

# PRIMATE CONSERVATION

The Journal of the IUCN/SSC Primate Specialist Group

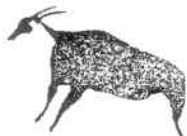
Proceedings of the Symposium "Primate Conservation: A Retrospective and a Look Into the 21<sup>st</sup> Century" held during the XVI<sup>th</sup> Congress of the International Primatological Society, August, 1996, Madison, Wisconsin.

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Front cover. Coquerel's dwarf lemur, *Mirza coquereli*. Photograph by Russell A. Mittermeier

# A Word from the Chairman

We are pleased to be able to present this issue of *Primate Conservation* which includes the papers given at a special conservation symposium at the XVIth Congress of the International Primatological Society, organized in conjunction with the XIXth Conference of the American Society of Primatologists, in Madison, Wisconsin, from 11-16 August, 1996. This day-long symposium, "Primate Conservation: A Retrospective and a Look into the 21st Century", held on the afternoon of August 13th and the morning of August 14th, had several objectives. First of all, since this was the largest IPS Congress ever (more than 1,300 people), we wanted to take the opportunity to present to the broader primatological community the activities of the IUCN/SSC Primate Specialist Group (celebrating 20 years of its existence in its modern form in January 1997), as well as other organizations involved in primate conservation over the past two decades, such as the International Primatological Society (IPS), the Primate Society of Great Britain (PSGB), one of the earliest and most active national primates societies, the American Society of Primatologists (ASP), and, not least, our chief collaborator within the IUCN Species Survival Commission, the Conservation Breeding Specialist Group (CBSG). Second, we wanted to highlight the fact that we had, at least so far, made it through this century without apparently losing a single taxon. This is particularly significant since the primates are the only larger group of mammals (and perhaps the only larger group of vertebrates) for which such a statement can be made; all of the others (marsupials, bats, rodents, carnivores and ungulates) having lost species or subspecies. However, at the same time, we wanted to emphasize the fact that, in spite of such a stellar record, a significant portion of the Order Primates now fall into the "critically endangered" and "endangered" categories of the *IUCN Red List of Threatened Animals*: A total of 31 (5% of the approximately 620 taxa recognized) in the former category and 62 (10%) in the latter, representing 15% of all primate taxa. The case studies of the conservation status of, and conservation efforts for, a number of these critically endangered and endangered taxa indicate clearly the range of activities involved in preventing primate extinctions in the next century, increasingly having to take into account regional and local socioeconomic aspects as a means of slowing or stopping habitat destruction and hunting.

Of the 21 presentations given at the symposium, 17 are published here. An additional paper concerning the conservation activities of the American Society of Primatologists was kindly provided by Randall Kyes and Susan Howell. In addition to the two sessions in which these papers were presented, we also held a brief roundtable discussion on the strategies for primate conservation in the next century, and presented the idea of an *Action Plan for the Critically Endangered and Endangered Primates for the 21st Century*. This idea will again be discussed during a shorter symposium to be held at the XVIIth Congress of the International Primatological Society, at Antananarivo, Madagascar, in August 1998. The aim is to have such a document at hand by the end of 1999. The principal message is that although we have managed to accomplish a great deal in this century in terms of preventing extinctions, a significant portion of global primate diversity is represented by species that are down to a few hundred individuals and, as the paper by Oates, Struhsaker and Whitesides indicates, at least one West African subspecies of the red colobus may have already gone extinct. Clearly, we have our work cut out for us in the coming century to identify and combat the increasing pressures on natural primate populations. We hope that the results of this symposium will increase everyone's understanding of what has been done so far and, in so doing, help us to organize our efforts more effectively for the major challenges that we face in the future.

In closing, we would like to offer special thanks to the participants in this symposium for their excellent presentations of their admirable work worldwide, and to the Congress organizers: the IPS, the ASP, the University of Wisconsin, and the Wisconsin Regional Primate Research Center. The symposium was very well attended, with more than 300 people present in some of the sessions, and we hope that those of you who were not there will benefit from what we have been able to include in this issue of *Primate Conservation*.

Russell A. Mittermeier, Chair  
Anthony B. Rylands, Deputy Chair  
IUCN/SSC Primate Specialist Group

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# Primate Conservation: A Retrospective and a Look into the 21<sup>st</sup> Century

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## Introduction

As we approach the final years of the 20<sup>th</sup> Century, we contemplate environmental changes that may be wrought by global warming and ozone layer depletion, and brace ourselves for the mass extinctions of plants and animals predicted by many of the world's leading biologists. As primatologists, we contemplate the subjects of lifelong study and wonder how many of the world's prosimians, monkeys and apes will survive into the next millenium, as efforts to stem the loss of their tropical forest habitats meet with only minimal success.

During the last few decades, interest in non-human primates has grown significantly on a number of fronts and has helped build support for their conservation. Pioneering and long-term field studies of the great apes (e.g., Schaller 1963; Goodall, 1968; Van Lawick-Goodall 1971; Fossey 1983; Galdikas 1995) have dispelled age-old myths about mankind's closest living relatives - greatly narrowing the gaps between these species and our own - and provided new insights into human origins and behavior. The continuing search for drugs to treat global maladies such as cancer, AIDS and malaria has required large numbers of non-human primates as experimental subjects (Mack and Mittermeier 1984). For some species, this use has contributed to serious declines of wild populations and ultimately forced issues of conservation and captive breeding as part of the long-term strategy for biomedical research. In other cases, little-known and formerly obscure primate species of the Neotropics, Africa and Asia have emerged as prominent "flagships" for conserving their tropical forest habitats, which biologists agree are the richest natural ecosystems remaining on our planet.

While interest in non-human primates grows, the threats to their survival persist as well. Varying combinations of habitat destruction, hunting and live capture have driven dozens of primate species to the brink of extinction, to the point that several taxa now number only in the low thousands, and a few probably no more than a few hundred individuals. Such populations are doomed without long-term protection, monitoring and a heightened understanding of their plight by local human populations.

In the face of continuing threat, however, primate conserva-

tionists can also look back upon the last century and realize with some degree of pride that, to the best of anyone's knowledge, not a single primate taxon has gone extinct during that period. The few years remaining until the year 2000 could conceivably witness the loss of such primates as the Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) of Vietnam or Miss Waldron's red colobus (*Procolobus badius waldroni*) of West Africa, both critically endangered and the latter not located in several recent surveys. Reaching the New Millenium with the survival of these and other threatened taxa is an achievable goal, providing that existing primate conservation programs are sustained and new ones created according to a global strategy for the most endangered. Fortunately, support for global primate conservation appears to be increasing in the latter half of the 1990s after having suffered something of a dry spell, and the expertise is at hand to direct available resources to the highest priority species, habitats and projects.

## Global Overview of Primate Diversity and Distribution

The Order Primates represents one of 20 mammalian orders that together total at least 4,675 species (Wilson and Reeder 1993; Hutterer 1995). It includes 13 families, 63 genera, 273 species and approximately 620 taxa worldwide. Two Suborders of primates are recognized: the Prosimii (prosimian or lower primates), with seven families, and the Anthropoidea (higher primates), with six (Table 1).

Living prosimian primates occur only in the Old World, despite the fact that North America once represented a major center of their early evolutionary history. Of the seven extant prosimian families, five (Lemuridae, Cheirogaleidae, Megaladapidae, Indriidae and Daubentoniidae) occur naturally only in Madagascar, where they are represented by 14 genera, 32 species and 50 taxa. The family Tarsiidae is only slightly more geographically widespread, represented in Indonesia and the Philippines by one genus, seven species and 12 taxa. The eight genera, 19 species and 43 taxa of the Lorisidae are distributed throughout mainland Africa, India and South-east Asia.

The anthropoid primates are a much more diverse group than the prosimians, having almost twice the number of genera and

Table 1. Primate diversity by Family.

Family	Common Name(s)	Distribution	Genera	Species	Taxa
<b>Sub-Order Prosimii</b>					
Cheirogaleidae	Dwarf, mouse and fork-marked lemurs	Madagascar	5	8	11
Megaladapidae	Sportive lemurs	Madagascar	1	7	7
Lemuridae	Ring-tailed, gentle, brown, black, crown, red-bellied, mongoose and ruffed lemurs	Madagascar	4	10	19
Indriidae	Indri, avahi and sifakas	Madagascar	3	6	12
Daubentoniidae	Aye-aye	Madagascar	1	1	1
Lorisiidae	Angwantibos, lorises, pottos and galagos	Africa, Asia	8	19	43
Tarsiidae	Tarsiers	Asia	1	7	12
			23	58	105
<b>Sub-Order Anthroidea</b>					
Callitrichidae	Marmosets, tamarins and Goeldi's monkey	Neotropics	5	36	57
Cebidae	Owl, titi, squirrel, capuchin, saki, bearded saki, howling, spider and woolly monkeys, uakaris and muriquis	Neotropics	11	62	147
Cercopithecidae	Macaques, baboons, mangabeys, guenons, colobus, leaf monkeys, langurs, snub-nosed monkeys and proboscis monkeys	Africa, Asia	19	101	273-283
Hylobatidae	Gibbons and siamangs	Asia	1	11	28
Pongidae	Great apes	Africa, Asia	3	5	9
Hominidae	Man	Global	1	1	1
			40	216	515-525
<b>Total</b>			63	274	620-630

four times the number of species and total taxa. Of the six anthropoid families, two (Callitrichidae and Cebidae) occur only in the New World tropics, two (Cercopithecidae and Pongidae) occur throughout much of Africa and Asia, one (Hylobatidae) is restricted to Asia, and the last (Hominidae), represented by our own species, is global in its distribution. New World non-human primates comprise 16 genera, 98 species and 203 taxa. By comparison, the Old World monkeys (Subfamilies Cercopithecinae and Colobinae), although much more widely distributed, are only slightly more diverse, comprising 19 genera, and a few more species. The lesser apes, which include the gibbons and siamangs, are a relatively small group that includes only one genus, 11 species and 28 taxa. The great apes are even less diverse, with three genera, only five species and nine taxa overall. Finally, the human primate is the sole representative of a morphologically variable, yet monotypic family. Accordingly, for the remainder of this paper, we use the word "primate" only in reference to non-human taxa unless otherwise specified.

