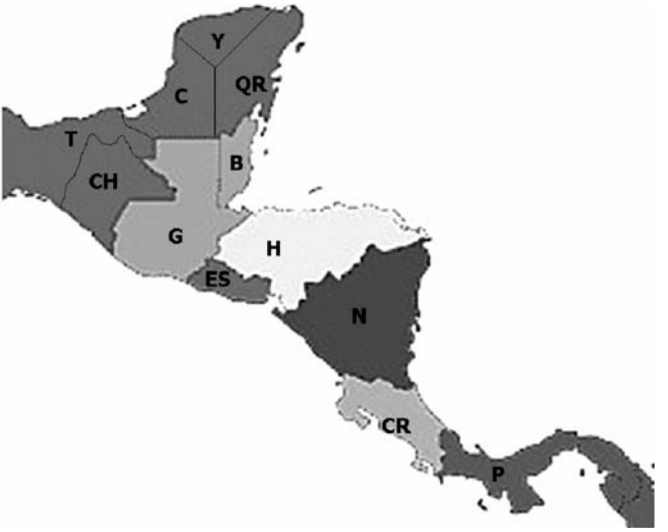

Figure 1. Mesoamerican countries: T, CH, C, Y, and QR are the southern states of Mexico that form part of the Mesoamerican region. G, Guatemala; B, Belize; ES, El Salvador; H, Honduras; N, Nicaragua; CR, Costa Rica; and P, Panama.

from coral reefs and lowland rainforests to pine savannas, semi-arid woodlands, grasslands, and high-mountain forests, constituting about 33 distinct "ecoregions" according to biogeographers (UNDP, 1999; UNEP, 2004). Because of its geographical location, it is a critical migration corridor for many wintering bird species and for some insect groups such as the monarch butterflies (Moore and Simons, 1992; Terborgh, 1989). The region contributes to less than 1.0% of the world's land surface, but it is home to a disproportionate share—about 7–10%—of the planet's biological diversity (Mittermeier *et al.*, 1998).

Mesoamerica is considered to be one of the world's most important centers of origin of genetic diversity and of domestication of important agricultural crops. Its indigenous peoples bred maize, squash, various beans, and chili peppers from wild species endemic to the region (FAO, 2001). The region holds the world's interest as well as a result of having been the cradle of one of the most ancient and sophisticated civilizations of mankind—the Maya (Gómez-Pompa *et al.*, 2003). Indigenous people still inhabit the region and they represent about 16% of the total population (*ca.* 45 million). Although the concentration of the population of indigenous groups is not uniform across Mesoamerican nations, they constitute an important demographic, social, and cultural component of each country in the region (Figure 2). Most of the indigenous people are found

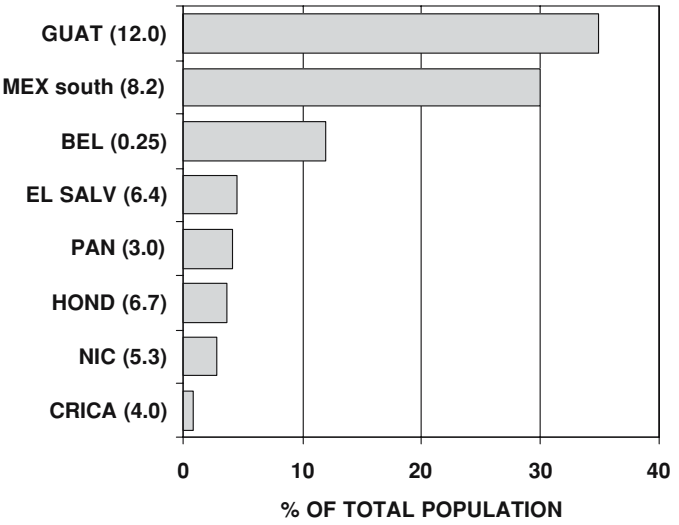

Figure 2. Indigenous population of Mesoamerica as percent of the total population in each country. Total population for each country as millions of people between parenthesis.

in rural and remote areas where tropical forests are still present. It is ironic that amidst such biological wealth in the region, poverty and marginalization are a predominant feature of its human inhabitants (UNEP, 2004). Conservation of areas of native vegetation in the region will need to consider sustainable use and social and economic equity as key elements of any conservation equation (Aguilar-Støen and Dhillon, 2003).

PRIMATE FAUNA

Mesoamerica harbors the northernmost representatives of the Primate Order in the American continent, and these, as the rest of the region's biological richness, are part of the natural and cultural patrimony of its nations. Primate diversity in Mesoamerica is represented by 6 genera (*Saguinus*, *Aotus*, *Alouatta*, *Ateles*, *Saimiri*, and *Cebus*) and some 21 species or subspecies (see Table 1 in Rylands *et al.*, chapter 2). Sixteen of these taxa are endemic to the region (Rodriguez-Luna *et al.*, 1996; Rowe, 1996; Nowak, 1999).

Mesoamerican primates contribute importantly to the richness of arboreal mammals in the tropical forests of the region accounting for approximately 61% of the 55 recognized taxa (15 rodent taxa, 13 marsupial taxa, 4 carnivore taxa, and 2 sloth taxa) (Reid, 1997; Emmons, 1990). Mesoamerican primates occur in various habitats from wet to dry forests to cloud forests to

Table 1. PrimatLit hits regarding documentation on Mesoamerican primates for the 1940–2004 period. Note low number concentration for countries such as Nicaragua, Guatemala, Honduras, and El Salvador, and for taxa such as *Saimiri*, *Saguinus*, and *Aotus*

	Alouatta	*Ateles*	*Cebus*	*Saimiri*	*Saguinus*	*Aotus*	Total
Mexico	302	166					468
Belize	113	31					144
Guatemala	24	25					49
El Salvador	12	16	11				39
Honduras	16	16	16				48
Nicaragua	46	20	15				81
Costa Rica	186	90	190	82			548
Panama	111	65	65	46	51	42	380
Total	810	429	297	128	51	42	1757

mangroves and occupy a wide variety of feeding niches ranging from part-time folivory to frugivory, omnivory, insectivory, gumnivory, or a combination of several of these categories (Rowe, 1996). All taxa are arboreal and, except for one (*Aotus*), diurnal. Social-group living is the rule, with *Aotus* living in pair-bonded family groups, *Ateles* forming fission–fusion communities (Rowe, 1996), *Saguinus* adopting a polyandrous/polygynous mating system associated with cooperative infant care (Garber, 1997), *Saimiri* living in large sex-segregated social groups characterized by males undergoing a fatting stage and female birth synchrony (Boinski, 1987, 1988), *Alouatta* living in small bisexual groups generally containing one or two adult males (*Alouatta pigra*) (see Van Belle and Estrada, chapter 4) or larger multimale–multifemale groups (*Alouatta palliata*) (Carpenter, 1934), and *Cebus capucinus* with a slow life history, living in multimale–multifemale groups with a single dominant male as the primary breeder (see Jack and Fedigan, chapter 13). Mesoamerican primates participate in important ways, as primary consumers, in the recycling of matter, nutrients, and energy in the tropical ecosystem (Estrada and Coates-Estrada, 1993) and play an important role in the natural process of forest regeneration via the dispersal of seeds of a broad spectrum of plants (Chapman, 1988; Estrada and Coates-Estrada, 1984; Garber, 1986).

PRIMATE STUDIES IN MESOAMERICA

Primate studies have a long and important history in Mesoamerica. They began with the investigation by Clarence Ray Carpenter of the behavior of the howler monkeys of Barro Colorado Island (BCI) in Panama. This was the first

scientific study of primates in the wild, representing the birth of this phase of our discipline (Carpenter, 1934). A series of consecutive studies in the same site quickly added information on howler monkey behavior and ecology and later expanded to include the other primates (*Cebus*, *Ateles*, and *Aotus*) found or introduced on BCI (Altmann, 1959; Bernstein, 1964; Chivers, 1969; Collias and Southwick, 1952; Hladik and Hladik, 1969; Milton, 1980; Mittermeier, 1973; Moyniham, 1964, 1970; Oppenheimer, 1969; Richard 1970; Thorington *et al.*, 1976; Wagner, 1956).

This development paved the way for the expansion of primate studies in mainland Panama (Baldwin and Baldwin, 1972; Garber, 1980, 1981), Costa Rica (Boinski, 1985, 1986; Fedigan and Baxter, 1984; Glander 1975, 1978), new localities in Panama (Milton and Mittermeier, 1977), Tikal, Guatemala (Cant, 1978; Coelho *et al.*, 1976; Schlichte, 1978) and Los Tuxtlas, Mexico (Estrada, 1982). These efforts provided comparative studies on intraspecific variability in the behavior and ecology of *A. palliata* at different locations in Mesoamerica, and added new data on species such as *Saguinus geoffroyi, Saimiri oerstedii, Cebus capucinus, Ateles geoffroyi,* and *Alouatta*.