Looking at global primate diversity from a regional perspective, we see that it is by no means evenly distributed (Table 2). For example, the remaining tropical forests of Madagascar are dwarfed by the extensive tropical forests of Africa, Asia, Central and South America, yet Madagascar has by far the densest concentration of primate diversity anywhere on Earth within an area of 587,045 km<sup>2</sup>. Although usually considered part of the Ethiopian zooge-

ographical region, Madagascar is in many respects a zoogeographical region in itself, and especially so with respect to its unique primate fauna. All of Madagascar's primates are endemic, with the exception of *Eulemur mongoz* and *E. fulvus*, which also occur on the nearby Comoro Islands, but were almost certainly introduced there by man (Tattersall 1983).

With the exception of the Barbary macaque (*Macaca sylvanus*), all primates of Sub-Saharan Africa and nearby islands (e.g., Zanzibar, Bioko, etc.) occur within the Ethiopian zoogeographical region. They include 20 genera, 72 species and 190-200 taxa overall. If we consider Madagascar in combination with the African continent, the entire region harbors a significant 38% of global primate diversity at the species level, but an even more impressive 54% of higher order (*beta*) diversity at the generic level.

Within the Neotropics, primates occur from southern Mexico through Central America and northern South America as far as southern Brazil, northern Argentina, Paraguay and perhaps Uruguay (but not in Chile). Native primate populations also occur on Trinidad; there are several introduced populations of African primates on the islands of St. Kitts, Nevis, Barbados, and Grenada; and both New World and Old World species have been introduced to the island of Puerto Rico. Sixteen genera and 203 taxa are found within the Neotropics, figures comparable to those for Africa. However, the 98 primate species of the Neotropics are the most for any major region, account for 36% of global primate diversity, and are roughly equivalent to the number of species inhabiting both Africa and Madagascar.

Asian primates are found mainly in the Oriental zoogeographical region, as well as in the southeastern portion of the Palearctic and in Wallacea (the transition zone between the Oriental and Australian regions). In south Asia primates are widely distributed from the Indian subcontinent and the island of Sri Lanka throughout

Table 2. Primate diversity by major region.

Region	Genera	Species	Taxa
Neotropics	16	98	203
Madagascar	14	32	50
Africa	20	72	190-200
Asia	13	71	176
<b>Total</b>	63	273	619-629

southeast Asia as far as the Philippines and the Indonesian islands of Halmahera and Sulawesi, and in central and north Asia from Afghanistan through southern China (including the islands of Hainan and Taiwan) to Japan. In contrast to Africa (excluding Madagascar) and the Neotropics, where primates are basically continental, Asian primates are found in large numbers on islands as well. The region is home to 13 genera, 71 species and 176 taxa, a slightly lower level of generic diversity by comparison to the Neotropics and Africa, but a level of species diversity roughly equivalent to that of Africa.

Ninety-two of the world's 192 sovereign nations have wild primate populations; the top seven countries for primate species diversity are listed in Table 3. Brazil, with 77 species, is far and away the leader and accounts for slightly more than three-fourths of all Neotropical primate species. Together, the top four countries (Brazil, Democratic Republic of the Congo, Indonesia and Madagascar), which also represent the world's four major primate habitat regions, account for 182 species, or two-thirds of all living primates.

Furthermore, three of the top four countries for primate diversity - Madagascar, Brazil and Indonesia - also head the list of the world's top countries for primate endemism (Table 4). Madagascar is by far the international superstar with 33 unique species, 14 unique genera and five unique families, all three representing 100% levels of endemism. Primate faunas for the next two countries on the list, Brazil and Indonesia, are roughly 50% endemic. Although Brazil has more endemic species (38) than Madagascar, it covers an area almost 15 times as large, and only two (*Leontopithecus*, *Brachyteles*) of its 16 primate genera (12.5%) are endemic (one-seventh the number for Madagascar). Indonesia is a distant third on the list with 19 endemic species and one endemic genus (*Simas*), after which the numbers of endemic species fall off sharply and no other country can claim an endemic primate genus.

The key point here is that, within the broad geographic regions that provide critical habitat for wild populations of non-human primates, there are a handful of countries that harbor a disproportionately large share of the world's primate fauna. The four "megadiversity" countries - Brazil, Democratic Republic of Congo, Indonesia and Madagascar - must therefore rank among the highest global priorities for conserving primates. Furthermore, if we extend the analysis to consider subspecies as well, we find that other countries will rise toward the top of the priority list. Take India for example. With only 15 primate species and three endemics, it falls well below many other countries on the previous lists. However, of India's 34-35 primate taxa, 22 are endemic, and the additional 19 endemic subspecies represent important wild populations that should be considered when establishing conservation priority rankings.

Table 3. World's top seven countries for primate species diversity (> 30 species).

Country	Species	Genera
Brazil	77	16
Democratic Republic of the Congo	37	18
Indonesia	36	9
Madagascar	33	14
Cameroon	32	18
Peru	32	12
Colombia	31	12



Figure 1. Clear-cutting for pasture in the Amazon, near Manaus, Brazil. Photo by Russell A. Mittermeier.

### Threats to Primates

Threats to the survival of non-human primates are easily divided into three major categories: habitat destruction, hunting for food and a variety of other purposes, and live capture for export or local trade (Mittermeier *et al.* 1986). The effects of these threats vary significantly from species to species and from region to region, and are influenced by the extent of remaining habitat, the nature and degree of human activity within the range of a particular species, local hunting traditions, the size and desirability of different species as food items or as sources of other products useful to man, the demand for a given species in research or the pet trade, enforcement of existing wildlife laws, and regulation of commercial animal dealers. However, one or more of the three major threats affects almost all primate populations.

### Habitat Destruction

On a global scale, habitat destruction is without a doubt the principal factor contributing to the disappearance of wild primate populations (Figs. 1-3). The continuing growth of the human population and its ever-expanding need for natural resources has contributed greatly to the destruction or alteration of natural habitats on an almost unimaginable scale, and nowhere has this problem been more acute than in the tropical regions of the world. More than 90% of all nonhuman primates inhabit the tropical forests of Africa, Asia, and South and Central America, and these forests are being cut at a rate of more than 10 million hectares per year (Bryant *et al.* 1997).

The immediate effects of habitat destruction on non-human primates vary significantly from one region to the next. For example, in Madagascar and the Atlantic forest region of eastern

Table 4. World's top six countries for primate endemism.

Country	Endemic Species (%)	Endemic Genera (%)
Madagascar	33 (100)	14 (100)
Brazil	39 (51)	2 (12.5)
Indonesia	19 (53)	1 (1.1)
Colombia	4 (13)	0 (0)
Peru	3 (9)	0 (0)
Democratic Republic of the Congo	3 (8)	0 (0)

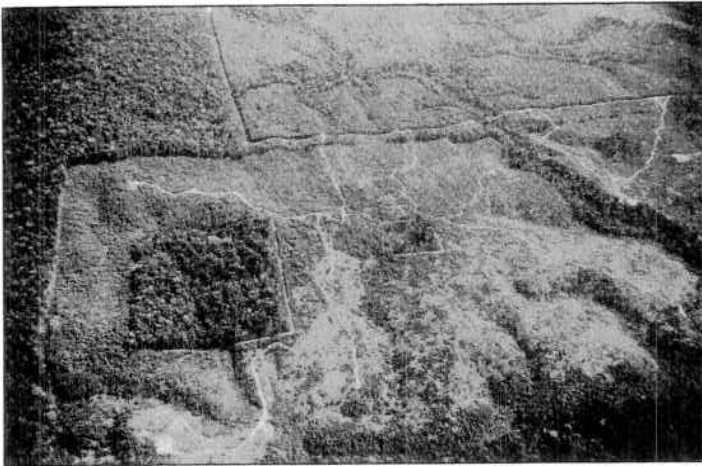


Figure 2. Pasture, forest patches and erosion, site of the Project "Biological Dynamics of Forest Fragments" of the National Institute for Amazon Research (INPA), Manaus, and the Smithsonian Institution, Washington, D. C., 80 km north of Manaus, Brazil. Photo by Russell A. Mittermeier.

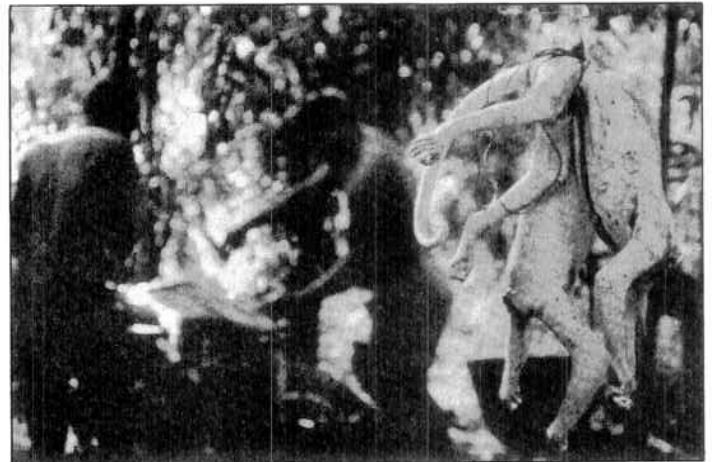


Figure 4. Capuchin monkeys, *Cebus apella*, shot for food in French Guiana. Photo by Russell A. Mittermeier.