Since the 1970s, we witnessed the development of long-term monitoring of populations of *A. palliata* on BCI (Milton, 1977, 1980), in La Pacifica and Santa Rosa (Clarke, 1982, 2002; Fedigan, 1984, 2003; Glander, 1975, 1978, 1992, this volume), and in Los Tuxtlas (Estrada, 1982; Estrada and Coates-Estrada, 1996), and of *A. pigra* in Bermudian Landing, Belize (Bolin, 1981; Horwich, 1983). More recently, field projects have unfolded in the island of Ometepe, Nicaragua (Garber *et al.*, 1999), in Pico Bonito National Park, Honduras (Hines, pers. comm.), in El Salvador (Horwich, pers. comm.), in Belize (Horwich *et al.*, 2001; Ostro *et al.*, 2001; Pavelka *et al.*, 2003), in various sites in southern Mexico, and at Tikal and Lachúa in Guatemala (Estrada *et al.*, 2004). Notwithstanding these past and recent efforts, there are still large areas in Mesoamerica for which we lack essential information regarding the distribution, demography, and ecology of primate species, and the conservation status of the habitats and populations.

PUBLISHED INFORMATION ON MESOAMERICAN PRIMATES

How rich is our database on Mesoamerican primates? A search of the PrimateLit database for the period 1940–2004 resulted in 1757 citations encompassing reports on taxonomy, general biology, ecology, behavior, and conservation

Table 2. Forest cover changes in the Mesoamerican region. See Appendix 1 for sources of raw data. The southern states of Mexico under consideration are Tabasco, Chiapas, Campeche, Yucatan, and Quintana Roo. Countries ranked by current forest cover

	Total land (km^2)	Original forest cover (km^2)	Original Forest as % land area[a]	Forest in 2000 as % land area	Current Forest cover (km^2)	Forest cover change % 1990–2000
Mexico (South)	226,712	204,041	90	28	63,479	−1.10
Honduras	112,520	112,090	100	48	54,009	−1.03
Nicaragua	131,847	130,000	100	25	32,961	−3.01
Panama	75,536	73,254	97	38	28,703	−1.65
Guatemala	108,917	107,801	99	26	28,318	−1.71
Costa Rica	51,113	50,078	98	39	19,934	−0.77
Belize	22,965	21,123	92	59	13,549	−2.32
El Salvador	21,046	20,829	99	6	1,262	−4.60
Total (km^2)	750,656	743,018			242,219	
%		99			32	

[a] Original forest refers to estimated forest cover about 8000 years ago, assuming current climatic conditions (see http://earthtrends.wri.org/pdf_library/country_profiles/).

(Table 1). The frequency distribution of these citations is skewed (80%) toward reports of research conducted in Costa Rica, Mexico, and Panama, reflecting the greater longevity and intensity of primate research in these countries than in the rest of Mesoamerica (Table 1). When the PrimateLit hits are examined for each major taxa, it is evident that almost 87% of the reports provide information on *Alouatta*, *Ateles*, and *Cebus*, while documentation for the other three genera is particularly small (Table 1). This cursory review of the available scientific literature suggests that in spite of almost eight decades of primate research in Mesoamerica, there are critical gaps in the available information for several Mesoamerican countries and taxa that deserve immediate attention. This situation is particularly pressing considering the extensive and intensive loss of primate habitat in the region (see Table 2).

CONSERVATION PROBLEMS

The following paragraphs tackle aspects of rates of tropical rain forest loss, land-use patterns, human population growth trends, as well as regional conservation initiatives by Mesoamerican countries. Statistics reported here were taken from sources listed in Appendix 1. These were used as raw data or as transformed indices and variables to illustrate states, trends, and patterns of forest cover

changes over time, land-use patterns, human population density and growth, indigenous population figures, human development indices, and the current system of natural protected areas in Mesoamerica.

It has been suggested that in Mesoamerica, habitat loss and fragmentation are major causes for the loss of plant and animal biodiversity and of local extinction of primates (Estrada and Coates-Estrada, 1996; UNEP, 2004). Further, such processes of land-use undermine the viability of remnant primate populations (Marsh, 2003). General deforestation rates in the region are exceedingly high, estimated at 44 ha/hr or 440,000 ha/yr (FAO, 2000; Sader *et al.*, 1999). Original forest cover (8000 years ago assuming current climatic conditions) for the countries in the region ranged from 90% to 100% (World Resource Institute, 2004). Using FAO statistics and those from the World Resources Institute, our estimates indicate that currently ~70% of the original forest cover present in the region has been lost as a result of human activity (Table 2). Deforestation rates for the period 1990–2000 are highest in El Salvador followed by Nicaragua, Belize, Guatemala, and Panama. Lower forest cover change rates for the period are found in Mexico, Honduras, and Costa Rica (Table 2) (FAO, 2004; World Resources Institute, 2004) (Figure 3).

Major proximate threats to forests in the region are agricultural activities. These are aimed at building up pasture lands for raising cattle and expanding agricultural land to raise food crops. Other threats are brought about by timber extraction, mining, colonization, and hydropower development

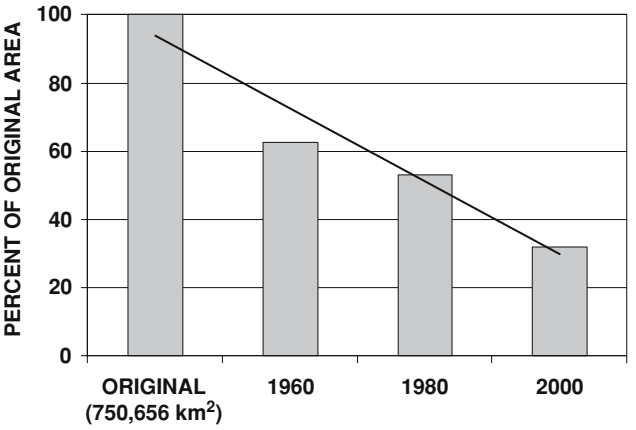

Figure 3. Percent of original forest remaining in Mesoamerica in three time periods. Original forest cover estimated as of 8000 years ago, assuming no climatic changes in the region (see World Resources Institute, 2004).

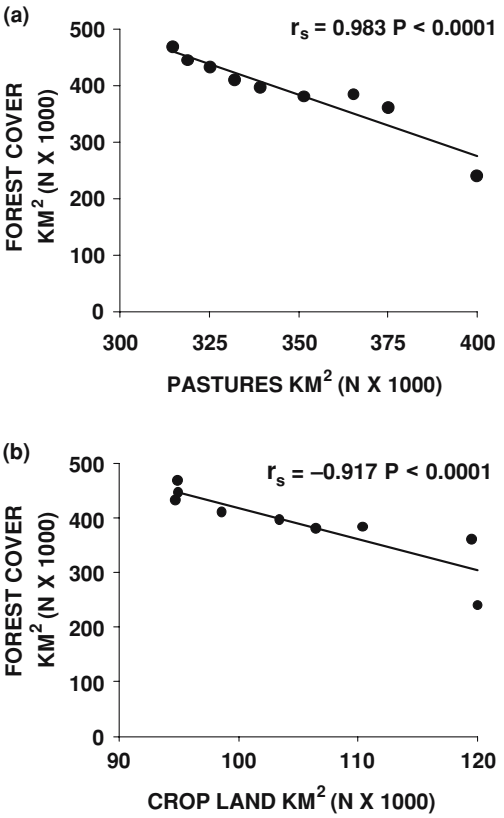

Figure 4. Forest cover as a function of expansion of pastures (a) and of cropland (b) in 5-year intervals for the period 1960–2000. The trend line is shown for illustrative purposes only.

(UNDP, 1999). FAO statistics for land-use patterns for the period 1960–2000, arranged in 5-year intervals, show a clear tendency for significant decreases in forest cover associated with increases in pasture and crop-lands (Figure 4). The changes in forest cover translate into extensive loss of primate habitats throughout Mesoamerica.

HUMAN POPULATION PRESSURES

Current human population in Mesoamerica is estimated to be about 45 million, with a growth rate of 3% since the 1950s. It is expected that the population will double in 20–35 years (FAO, 2000; UNDP, 1999; WWF, 2002; World Resource Institute (WRI), 2004). Demand for land and water and increases in food

production to feed growing urban and rural populations are corollaries of population growth in Mesoamerica. Such pressures are enhanced by global market—demands placed upon Mesoamerican countries to produce meat and agricultural products. While population density is 64 people/km^2 (world's average 41.5 people/km^2; WRI, 2004) and is expected to be 128 people/km^2 by 2030, it varies across the countries in the region. El Salvador has the highest population density (296 people/km^2) followed by Guatemala (119 people/km^2) and Costa Rica (74 people/km^2). In the rest of the countries, except Belize where population density is the lowest (11 people/km^2), population density varies from 31 people/km^2 (Mexico) to 57 people/km^2 (Honduras). The percent of forest cover remaining in each country appears to be negatively related to human population density. For example, at one extreme, El Salvador has the lowest percent of forest cover in the region coupled with the highest population density (Figure 5). At the other extreme, Belize retains the highest percent of forest cover and the lowest human population density. Intermediate positions are occupied by Guatemala, Costa Rica, and Panama (Figure 5).