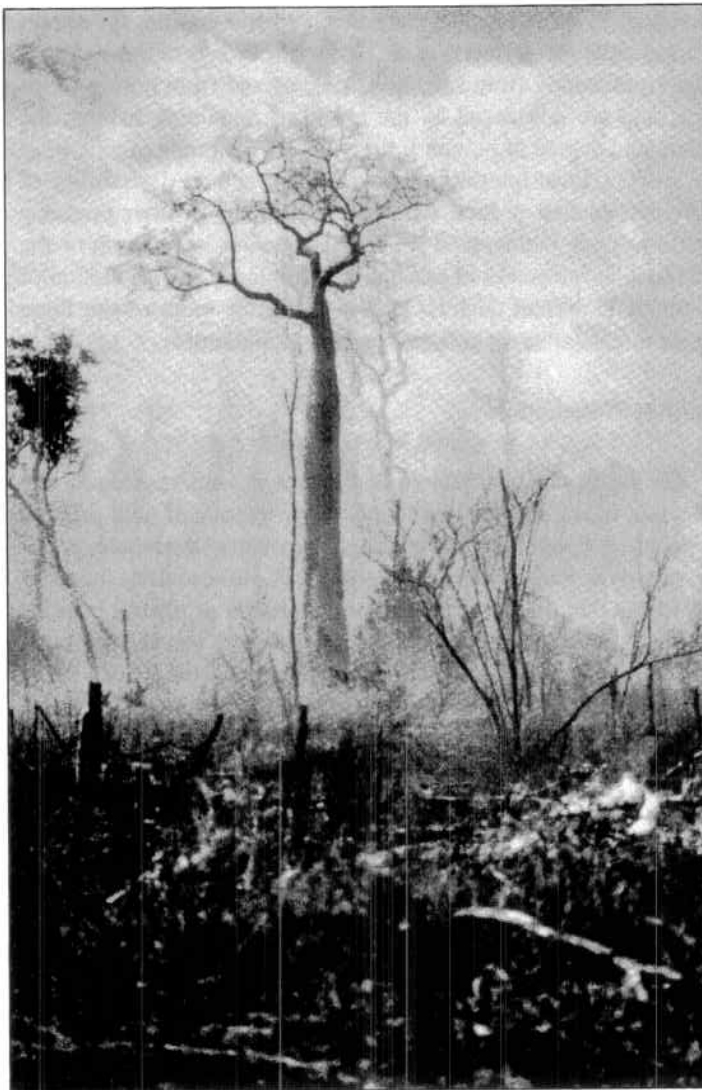


Figure 3. Forest destruction for farmland in the Analavo area, south-west Madagascar, in 1985. Photo by Russell A. Mittermeier.

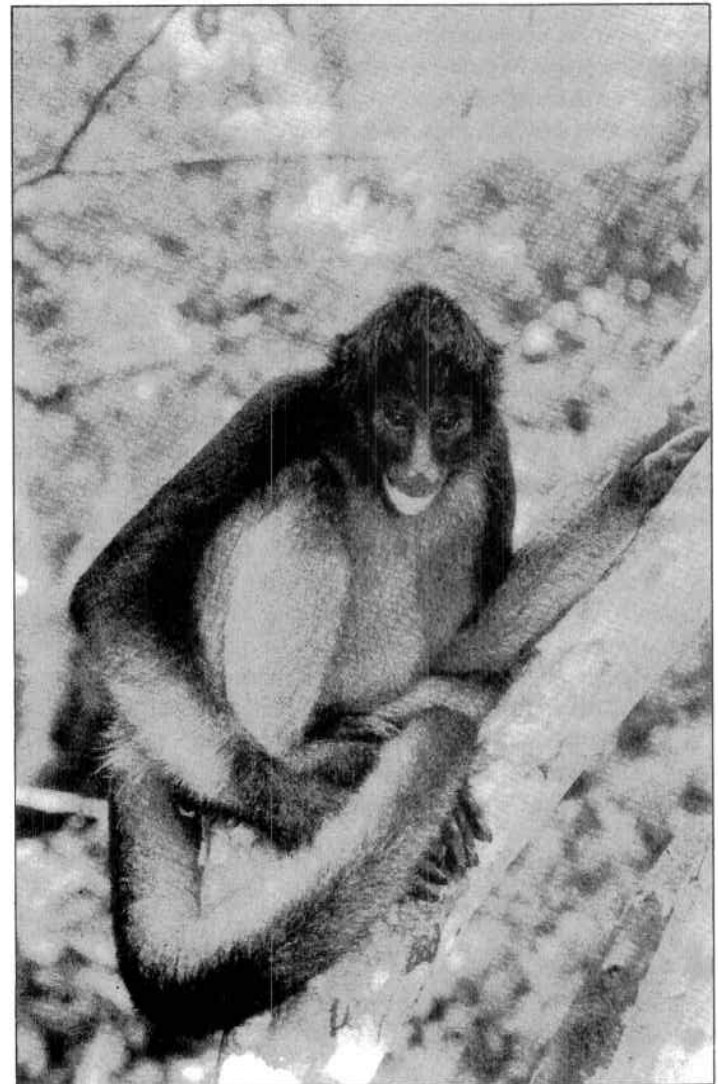


Figure 5. Larger monkeys such as this spider monkey, *Ateles belzebuth belzebuth*, from Colombia, suffer most from hunting. Photo by Russell A. Mittermeier.



# Funding For Primate Conservation: Where Has It Originated?

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## Introduction

Mankind has always had a keen interest in other primate species, particularly in terms of comparative behavior and our shared evolutionary histories. In the late 1970s and early 1980s, however, this interest began to expand significantly toward issues of conservation and species survival. As Russell Mittermeier (1997) has pointed out, three groundbreaking events of that period helped build a solid foundation for future funding of primate conservation initiatives worldwide:

- Renewal and expansion of the Primate Specialist Group (PSG) of the International Union for the Conservation of Nature and Natural Resources' Species Survival Commission (IUCN/SSC);
- The PSG's presentation of a *Global Strategy for Primate Conservation* (Mittermeier 1978); and
- Creation of the World Wildlife Fund - U.S. (WWF-US) Primate Program, with a special Primate Action Fund to provide rapid support for worthy conservation projects.

This paper documents the role played by the WWF-US Primate Program's Primate Action Fund in supporting grass-roots primate conservation efforts on a global scale and helping to leverage additional support from various other existing and new sources.

## Creation of the WWF-US Primate Program and Primate Action Fund

The IUCN/SSC *Global Strategy for Primate Conservation*, launched in 1978, provided an excellent framework for project review and development for institutions interested in supporting primate conservation projects. The New York Zoological Society (NYZS; now the Wildlife Conservation Society) was largely responsible for launching the *Global Strategy*, and took a leadership role by supporting a number of field-based projects within its framework. While NYZS maintained a focus on Africa, the WWF-US Primate Program, established in 1979, quickly developed complementary programs in Brazil's Atlantic coastal forests and in Madagascar. Both NYZS and WWF-US also funded initiatives throughout tropical Asia and in

Amazonia, in many cases jointly supporting key projects. However, a large gap remained between projects proposed at the time and what available funding could effectively support.

The initial stimuli for what became known as the Primate Action Fund were the requests from field and foreign primatologists for small grants to support a variety of activities. In 1980, in response to these requests, the WWF-US Primate Program created a modest Primate Discretionary Fund of \$15,000 (also referred to in-house as the Small Primate Project Fund). Neither name lasted very long. In general, institutions shy away from showcasing their discretionary funds, so the word "discretionary" remained in-house, and the use of the term "small primate" created the impression that these funds only supported projects dealing with marmosets and tamarins, and the like. Clearly, a concise name was needed to describe the nature of this new funding mechanism, and preferably one that would allow for advertising the program internationally. The name Primate Action Fund was first introduced in 1982, and remained with the program until it was discontinued in 1989 (Appendix I).

To establish the fund as a continuing and growing entity, a strong case was made regarding its catalytic effects. The first request for its renewal in 1981 included an increase to \$20,000, and emphasized the following points about the fund's effectiveness:

"Since the initiation of the *Global Strategy for Primate Conservation* in 1978, it has become clear that rapid funding of small but significant projects is really the backbone of the entire effort to save representative populations of the world's nonhuman primates. Rapid, small projects-funding has been especially important for short-term pilot projects and surveys, and also as a means of encouraging and facilitating submission of projects by qualified local researchers. The great increase in funding projects like these has been a major reason for the success of the *Global Strategy*.