Population growth projections from FAO (2004) for the period 2004–2030 show that Guatemala, Honduras, and Nicaragua have the steepest population growth rates, followed by El Salvador (Figure 6). Ironically, the countries with the greatest population growth are also countries with large expanses of forest cover, high human poverty, and low human development indices (Table 3). These patterns serve to predict where the major pressures upon natural resources are likely to be found in the near future.

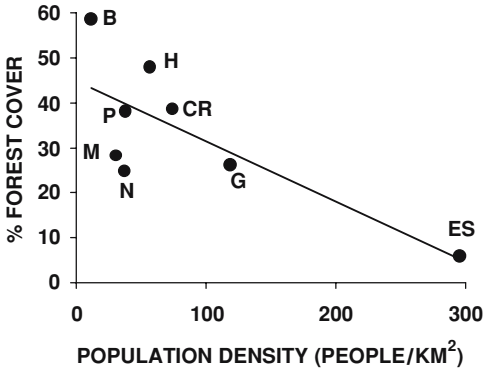

Figure 5. Current percent of forest cover as a function of total land and population density in each Mesoamerican country. The trend line is shown for illustrative purposes only. Codes for countries as in Figure 1, except for M = Mexico (south).

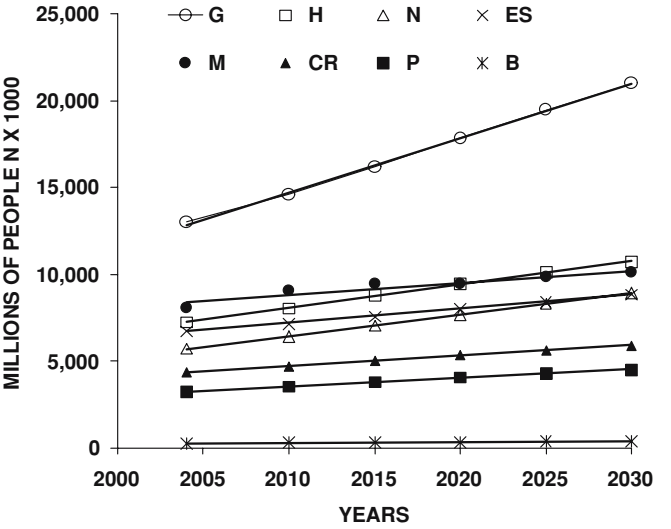

Figure 6. Population growth projection for each Mesoamerican country. Country codes as in Figure 5. Note the steep slopes for Guatemala ($y = 312.8$), Honduras ($y = 134.7$), Nicaragua ($y = 124.7$), El Salvador ($y = 91.6$). Less steep slopes in Mexico ($y = 69.1$), Costa Rica ($y = 59.9$), Panama ($y = 49.7$), and Belize ($y = 4.1$). Graph built with data from FAO (2004; http://faostat.fao.org/).

Table 3. Human population in Mesoamerica, including the indigenous component. Also shown are the Human Poverty Index and the Human Development Index for each country. Countries are ranked according to their HDI

Country	Total land (km^2)	Current forest cover (km^2)	Population	Annual population growth rate (%)	HPI[a]	HDI[b]	Rank HDI
Nicaragua	131,847	32,961	5,335,000	2.6	24.3	0.643	121
Guatemala	108,917	28,318	12,036,000	2.6	22.9	0.652	119
Honduras	112,520	54,009	6,781,000	2.5	19.9	0.667	115
El Salvador	21,046	1,262	6,415,000	1.7	17.2	0.719	105
Belize	22,965	13,549	251,000	2.4	8.8	0.776	67
Panama	75,536	28,703	3,064,000	1.5	7.8	0.788	59
Mexico (South)	226,712	63,479	8,000,000	1.4	8.8	0.800	55
Costa Rica	51,113	19,934	4,094,000	1.8	4.4	0.832	42
Total (km^2)	750,656		45,976,000				

[a] Human Poverty Index (HPI-1). A composite index measuring deprivations in the three basic dimensions captured in the human development index—a long and healthy life, being educated and a decent standard of living.