Increased funding of projects by local researchers from countries in which the animals of interest occur has been a key part of the program. Though they may be highly competent biologists and conservationists, these people simply are not always fluent in English and/or not familiar with IUCN/WWF application procedures. In the past, they either submitted poorly written proposals that were rejected out-of-hand or, worse yet, never submitted project proposals at all. Consequently, many important projects failed to

## Appendix

### ASP RESOLUTION REGARDING CONSERVATION OF WILD PRIMATE POPULATIONS

On September 10, 1993, the ASP Board of Directors approved a resolution outlining the Society's position on the conservation of wild primate populations. The text of the resolution follows:

WHEREAS, many wild populations of nonhuman primates are declining due to habitat loss associated with increasing human demands for agricultural land and forest products; and

WHEREAS, eradication of primates as agricultural pests and hunting of primates for food are also contributing to the decline of wild primate populations; and

WHEREAS, careless capture of nonhuman primates can threaten the viability of natural populations and result in unnecessary suffering, mortality, and wastage; and

WHEREAS, the United States is the world's largest importer of nonhuman primates for scientific use and is a Party to the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); and

WHEREAS, the scientific study of nonhuman primates contributes to advances in human and veterinary medicine and yields information that is essential to the conservation of wild primate populations; and

WHEREAS, all primate species are listed in Appendix I or Appendix II of the Convention and the Convention recognizes that trade in species threatened with extinction should be regulated; and

WHEREAS, many of the primate species most often involved in scientific research and testing in the United States are available from sources other than wild populations within the natural ranges of these species,

THE AMERICAN SOCIETY OF PRIMATOLOGISTS RESOLVES:

To encourage actions that provide for appropriate scientific access to nonhuman primates while ensuring that importation of primates into the United States does not contribute to the decline of natural primate populations;

To support limitation of importation of nonhuman primates to those that are humanely obtained through purpose breeding or, when necessary, capture in accordance with good wildlife management practices;

To recognize that the availability of purpose-bred primates can never fully replace the need for scientific access to the full-range of primates from wild populations and that prediction of which primate populations may yield critically important information is not possible;

To respect the rights of primate habitat countries to decide for themselves, within the terms of the Convention (to which we are all Parties), whether or not to make nonhuman primates available for export;

To seek means of promoting the health and well-being of primates during all phases of trade from capture through quarantine; and

To recognize the continuing need for objective and reliable population data on wild primate populations.

*This resolution does not imply endorsement by the American Society of Primatologists of any specific legislation or other activity, and may not be represented by anyone as such an endorsement (Approved by the ASP Board of Directors 9/10/93).*

1995 for her long-term dedication to the interests of primates and conservation.

#### *Travel Award*

This award provides financial support (\$500) for students and scientists from habitat countries to attend the International Primatological Society (IPS) Congress. In 1994, ASP allocated \$500 to be administered by the IPS in support of travel to the IPS Congress in Bali, Indonesia. In 1996, ASP presented travel awards to Mukesh Chalise of Nepal and Shu-Yi Zhang of China to assist with travel expenses to attend the joint IPS/ASP Congress in Madison, Wisconsin. The Conservation Committee is currently establishing a formal mechanism by which to administer this award.

#### **ASP Conservation Grants**

In addition to the Conservation Awards, the ASP also maintains an active small grants program for conservation-related projects. This program is particularly significant as it provides support for projects that have direct impact on primate conservation. Project proposal guidelines are published in the *ASP Bulletin*.

#### *Conservation Small Grants*

Proposals for Conservation Small Grants are solicited on an annual basis for conservation research, education, or related projects. Members of the ASP or IPS working in habitat countries are especially urged to apply or to assist someone from a habitat country in designing a conservation project or submitting a proposal. Conservation Small Grant awards are made once a year for a one-year period and range from \$500 to \$1500. Grant proposals are reviewed by the members of the ASP Conservation Committee during the annual meeting of the ASP. Award recommendations are then presented to the ASP Board of Directors for final approval. Recipients of grants are asked to submit a brief progress report within 12 months of the award for publication in the *ASP Bulletin*.

The Conservation Small Grants program was established in 1989. To date, the ASP has funded 29 conservation projects conducted in 15 different habitat countries. Table 5 provides a summary of the Conservation Small Grant awards.

#### *Emergency Grants*

This granting mechanism provides emergency funds for conservation projects of critical importance. The ASP Conservation Committee reviews emergency grant proposals at any time and submits their favorable recommendation to the ASP Board of Directors for final approval. In 1993, Patrick Mehlman (LABS of Virginia, Inc., USA) received emergency funding for a project aimed at preventing the premature culling of free-ranging Barbary macaques in Morocco.

#### **Summary**

From its inception, the ASP has championed the well-being and conservation of nonhuman primates. Through the efforts of the

Conservation Committee and strong support from the Society's membership, standing committees, and Board of Directors, the ASP has made significant progress in promoting primate conservation worldwide. But much more needs to be done.

In 1995, Ray Rhine and the members of the Conservation Committee drafted a Conservation Action Plan designed to guide future ASP conservation activities. Foremost among the aims was the establishment of an ever-increasing financial base to provide greater funding for a growing number of conservation-related projects. The goal is to accumulate a large enough endowment to make a noticeable impact on primate conservation and to ensure continued support during periods of limited contributions. With the continued growth of the ASP Conservation Fund, the American Society of Primatologists is committed to supporting a greater number of conservation activities and providing recognition for those individuals whose dedication and commitment to primate conservation is so critical to the survival of the species.

The future of nonhuman primates in the wild depends largely on the steps that are taken today to ensure their preservation. This is as true today as it was 20 years ago, but the present outlook is much less optimistic than it used to be. Primate conservation has entered a period of urgency and all those who study or admire these creatures should consider the implications of their disappearance. Without increased support for important conservation initiatives, the future of the world's primate populations is questionable.

#### **Acknowledgments**

We would like to thank Ray Rhine, Jo Fritz, Joe Erwin, Orville Smith, Janette Wallis, Carolyn Crockett, and Jeffery French for providing information related to this report. We also would like to thank Peggy O'Neill Wagner for making available back issues of the *ASP Bulletin*. For more information about the American Society of Primatologists, check the ASP world wide web home page at: <[www.asp.org](http://www.asp.org)>.

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**Table 4.** American Society of Primatologists Senior Biology and Conservation Awards (1989-1997).

Year	Recipient	Affiliation	Country
1989	Angelo Figueroa	Cayo Santiago	Puerto Rico (USA)
1990	Chuck L. Darsono	C.V. Primates	Indonesia
1991	Gerry Ruppenthal	University of Washington, Seattle	USA
1992	No award given		
1993	Robin Kingston*	Primate Center, Belém, Brazil	UK
1994	Hilali Matma	Gombe Stream Research Center	Tanzania
1995	Dehua Yang	Yunnan Laboratory Primate Center	China
1996	Alexander Peal	Society for Renewal of Nature Conservation in Liberia	Liberia
1997	Nancy Czekala	Center for Reproduction of Endangered Species	USA
	Jeremy Mallinson	Jersey Wildlife Preservation Trust, Jersey	British Isles

\* Last known affiliation.

**Table 5.** American Society of Primatologists Conservation Small Grants (1989-1997)\*.

1989	<b>Diane K. Brockman</b> , Yale University, USA, "Determination of <i>Propithecus</i> Reproductive Physiology through Fecal Steroid Analysis". <b>Lisa Paciuli</b> , Monkey Jungle, USA, "Use of Training for Enrichment Purposes".
1990	No Grants given
1991	No Grants given
1992	<b>Anne Savage</b> , Roger Williams Park Zoo, USA, "Proyecto Titi: The Development of an International Primate Conservation Education Program". <b>Rodrigo M. Avila</b> , Universidad Nacional, Costa Rica, "The significance of Keystone Plant Species for the Maintenance of Primate Populations in the Tropical Forests of Costa Rica".
1993	<b>Anne Savage</b> , Roger Williams Park Zoo, USA, "The Use of Water Quality Monitoring to Enhance Conservation of Endangered Primates in Colombia: An International Exchange of Information Between Colombia and Rhode Island". <b>Thad Bartlett</b> , Washington University, St. Louis, USA, "Feeding and Ranging by the White-Handed Gibbon ( <i>Hylobates lar</i> ) in Central, Thailand".
1994	<b>Anwaruddin U. Chodhury</b> , Gauhati University, India, "Survey and Eco-behavioral study of the Hoolock Gibbon ( <i>Hylobates hoolock</i> ) in Eastern Assam and Adjacent Areas of Arunachal Pradesh". <b>A.K. Gupta</b> , Forest Training Division, India, "Effects of Shifting Cultivation on the Ecology and Conservation of Mammals in Northeast India, With Special Reference to <i>Trachypithecus phayrei</i> ". <b>Dawn Hawkins</b> , University College London, UK, "Consequences and Causes of Population Decline in Yellow Baboons ( <i>Papio cynocephalus</i> )". <b>Madhu Rao</b> , Duke University, USA, "Secondary Extinctions Due to the Extirpation of Lion-tailed macaques ( <i>Macaca silenus</i> ) from Rain Forest Fragments in the Western Ghats of southern India".
1995	<b>Lilan Basse</b> , Tufts University, USA, "A study of Inter-relationships of Gastro-intestinal Parasitic Diseases of Humans and Chimpanzees Along the Boundaries of Kibale National Park, Uganda". <b>Loretta Cormier</b> , Tulane University, USA, "The Ethnoprimateology of Guaja Hunter-gatherers". <b>Anne Savage</b> , Roger Williams Park Zoo, USA, "The Development of Artificial 'Bindes' to Reduce Firewood Consumption in Coloso, Colombia". <b>Lori Sheeran</b> , California State University, Fullerton, USA, "A Conservation Plan of the Gibbons of Xiaobahe, Wuliang Reserve, China". <b>Carey Yeager</b> , Fordham University, USA, "Conservation of Borneo's Rainforest: An Integrated Approach".
1996	<b>Mukesh K. Chalise</b> , Natural History Society of Nepal, Nepal, "Familiarization of Environmental Problems Through Conservation Education". <b>Anwaruddin Choudhury</b> , The Rhino Foundation, India, "A Survey of Primates in the Jaintia Hills District of Meghalay". <b>MaLinda Henry</b> , Miami University, USA, "Inter-Specific Competition for Food Resources Between <i>Pan paniscus</i> and <i>Homo sapiens</i> in Lomako Forest of Zaire". <b>Zhaoyuan Li</b> , Academia Sinica, China, "Impacts of Habitat Fragmentation on the Behavior and Social Structure of the White-headed Langur, <i>Presbytis leucocephalus</i> in China". <b>W. Scott McGraw</b> , SUNY, Stony Brook, USA, "Survey of Endangered Primates in Eastern Ivory Coast". <b>Richard Nisbett</b> , University of Oklahoma, USA, "Continuation of Radio Broadcasts in Support of the Society for the Conservation of Nature in Libia". <b>Erwin Palacios</b> , Fundación Natura, Caparu Biological Station, Colombia, "Ecological Bases for Lake-and River-side Habitat Use by <i>Alouatta seniculus</i> in Colombian Amazonia". <b>Anne Savage</b> , Roger Williams Park Zoo, USA, "The Use of 'Bindes' as an Alternative to Long-term Resource Consumption in Colombia". <b>Ian Singleton</b> , Jersey Wildlife Preservation Trust, British Isles, "Seasonal Migration and Population Structure of Sumatran Orangutans ( <i>Pongo pygmaeus abelli</i> ) in the Gunung Leuser National Park".
1997	<b>Kimberley A. Phillips</b> , Hiram College, USA, "Conservation of Capuchin and Howler Monkeys in Trinidad". <b>Zhaoyuan Li</b> , Academia Sinica, China, "The Impacts of Habitat Fragmentation on the Behavior and Social Structure of the White-headed Langur, <i>Presbytis leucocephalus</i> , in China". <b>Rondang S.E. Siregar</b> , Orangutan Reintroduction Project, Wanariset Station, Indonesia, "Assessing the Behavioral Competence of Rehabilitant Orangutans Reintroduced to the Meratus forest, East Kalimantan". <b>Joanna E. Lambert</b> , University of Florida, USA, "The Status of Red Colobus ( <i>Procolobus badius</i> ) Populations in Regenerating Areas of Kibale National Park, Uganda". <b>Júlio César Bicca-Marques</b> , University of Illinois, USA/Federal University of Acre, Brazil, "Cognitive Aspects of Tamarin (genus <i>Saguinus</i> ) Foraging Decisions".