[b] United Nations Development Program. Introduced in 1990 a new way of measuring development—by combining indicators of life expectancy, educational attainment, and income into a composite human development index, HDI. This index sets a minimum and a maximum for each dimension and then shows where each country stands in relation to these scales—expressed as a value between 0 and 1. HDI involves 175 countries. The following are the 10 top ranking: 1: Norway; 2: Iceland; 3: Sweden; 4: Australia; 5: Netherlands; 6: Belgium; 7: United States; 8: Canada; 9: Japan; 10: Switzerland. For details on how the indices are calculated, see United Nations Development Program. http://hdr.undp.org/reports/global/2003/indicator/index_indicators.html.

CONSERVATION INITIATIVES BY MESOAMERICAN COUNTRIES

Concerned with the conservation of biodiversity and with the aim of curbing the loss of natural habitat, between 1993 and 1994, the governments of Mesoamerica ratified the international convention on biological diversity. This led to the consolidation of existing, and to the creation of new, natural protected areas in each country. It also resulted in the establishment of the Mesoamerican System of Natural Protected Areas (UNDP, 1999; http://www.biomeso.net/). Currently, Mesoamerica has a total of 420 protected areas, encompassing about 15 million ha or *ca*. 20% of the territory under consideration (Figure 7, Table 4) (CCAD, 2003).

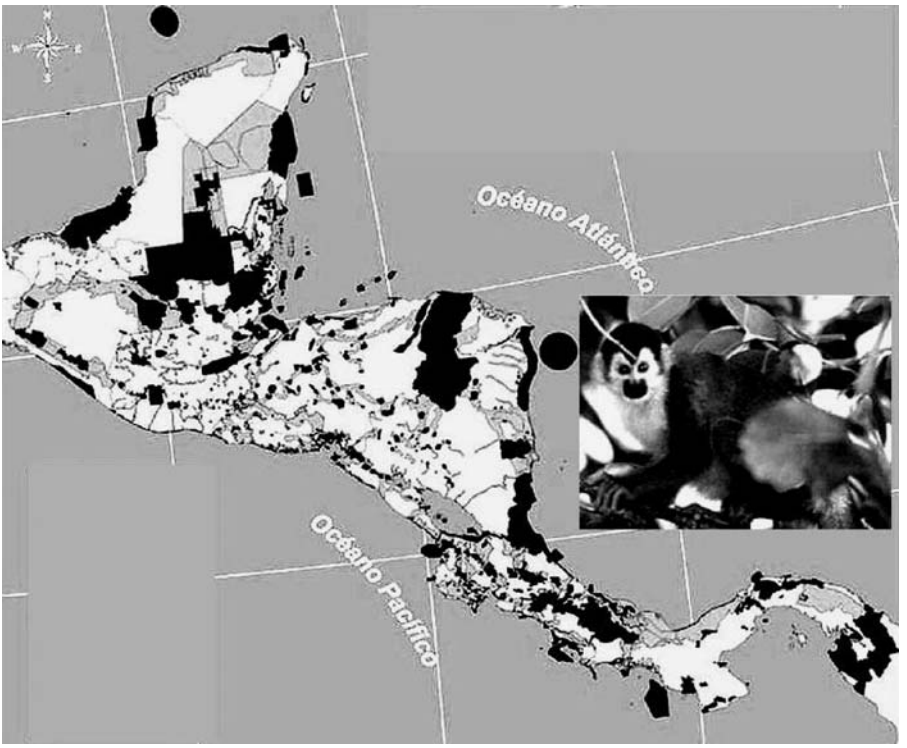

Figure 7. Mesoamerican system of natural protected areas (black areas; $N = 420$; *ca*. 15 million ha or *ca*. 20% of territory) and projected Mesoamerican Biological Corridor interconnecting these and other reserves throughout the region (light gray areas) (map adapted from UNDP, 1999; CCAD, 2003; http://www.biomeso.net/). Reduced effects of isolation in natural protected areas and sustainable use and protection of biodiversity in intermediate areas are key features of corridors in each country.

Table 4. Contribution by each country to the system of natural protected areas in Mesoamerica. Countries ranked by percent of territorial land under protection. For sources of data see Appendix 1

Country	Total land (km^2)	Number of protected areas	Protected area (km^2)	% of territory
Belize	22,965	54	19,670	35
Costa Rica	51,113	126	15,556	31
Panama	75536	42	19,664	26
Mexico (South)	226,712	29	38,902	20
Guatemala	108,917	48	20,614	19
Nicaragua	131,847	75	21,605	18
Honduras	112,520	42	10,703	10
El Salvador	21,046	4	91	0.40
Total	750,656	420	146,805	
%			20	