\* Only the principle investigator is listed. A number of projects also involved participating investigators from habitat countries.

**Table 3.** *American Journal of Primatology* Subscription Awards

Year	Recipient	Affiliation	Country	
1987	José Márcio Ayres	Universidade Federal do Pará	Brazil	
	Jito Sugardjito	Research and Development Center, LIPI	Indonesia	
	Adelmar F. Coimbra-Filho	Rio de Janeiro Primate Center	Brazil	
	José Vicent Rodriguez		Colombia	
	Wang Sung		China	
	Ferdinand Baal	Suriname Forest Service	Suriname	
	Filomeno Encarnación	Universidad Nacional Mayor de San Marcos	Peru	
	Marcos Aurélio Fulgencio Malacco	Centro Nacional de Primatas, Belém	Brazil	
	Pothin Rakotomang	University of Madagascar	Madagascar	
	Mariella Leo Luna	Universidad Nacional Agraria de La Molina	Peru	
1988	No new awards given; 10 subscriptions were continued			
1989	Elvira Maria Pereira	Universidade Federal do Acre	Brazil	
	Alejandro Diego Brown	Universidad Nacional de Tucumán	Argentina	
	J. Mangalaraj Johnson		India	
1990	Julio C. Ruiz	Centro Argentino de Primates	Argentina	
1991	Juan Carlos Serio Silva	Universidad Veracruzana	México	
	Felix S. Nunez	Universidad de Panamá	Panamá	
	Alcides Pissinatti	Rio de Janeiro Primate Center	Brazil	
	Alphonse Nemeve	D.A.I. - N.R.M.P., USAID	Rwanda	
	Sharon Matola	Belize Zoo	Belize	
	Dondin Sajuthi	Institut Pertanian Bogor	Indonesia	
	1992	Tony A. Ohaeri	University of Ibadan	Nigeria
		Ruth Tiffer	Area de Conservación Guanacaste	Costa Rica
		Jatna Supriatna	University of Indonesia	Indonesia
		Marina Wong	Brunei Museum	Brunei
1993	M. K. Giri	Natural History Society of Nepal	Nepal	
	Fernando Nassar-Montoya	La Salle University	Colombia	
	Lawrence Sirengo	Institute of Primate Research	Kenya	
	Eduardo Marcelino Veado	Estação Biológica de Caratinga	Brazil	
1994	Maria Fatima Arruda	Universidade Federal do Rio Grande do Norte	Brazil	
	Gilbert Isabirye-busata	Makerere University	Uganda	
1995	Grace Wong	Universidad Nacional, Heredia	Costa Rica	
	Gabriel Zunino	Museo Argentino de Ciencias Naturales	Argentina	
	Farid Ahsan	University of Chittalong	Bangladesh	
1996	No new awards given; 16 subscriptions were continued			
1997	Júlio César Bicca-Marques	Universidade Federal do Acre	Brazil	
	Mewa Singh	Mysore University	India	
	Arun Srivastava	NE Center, Indo-US Primate Project	India	

### Subscription Award

This award provides the *American Journal of Primatology* to worthy individuals in habitat countries who otherwise would have little access to the scientific literature on nonhuman primates. Preference is given to individuals who will make the journal available for use by students and colleagues. A nominating letter is required and should describe the nominee's credentials and primate-related activities.

Subscription awards were first presented in 1987 to 10 individuals. The recipients were also awarded a one-year membership in the ASP. Prior to 1991, subscription awards (and ASP membership) were renewed for one year. Since 1991, a number of awards have been renewed for several years. Currently, subscription awards are granted for a 5-year period. Recipients are requested to submit a brief report every two years summarizing the use of the journal. To date, subscription awards have been presented to 36 individuals in 20 different habitat countries. There are 19 AJP subscription awards currently in effect. Table 3 provides a summary of Subscription award recipients.

### Senior Biology and Conservation Award

This award is one of ASP's highest honors. It carries a \$500 honorarium and is given to recognize an individual without an advanced degree who has made substantial contributions over many

years to promote primate conservation either through direct action or via enhancement of biological knowledge or the well-being of primates. Past nominees have included park rangers, census takers, animal caretakers, research technicians, and individuals involved in private enterprise that benefits primate conservation. A nominating letter is required and should detail the nominee's qualifications, contributions to primate biology and conservation, and period of service. The award is typically presented at public ceremonies by senior officials.

The Senior Biology and Conservation award was first presented in 1989 to Anguelo Figueroa of Puerto Rico. Subsequent recipients include Chuck Darsono, Gerry Ruppenthal, Robin Kingston, Hilali Matama, Dehua Yang, Alexander Peal, Nancy Czekala, and Jeremy Mallinson. These nine individuals represent six different countries. Table 4 provides a summary of Senior Biology and Conservation award recipients.

### Special Recognition

In addition to the three main awards described above, the Society also has recognized individuals for their outstanding commitment to the conservation of nonhuman primates. Two individuals have been recognized to date. In 1985, Farood Siddiqi received special recognition for his many years of research and conservation work on primates in India. Jo Fritz was honored in

**Table 2.** American Society of Primatologists Conservation Awards (1985-1997).

Year	Recipient	Affiliation	Country
1985	Fatima Omari	University of Dar es Salaam	Tanzania
	Ilmar Santos & Cristina Alves	Federal University of Minas Gerais	Brazil
1986	Potin Rakotomanga	University of Madagascar	Madagascar
	Claudio Valladares-Padua	Rio de Janeiro Primate Center	Brazil
	Mariella Leo Luna	Universidad Nacional Agraria de La Molina	Peru
1987	Alejandro Estrada	Instituto de Biología - UNAM	Mexico
1988	Fallet Young	Community Baboon Sanctuary	Belize
1989	Jatna Supriatna	University of Indonesia	Indonesia
1990	No awards given		
1991	Andrea Martins	Golden Lion Tamarin Conservation Program	Brazil
1992	Albertus H. Pramano	Yayasan Bina Saina Hayati	Indonesia
	Felix Rakotondraparany Gilbert Rakotoarisoa, Nasolo Rakotoarison, Julien Ramanamparonjy & Herilala Randdriamahazo	Parc Tsimbazaza	Madagascar
1993	Eduardo Marcelino Veado	Estação Biológica de Caratinga, Caratinga	Brazil
1994	No awards given		
1995	No awards given		
1996	Mukesh K. Chalise	Natural History Society of Nepal	Nepal
1997	Juan Carlos Serio Silva	Instituto de Ecología, A. C.	Mexico

an effective conservation program. In 1985, the ASP opened a separate account to process tax deductible donations made to the Society in support of primate conservation. A substantial donation was received by the ASP earlier that year from Mrs. Leslie Smithgall to promote conservation work with gorillas. As a result of that gift and in conjunction with the efforts of Charles Snowdon and the other Conservation Committee members, the Society established the ASP Conservation Fund to manage financial contributions in support of primate conservation. The funds are allocated on the recommendation of the Conservation Committee with the approval of the ASP Board of Directors.