Major contributors (in km^2) to the system of protected areas are Mexico (38,902), Nicaragua (21,605), and Guatemala (20,614), followed by Belize (19,670), Panama (19,664), Costa Rica (15,556), and Honduras (10,703), with El Salvador having the lowest contribution (91) (Table 4). The countries with the largest areas protected in proportion to their size are Belize, Costa Rica, Panama, Mexico, Guatemala, Nicaragua, Honduras, and El Salvador (Table 4). In spite of these efforts, according to the United Nations Environmental Program, the Mesoamerican system of natural protected areas suffers several problems: few of the areas are actually protected, others remain as paper parks, about 70% are less than 10,000 ha in size, half are not even staffed, only 12% have specific management plans, most are poorly delimited, research projects are only being carried out in a few dozen of them, deforestation rates in surrounding areas are particularly high at approximately 44 ha/hr, and protected areas are virtual islands of vegetation surrounded by altered landscapes (UNEP, 2004; CCAD, 2003). According to UNEP, the lack of steady economic growth in the region makes it difficult or impossible to significantly reduce rural poverty, which in turn will continue to exert enormous pressure on natural habitats and weakly protected reserves.

THE MESOAMERICAN BIOLOGICAL CORRIDOR

Notwithstanding such problems, Mesoamerican countries continue to make efforts to find ways to expand the ecological, social, and economic benefits of conserving their biodiversity, and to mitigate the effects of isolation on existing

protected areas. Using remote sensing technology and the results of ground surveys involving sociological, economic, demographic, and biological assessments, each nation has, in a coordinated fashion, proposed a system of biological corridors that will connect protected areas in each country (Figure 7). Management of intermediate areas would involve sustainable use of the land. This proposal gave rise to the Mesoamerican Biological Corridor (MBC) initiative (UNDP, 1999; World Bank, 2004).

The rationale behind the concept of the MBC is that by providing and sustaining connectivity, viability of species and populations in natural protected areas will be enhanced. The cardinal principle of this strategy must be to avoid fragmentation of natural areas and the resulting isolation of vulnerable "islands" of native vegetation surrounded by landscapes altered by human activity. A major focus of the MBC concept is to integrate conservation and sustainable use of biodiversity within the framework of sustainable economic development (NASA, 2004; UNEP, 2004). The idea was proposed in 1992 at the CACB (Central American Convention on Biodiversity), and preparatory phases were completed between 1994 and 1996. The agreement was signed at a presidential summit the following year and diagnostic activities began in 1999 with a 5-year plan that will end in 2004 (UNDP, 1999).

The significance of the MBC for conservation of primate populations and species cannot be underestimated and it may be reduced to four key aspects: (1) increased area of habitat available, (2) increased connectivity, (3) possible increased effective population size, and (4) increased probability of persistence. Important initiatives by primatologists working in the region may be to contact the MBC division in the country where research is being conducted (headquarters for project is found in Nicaragua; see Appendix 2), to explore possibilities of articulating efforts and build interest in protection of primate habitats and populations, to participate in capacity-building by training local biologists, to conduct more diagnostic field projects in undocumented areas and on more primate taxa, and to possibly join forces via the American Society of Primatologists and the International Primatological Society to link conservation efforts with the MBC project.

FINAL COMMENTS

The primates of Mesoamerica represent an important and successful radiation of nonhuman primates that have been under investigation since the 1930s.

Despite many decades of research, documentation is still needed concerning the ecology, diet, social behavior, reproductive biology, and ecological impact of the Mesoamerican primate taxa, and how factors such as deforestation, human disturbance, and habitat change have affected the current distribution, demography, genetic variability, and conservation status of populations in the region. Mesoamerican primates are an integral cultural component of the natural patrimony of all countries in the region. The investigation of their biology, behavior, ecology, and conservation is a fundamental aspect of research providing information for sustaining the biodiversity of the region, the natural history of neotropical primates, their role in forest ecology as seed dispersers, seed predators, pollinators, and agents of forest regeneration, and on the evolution of the Order Primates.

The goal of this volume is to present a comprehensive overview of the most recent advances in primate field research, ecology, and conservation biology in Mesoamerica. This includes information on taxonomy and the historical biogeography of primate origins in Mesoamerica, demographic and population trends from new and long-term field studies, data on feeding ecology, ranging behavior, cognition, and behavioral plasticity, and the effects of habitat disturbance (natural and human induced) on population viability. Chapters are designed to integrate newly collected field data with theoretical perspectives drawn from evolutionary biology, socioecology, biological anthropology, cognitive ecology, and conservation. Several chapters employ innovative methodological techniques such as remote sensing and geographic information systems, experimental field studies, landscape ecology, and reproductive endocrinology to address critical research questions. Data presented in other chapters provide a framework for developing action plans for future research, identifying geographical regions and species for which we continue to lack sufficient information, and highlighting areas for immediate conservation action.