The ASP Conservation Fund has shown substantial growth since 1985 as a result of generous contributions from the general public, private organizations, ASP membership, and Society-related fund-raising activities. Some of the more notable fund-raising initiatives include the annual ASP Conservation Silent Auction (initiated by Kenneth Gold in 1992); the annual Conservation Challenge (offered by David Taub/LABS of Virginia, Inc. since 1992); and sales from various ASP-sponsored books such as *Primate Humor* and, from the ASP Special Topics in Primatology Series, *Primate Conservation: The Role of Zoological Parks* (both edited by Janette Wallis in 1994 and 1997, respectively). The ASP Conservation Silent Auction and Conservation Challenge are held in conjunction with the annual meeting of the ASP.

Although it is not possible in this overview to recognize all the people who have contributed their time and effort to the development of the Conservation Fund, there are two individuals whose efforts were central to its growth: Jo Fritz and Ramon Rhine. During her double term as Chair of the Conservation Committee, Jo Fritz, affectionately known as the "the Bag Lady" for her famous monkey chow bag solicitations (for conservation donations) during the annual banquet at the ASP Meetings, was instrumental in promoting awareness of the need for regular contributions in support of primate conservation. More recently, Ray Rhine, who also served a double term as Conservation Committee Chair, was very successful in generating considerable financial support for the Conservation Fund.

### ASP Conservation Awards

The focus of ASP's conservation efforts has been to promote and enhance conservation awareness, education, and research, especially in habitat countries (countries with native primates). To help achieve this goal, the ASP created a number of special conservation awards presented to deserving individuals in recognition of their dedication and contribution to primate conservation. Awards are made once a year during the annual ASP meeting. Award nominations are reviewed and evaluated by the Conservation Committee during the meeting. The Committee's recommendations are then submitted to the Board of Directors for final approval. There is no requirement that an award be limited to a single individual nor that an award should be made each year. Nomination information is published in the *ASP Bulletin*.

#### Conservation Award

This award provides recognition and financial support (\$500) for students and young investigators from habitat countries who demonstrate potential for making significant and continuing contributions to primate conservation. Those eligible include students, researchers, and educators from primate habitat countries for whom no more than five years have elapsed since receipt of their terminal degree. A nominating letter is required and should provide background information about the nominee, along with a statement about the nominee's qualifications for the award, focusing on past and potential contributions to primate conservation. Past awards have been presented by U.S. Ambassadors or other senior officials, thereby obtaining favorable publicity for the award, its recipient, and primate conservation in the recipient's country.

Conservation awards were first presented in 1985 to Fatima Omari of Tanzania and to Ilmar Bastos Santos and Cristina Alves of Brazil. To date, 14 awards have been presented to individuals in eight different habitat countries. Table 2 provides a summary of Conservation award recipients.

# Conservation Efforts of the American Society of Primatologists

Randall C. Kyes<sup>1</sup> and Susan M. Howell<sup>2</sup>

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## Introduction

The American Society of Primatologists (ASP) was founded in 1976 as an educational and scientific organization dedicated to Primatology (J. Erwin, pers. comm. 1998). Its purpose is to promote and encourage the discovery and exchange of information regarding primates, including all aspects of their anatomy, behavior, development, ecology, evolution, genetics, nutrition, physiology, reproduction, systematics, conservation, husbandry, and use in biomedical research (ASP Constitution).

Primate conservation has always been a high priority of the ASP. In the November 1977 (Vol. 1, No.4) issue of the *ASP Bulletin*, Orville A. Smith, then ASP President, stressed that an immediate objective of the society must be to "establish broad areas of agreement on primate use and primate conservation, so that we can formulate common approaches toward a fundamental goal in which we already have agreement: the continued existence of non-human primates" (p.1). That same year, the Conservation Committee was established as a standing committee of the ASP, charged with the oversight of Society-related conservation efforts. Peter Rodman was asked to serve as the first chair of the Conservation Committee. See Table 1 for a complete list of the ASP Conservation Committee Chairs.

During the past 20 years, the ASP has made significant progress in promoting primate conservation worldwide. This paper provides an overview of the ASP's conservation efforts to date. It is not intended to be a complete historical account of all ASP con-

servation-related activities, but rather, a summary of the major contributions and initiatives that best characterize the conservation efforts of the American Society of Primatologists. Most information originated from the ASP Conservation Committee reports published in the *ASP Bulletin*. Where data were inconsistent or incomplete, past Chairs of the Conservation Committee were contacted to help supplement the reports and clarify discrepancies. We apologize for any oversights or omissions.

## ASP Conservation Committee

The ASP Conservation Committee is responsible for overseeing Society-related conservation activities. Committee duties include: 1) establishing liaison between the Society, conservation groups, and research resources development agencies; 2) providing information on the status of wild populations of nonhuman primates; 3) monitoring primate trade, research demands, success of captive breeding programs, and enactment and abuse of legislation aimed at conservation of nonhuman primates; 4) cooperating with all other committees of the Society in the mutual exchange of relevant information; and 5) recommending individuals deserving of special recognition because of their outstanding contributions to primate conservation.

The ASP Conservation Committee has addressed each of these duties over the years, although the activities associated with the fifth objective encompass the most visible conservation efforts of the Society. Each year, the ASP presents several special conservation awards and makes a number of small grant awards for conservation-related activities (described below). The ASP conservation awards and grants program has proven to be an effective mechanism by which to promote and enhance conservation awareness, education, and research. Maintaining a special fund to support these conservation-related activities has, in and of itself, developed into a major conservation initiative of the ASP.

## ASP Conservation Fund

It was recognized early on that ensuring available funds to support ASP conservation efforts was a necessary component of

**Table 1.** American Society of Primatologists Conservation Committee Chairs.

Year	Committee Chair	Affiliation
1977	Peter Rodman	University of California, Davis
1980	Stephen Gartlan	Wisconsin Regional Primate Research Center, Madison
1982	Bernadette Marriott	Johns Hopkins University School of Medicine,
1984	Charles Snowdon	University of Wisconsin, Madison
1986	Jo Fritz	Primate Foundation of Arizona
1988	Jo Fritz	Primate Foundation of Arizona
1990	John Anderson	University of California, Davis
1992	Ramon J. Rhine	University of California, Riverside
1994	Ramon J. Rhine	University of California, Riverside
1996	Randall C. Kyes	University of Washington, Seattle

ponents of the different Action Plans.

The main role of IPS now might be to secure such major international funding. Assisting in the training of conservationists from habitat countries, in-country and out-country. Likewise, the provision of adequate facilities in-country, especially literature and equipment, are the other key contributions that IPS can continue to make on a larger scale, with the help of national affiliates.

Communication is the key with regard to publicizing the actual status of primate populations and the desired solutions to critical problems. The emphasis needs to be on conserving primates and their habitat in relation to improving the quality of life of local people. This is not so difficult, as tropical rain forest, the main primate habitat, is much more productive economically if sustained, rather than clearing for monoculture, which is demonstrably disastrous. The loss of income from not clear-felling, is eclipsed by the long-term income from the sustainable extraction of numerous forest products.

The main sequence of activity over the last 25 years has been (1) identifying critical situations for primates, (2) formulating a mechanism for combating such problems, (3) protesting systematically at abuses of primates in the wild and in captivity, (4) developing Action Plans for primate (habitat) conservation, (5) seeking to implement the priority projects in Action Plans, and (6) promoting a variety of education programs world-wide.

The unique feature of primate societies - internationally and nationally - is that they span the intellectual spectrum, from field to laboratory. Hence, there is lively (at the very least) dialogue between those seeking to conserve primates and those involved in essential health research. The lunatic fringe, mostly at the protectionist end of the spectrum, has introduced unnecessary, divisive conflict. It has tended to obscure and frustrate the common desires of all primatologists - to ensure the long-term survival of populations of all primate species, and all their habitats, which involves a greater depth of understanding of all aspects of their biology. Laboratory research, captive breeding and field management should all subservise this common aim.

## Acknowledgments

The material in this paper has been drawn from personal correspondence as a committee member and officer of both PSGB and IPS, and from *Primate Eye*, the newsletter of the PSGB, and from the IPS Newsletter. I am indebted to all those, in both societies, who have shared in these conservation endeavors.

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**Table 1. Cont.**

- 3 - Conservation of the gelada baboon (*Theropithecus gelada*) and the hamadryas baboon (*Papio hamadryas*) in Ethiopia  
 4 - Conservation of the Barbary macaque in Morocco and Algeria  
 5 - Investigation of alternate methods of baboon control in East Africa

**MADAGASCAR****Highest priority**

- 1 - A preliminary program of lemur conservation in Madagascar  
 2 - A survey of lemur populations in the eastern rain forest of Madagascar

the formulation of the Primate Action Plans.

It has been difficult to separate the activities of PSG and IPS, because the same people are involved in both. Action Plans have been produced for the Neotropics by Russell Mittermeier (various unpublished versions from 1983), African primates by John Oates (1986, 1996), Asian primates by Ardith Eudey (1987), lemurs of Madagascar by Russell Mittermeier *et al.* (1992) and Mesoamerican primates by Ernesto Rodríguez-Luna *et al.* (1996a, 1996b). Four newsletters, *Asian Primates*, *African Primates*, *Lemur News*, and *Neotropical Primates*, are now produced by the PSG, along with an annual journal, *Primate Conservation*.

By 1990, the Conservation Committee had identified 20 urgent projects - five in Africa, three in Madagascar, six in Asia and six in Latin America (Table 2). It was felt that promoting a larger number would be more effective than the previous focus on 3-4 projects in attracting interest and funds, given the different interests of national affiliates. It was gratifying that, by 1992, 16 of these 20 were already partially or fully in progress. Highly successful pre-congress training courses for primatologists from habitat countries were organized by Jeanne Altmann and colleagues immediately preceding the congresses in Bali in 1994 and Madison in 1996.

IPS, therefore, has provided a central coordinating role for primate conservation, mainly through symposia and workshops at its biennial congresses, with much business developed between times by correspondence, or at other conferences. Fund raising is not something that can be done internationally, except by approaches to International agencies and multi-national corporations. Hence, the efforts to encourage the national affiliates to become involved in such activities.

National societies are now active in the USA, U.K., France, Spain, Germany, Italy, Australia, Japan and Latin America (embracing the national societies of such as Brazil, Mexico, Peru, Venezuela, Colombia and Costa Rica). In 1993 the European Federation of Primatology was formed. Again, the collation and dissemination of scientifically-sound information is the main opportunity for a learned society, along with an emphasis on education of people at all levels (government, industry, urban and rural populations) in the developed and developing countries, in the north and the south.

**Discussion**

Primate conservation is all about identifying problems and considering the implications and options. Communication and a sound scientific basis for their resolution are crucial. Primatologists are uniquely placed for the latter, but often lack the business acumen for the former, although they can be very effective at in-country education, both in the North and in the habitat countries.

The production and up-dating of Action Plans have been a major achievement. IPS and national affiliates have played a major role. IPS, with PSG, has the central role, through its global status, but national societies are crucial, through their different foci, for developing priorities, especially with regard to education and fund-raising. Implementation of the Action Plans is much more difficult, requiring substantial funds and input of manpower. Discussions suggested that IPS needed an International agency in each continent as counterparts to resolve this problem, to implement the key com-

**Table 2: International Primatological Society (IPS) Conservation Priority Project List 1990-1992.**

Continent/Country	Location	Species
<b>Africa</b>		
Tanzania	Jozani Reserve	Zanzibar red colobus
Tanzania	Udzungwa	Endangered primates of relict forest
Kenya	Tana River	Endemic colobus and mangabey
Ivory Coast	Tai Forest	Endangered primates
Equatorial Guinea	Bioka	Endangered primates
<b>Madagascar</b>		
	Daraine	<i>Propithecus tattersalli</i> <i>Haplemur</i> spp. <i>Allocebus</i>
<b>Asia</b>		
Indonesia	Sulawesi	<i>Macaca nigra</i> , <i>M. hecki</i>
Indonesia	Mentawai Is.	3 endangered, endemic species
Vietnam	North	<i>Rhinopithecus avunculus</i> , <i>Hylobates concolor</i> , <i>Pygathrix nemaus</i>
China	South	<i>R. bieti</i> , <i>R. brelichi</i> , <i>H. concolor</i>
East Malaysia (Sarawak)	Sumunsan and other areas	Endangered <i>Presbytis</i> taxa
India	Western Ghats	<i>Macaca silenus</i>
<b>Americas</b>		
Brazil	Atlantic forest	<i>Leontopithecus caissara</i>
Brazil	Atlantic forest	<i>Brachyteles arachnoides</i>
Brazil	Amazon	<i>Saguinus bicolor</i>
Peru		<i>Lagothrix flavicauda</i>
Colombia		<i>Saguinus leucopus</i>
Costa Rica		<i>Saimiri oerstedii citrinellus</i>

**Table 1.** Revised Outline - Global Strategy for Primate Conservation - 1981-1983**SOUTH AND CENTRAL AMERICA****Highest priority**

- 1 - Conservation of endangered eastern Brazilian monkeys
- 2 - Conservation of primates in Brazilian Amazonia
  - 2.1 - Conservation of the white uakari (*Cacajao calvus calvus*)
  - 2.2 - Conservation of the southern bearded saki (*Chiropotes s. satanas*)
  - 2.3 - Conservation of the white-nosed saki (*Chiropotes albinasus*)
  - 2.4 - Conservation of the bare-face tamarins (*Saguinus bicolor* spp.)
  - 2.5 - Primate surveys in the major Amazonian tributary rivers
- 3 - Establishment and implementation of a reserve for the Peruvian yellow-tailed woolly monkey (*Lagothrix flavicauda*)
- 4 - Conservation of northern Colombian monkeys
  - 4.1 - Survey to locate a suitable reserve site for the cotton-top tamarin (*Saguinus oedipus*)
  - 4.2 - Status of the white-footed tamarin (*Saguinus leucopus*)
  - 4.3 - Status of relict populations of the woolly monkey (*Lagothrix lagotricha lugens*) and the spider monkey (*Ateles belzebuth hybridus*) in northern Colombia.
- 5 - Captive breeding of endangered Brazilian monkeys at the Rio de Janeiro Primate Center
- 6 - Establishment of a reserve for Goeldi's monkey and others sympatric monkeys in northern Bolivia

**High priority and Priority**

- 1 - Conduct status surveys and locate reserve sites in many countries and also in some existing protected areas
- 2 - Establishment of a primate research center in Surinam and development of Surinam as a model country for tropical rain forest conservation
- 3 - Effects of development on primate populations along the Transamazonian Highway, Brazilian Amazonia
- 4 - Distribution, systematics, ecology and conservation of the night monkeys in northern South America
- 5 - Development of conservation education programs in Peru, Brazil, N. Colombia, Surinam, French Guiana, S. Mexico and Costa Rica

**ASIA****Highest priority**

- 1 - Conservation of the lion-tailed macaque in south India
- 2 - Survey of primate populations in existing protected areas in China, with particular emphasis on the golden monkey (*Rhinopithecus roxellanae* ssp.), the douc langur (*Pygathrix nemaeus*), François' leaf monkey (*Presbytis francoisi*), the white-headed leaf monkey (*Presbytis leucocephala*), and the concolor gibbon (*Hylobates concolor*)
- 3 - Status survey of the Tonkin snub-nosed monkey (*Rhinopithecus avunculus*) and other primates in Vietnam, with emphasis on the development of a system of parks and reserves.
- 4 - Conservation of rare and endangered primates in Thailand
  - 4.1 - Conservation of the pileated gibbon (*Hylobates pileatus*) in Khao Soi Dao Wildlife Sanctuary and other areas
  - 4.2 - Conservation of sympatric primates in Huay Kha Khaeng Wildlife Sanctuary
- 5 - Implementation of primate reserve on Siberut, Mentawai Islands, Indonesia
- 6 - Continuing support for orang-utan research programs
- 7 - Conservation of endangered primates on Java, with special emphasis on the silvery gibbon and the Javan leaf Monkey
- 8 - Survey of the proposed Lanjak-Entimau Wildlife Sanctuary, Sarawak, East Malaysia
- 9 - Status survey of the Taiwan macaque (*Macaca cyclopis*)
- 10 - Status survey of the Phillipine tarsier (*Tarsius syrichta*)

**High priority and Priority**

- 1 - Conduct status surveys of primates in several regions of India, Burma, Laos, Kampuchea and Sumatra
- 2 - Support recommendations of recent primate surveys in Malaysia, Bangladesh and Sri Lanka
- 3 - Conservation of the proboscis monkeys in Sarawak, Brunei, Sabah, Kalimantan
- 4 - Status and conservation of the macaques of Sulawesi, Indonesia
- 5 - Conservation of Japanese macaques
- 6 - Status survey of the Hamadryas baboon (*Papio hamadryas*) in Yemen and Aden

**AFRICA****Highest priority**

- 1 - Establishment of the Outamba-Kilimi National Park in Sierra Leone
- 2 - Survey of primate populations in Liberia, with the aim of establishing the first Liberian national park
- 3 - Survey of primate populations in Guinea
- 4 - Survey of primate populations in the Zaire basin
- 5 - Primate conservation in rain forest relicts in East Africa
  - 5.1 - Conservation of Kirk's red colobus monkey (*Colobus kirkii*) on Zanzibar
  - 5.2 - Conservation of the Tana River mangabey and red colobus monkey
  - 5.3 - Conservation of the Uhebe red colobus monkey (*Colobus badius gordonorum*)
  - 5.4 - The effects of selective tree-felling on primate populations in the Kibale Forest, Uganda
- 6 - Primate conservation in Cameroon
  - 6.1 - Conservation and development of three national parks in the forest zone of Cameroon (Korup, Nja, Pangar-Djerem)
  - 6.2 - Conservation education in the forest zone of Cameroon
- 7 - Primate conservation in Gabon
- 8 - Conservation of eastern gorillas
  - 8.1 - Mountain gorilla conservation in Rwanda and Uganda
  - 8.2 - Development of gorilla and chimpanzee reserves in eastern Zaire
  - 8.3 - Support recommendations for gorilla conservation in Kahuzi-Biega National Park, Zaire

**High priority and Priority**

- 1 - Conduct status surveys of primates in Senegal, Ghana, Central African Republic, Congo, Guinea, E. Zaire
- 2 - Support recommendations from ongoing primate projects in the Ivory Coast and on the pygmy chimpanzee (*Pan paniscus*)

Cont.

most active national primate societies. They center on biannual conferences (usually one-day meetings in Spring and Winter), on identifying and disseminating information on important conservation issues, and raising funds for primate conservation initiatives. There is always an underlying focus on the interface between the wild populations and the captive stock, and PSGB has made special efforts to respond to priorities expounded by the parent organization, IPS, and by the PSG of IUCN.

### International Primatological Society (IPS)

The main activity of IPS is its biennial congress, an unique multidisciplinary gathering of primatologists, with a persistent focus on behavior, ecology, conservation, evolution and medicine, and involving field and laboratory researchers of every kind. The venues have been, starting in 1966, Frankfurt, Atlanta (Georgia), Zürich, Portland (Oregon), Nagoya/Kyoto, Cambridge, Bangalore, Florence, Atlanta, Nairobi, Göttingen, Brasília, Nagoya/Kyoto, Strasbourg, Bali, and Madison (Wisconsin). The officers of the Society are as follows: President, Secretary-General, Treasurer, two Vice-Presidents originally (now three, for Conservation, Captive Care and Membership/Information) and Secretaries for Europe, Australasia, Africa and the Americas. The seat of the Society was Frankfurt until about 1976, when it was transferred to the USA.