Despite many decades of primate research in Mesoamerica, there continue to remain many unanswered questions. This is highlighted in our volume by the limited behavioral, ecological, and demographic information presented on *S. geoffroyi*, *Aotus zonalis*, and *S. oerstedii*. All three species are restricted in their distribution to the southern region of Mesoamerica. Both *S. geoffroyi* and *S. oerstedii* have not been the focus of long-term field research since mid-1980s. *Aotus zonalis* has never been the focus of a long-term study. We hope this volume will stimulate the development and continuation of both basic field research and applied field studies that will open new lines of inquiry and education focusing on

all Mesoamerican primate taxa. We envision a new perspective in which primate research and forest conservation are strengthened by integrating theoretical perspectives and methodological tools from the fields of population genetics, landscape ecology, agroforestry, and behavioral ecology, along multidisciplinary lines. Within this framework, we must consider the needs of the human populations in the region and the progress being made, in spite of overpopulation, poverty, and underdevelopment, by Mesoamerican countries to preserve their natural biodiversity.

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World Resources Institute 2004, http://earthtrends.wri.org/

WWF 2002, Living Planet Report 2002. WWF, UNDP, WCMC. World Wide Fund For Nature. Gland, Switzerland. http://www.panda.org/

APPENDIX 1

Statistics reported here were taken in raw form the sources listed below. These were used raw or as transformed indices and variables to illustrate states, trends and patterns.

Indigenous Populations

http://www.globalgeografia.com/north_america/north_america1.htm
http://www.ciesas.edu.mx/bibdf/ini/webciesas/perfil_nacional.html
http://www.e-mexico.gob.mx/wb2/eMex/eMex_Perfil_Indigena_de_Mexico
UNDP http://geocompendium.grid.unep.ch/data_sets/index_nat_dataset.htm

Population Growth Trends

http://faostat.fao.org/
http://hdr.undp.org/reports/global/2003/indicator/indic_15_1_1.html
http://www.nationmaster.com/index.php

http://www.globalgeografia.com/north_america/north_america1.htm
http://www.worldbank.org/data/

Deforestation Rates

http://faostat.fao.org/default.jsp?language=EN
http://www.panda.org/news_facts/publications/general/livingplanet/index.cf
http://www.panda.org/downloads/general/LPR_2002.pdf
http://geocompendium.grid.unep.ch/data_sets/index_nat_dataset.htm
World Resources Institute http://earthtrends.wri.org/
Global Environmental Facility http://www.gefweb.org/
UNDP http://geocompendium.grid.unep.ch/data_sets/index_nat_dataset.htm;
http://www.worldbank.org/data/

Forest Cover

http://faostat.fao.org/default.jsp?language=EN
http://www.panda.org/news_facts/publications/general/livingplanet/index.cf
http://www.panda.org/downloads/general/LPR_2002.pdf
http://earthtrends.wri.org/gsearch.cfm?kw=indigenous+people&action=results
UNDP http://geocompendium.grid.unep.ch/data_sets/index_nat_dataset.htm
http://geocompendium.grid.unep.ch/geo3_report/index_report.htm
http://www.worldbank.org/data/

Land-Use Patterns

http://faostat.fao.org/default.jsp?language=EN
http://www.panda.org/news_facts/publications/general/livingplanet/index.cf
http://www.panda.org/downloads/general/LPR_2002.pdf
http://earthtrends.wri.org/

UNDP http://geocompendium.grid.unep.ch/data_sets/index_nat_dataset.htm

Social and Economic Development

United Nations Development Programme
http://www.unep.org
http://hdr.undp.org/reports/global/2003/indicator/index_indicators.html
http://hdr.undp.org/statistics/default.cfm
http://hdr.undp.org/reports/global/2003/indicator/indic_15_1_1.html

System of Natural Protected areas and the Mesoamerican Biological Corridor

United Nations Environment Programme, Global Enviornmental Facility
http://www.gefweb.org/
UNEP. 2004. United Nations Environmental Program
http://www.rolac.unep.mx/recnat/esp/CBM/cbm.htm
NASA Mesoamerican biological corridor project. http://www.ghcc.msfc.nasa.gov/corredor/
World Bank http://www.worldbank.org/data/
Mesoamerican Biological Corridor/Corredor Biológico Mesoamericano. http://www.biomeso.net/

APPENDIX 2

Directory of the Mesoamerican Biological Corridor Officials

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