The Vice-President for Conservation and the Conservation Committee run the conservation business of the Society, and organize a Symposium on this theme at each Congress. Hans Kummer inspired the development of an active conservation program; he off-loaded some of his responsibilities to the Secretary-General, the late Allan Schrier, while President. In 1973, he participated in an IPS/IUCN meeting to establish the PSG, first chaired by Barbara Harrison. A priority list was also drawn up for the PSG: (1) habitat conservation, (2) control of hunting and trapping and (3) isolated measures to save particular species; the emphasis was to be on forest ecosystems containing primates, especially great apes.

In 1974, projects were selected for support in Cameroon, Zaire, Upper Guinea, Brazil and India. Steve Gartlan took over in 1976, as the first Vice-President for Species and Habitat Conservation; he served two terms, until 1984. A sum of DM5,000 was provided to help in the creation of two national parks in Cameroon - Korup and Campo. There was much correspondence about the transfer of pygmy chimpanzees, *Pan paniscus*, from Zaire to the Yerkes Regional Primate Research Center in Atlanta, Georgia, as part of a conservation project - primatologists lined up forcefully on both sides of the fence.

At the Bangalore Congress in early 1979, Gartlan gave an impressive review of the current situation in each continent, country by country. He focused on habitat destruction as the greatest threat, the need to promote conservation education, the variable effects of hunting, the fluctuation of government policies, the need to manage as well as create national parks, the opportunities to influence projects financed internationally, and the importance of each country ratifying CITES. Five resolutions were approved: (1) on the conservation, breeding and judicious use of Indian primates in biomedical research in India and overseas; (2) on the contravention and evasion of import controls in the movement of primates; (3) on the proposed hydroelectric scheme for Silent Valley in Kerala, India (subsequently canceled); (4) on the protection of West Bhanugach Forest Reserve in Bangladesh; and (5) against military experiments on primates. Most of

these were the subject of extensive letter-writing campaigns, as was the creation of a park in Panama, and the export of great apes from Uganda in 1980.

This was the time when there was clamor for more Congresses in habitat countries and also when Conservation Awards originated, of which three were proposed to be awarded annually, one for each habitat continent. The first was awarded to a Tanzanian.

Conservation sessions at IPS Congresses have provided a forum for Russell Mittermeier, chairman of the PSG of IUCN, to involve IPS conservationists in the formulation of Primate Action Plans, following his 1991 promulgation of the Global Strategy for Primate Conservation, in which he identified 11 key projects in the Neotropics, 16 in Asia, 13 in Africa and two in Madagascar (Table 1). This was discussed in Atlanta in 1982, and led to the launching of the IPS Conservation Appeal by Suzanne Chevalier-Skolnikoff for the Conservation Committee, with requests for support from national affiliates, and 50% of IPS dues. She ran a very successful series of meetings and sales in California. The focus was on mountain gorillas in Rwanda, muriquis in south-east Brazil, the Korup National Park in Cameroon, and training awards.

In Nairobi in 1984, scientific ratings for conservation projects were formulated, the composition and activities of the conservation committee were more fully defined and the conservation appeal developed. Funds had been raised for the purchase of part of the Fazenda Montes Claros in south-east Brazil to ensure the protection there of the muriqui, *Brachyteles*. John Oates took over from Ken Green as Vice-President during this period, heralding an exciting new era. In 1986, at Göttingen, four priorities were agreed for funding: the yellow-tailed woolly monkey, *Lagothrix flavicauda*, of Peru; endangered primates of Thailand; the mountain gorilla, *Gorilla g. beringei*; and the Conservation Scholarship Program (to provide training for primatologists of habitat countries, usually in the USA or Europe). Between 1986 and 1992 about 15 young scientists were assisted to the tune of about \$3,000 each, often with matching funds from the other organizations, including national affiliates: from Bangladesh, Mexico, Argentina, Indonesia (2), Sierra Leone, India, Malaysia (2), China (2), Kenya, Tanzania and Uganda.

From 1988 to 1992 the Appeal and Scholarship Program continued under the direction of David Chivers. The committee was expanded to achieve a better geographical input, with sub-groups dealing with matters in each continent, chimpanzees, scholarship awards, symposium planning, the Appeal and International policy formulation.

The conservation symposium in 1990 in Japan focused on Conservation and Development - (1) the development and sustainable use of tropical rain forests and (2) the role of protected areas in primate conservation. Numerous resolutions were approved by the Business Meeting on CITES (concerning Japan, Taiwan, Thailand, Singapore and Uganda), Japan and the timber trade in South-east Asia, and on the plight of primates in Zaire, Congo, Mentawai Islands (Indonesia), Zanzibar and Myanmar.

In 1992 in Strasbourg, the theme was "Primate Conservation: the Way Ahead, Sustainability v. Protectability". There were related symposia on "Primates as Indicator Species in Tropical Forest Habitats", organized by Meg Symington, and "African Great Apes in Tropical Rain Forest", organized by Caroline Tutin and S. Kuroda. Before the "issues" symposia, the conservation sessions had tended to be a series of case studies from each continent, which helped in

FFI, WWF and the African Wildlife Foundation following the death of Digit in 1978, with Sandy Harcourt at the heart of activities. In 1981, we pressed for a ban on further imports of threatened species to the UK as well as on any new research programs on such species, and also argued for the phasing out of existing projects, in line with the current WHO/IUCN guidelines which had been recently formulated.

From 1982, Miranda Stevenson was the convenor, and interest subsequently centered on issues such as the use of West African chimpanzees by Spanish beach photographers (also in the Canary Islands), primate imports to the UK (and other parts of Europe), and the situation of the Barbary macaque, *Macaca sylvanus*, in North Africa. A productive conference concerning the latter was held in Gibraltar, and yielded eight resolutions and a book on the species (Fa 1984). There was growing concern about the waste of an educational opportunity and the likely decrease in fertility of the Gibraltar population through over-feeding by tourists. Julian Caldecott and Michael Kavanagh produced detailed guidelines about translocating primates, which are still very relevant today, and a symposium, "Conservation of Primates and Their Habitats", was held at the University of Leicester and Twycross Zoo, with two resulting publications (Harper 1983a, 1983b).

The Spanish beaches, lion tamarins, IMMUNO and its chimpanzee research, Gibraltar and its Barbary macaques, and the reintroduction of Barbary macaques to Morocco from Baron Gilbert de Turckheim's parks in France and Germany (a model for captive breeding success and, potentially, for reintroductions) were dominant issues through the 1980s. A symposium was held at the Zoological Society of London in 1986 in conjunction with Fauna and Flora International (then the Fauna and Flora Preservation Society) on "Current Issues in Primate Conservation" which resulted in the publication of a booklet (Stevenson *et al.* 1986).

From 1987 to 1996, Simon Bearder was convenor of the CWP, being especially involved with the development of the fund-raising appeal and its application (see below). Funds were provided for one

of the IPS Conservation Scholarships, for a Ugandan to attend a course at the Forestry Institute in Oxford. Bearder was also active in collating and disseminating information from many sources on primate conservation issues. Between 1990 and 1992, he dealt with 10 reports of illegal trafficking, 14 reports concerning threats to wild primates, 10 reports of misuse in captivity, 10 requests for education grants, and eight conservation guidelines and initiatives. Barbary macaques in European parks, and chimpanzees and AIDS research, were much in discussion. A grant was given for studies on the Gibraltar macaques. 1989 saw a review of primate imports to the UK and a joint statement was produced with the Captive Care Working Party on the problems of surplus animals of endangered species in captivity (unpublished).

#### Fund-raising

In 1984, following the IPS Congresses in Atlanta and Nairobi (see below), a Conservation Appeal was launched through the sale of T-shirts, leaflets, and other materials, creating an Action Fund (for special requests) and funds for the Mountain Gorilla and for South American primates. Miranda Stevenson played a major role in the development of this Appeal. It yielded £2360 in year 1, £2362 in year 2, £2071 in year 3, £3904 in year 4, £2265 in year 5, £2081 in year 6, and £15,043 in all. Following the IPS initiative, a proportion of membership fees were donated to the Fund. As a result of this £1124 was raised in 1992, but in the following two years the sums decreased; £714 in 1994, and £498 in 1995. Siân Waters is a providing renewed impetus, however, in her role as convenor for the Conservation Working Party, elected in 1996. Projects were funded in Tiwai Island, Sierra Leone, and Sarawak (proboscis monkeys, *Nasalis larvatus*) and, more recently, the black lemur, *Eulemur macaco*, in Madagascar, woolly monkey, *Lagothrix*, rehabilitation (from Cornwall, UK, to Brazil), and for the sun-tailed guenon, *Cercopithecus solatus*, in Gabon. The emphasis has shifted to giving support especially to education aspects of such projects.

This survey outlines and exemplifies the activities of one of the



Figure 2. Locations of primate field studies in the 1980's. Map drawn by Stephen Nash

# The Role of The International Primatological Society (IPS) and National Primate Societies in Global Primate Conservation

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## Introduction

This is, of necessity, a somewhat personal, chronological perspective of conservation activities, first by the Primate Society of Great Britain (PSGB), as an example of one of the older and more active national Primatological societies, and then by the International Primatological Society (IPS), also about 30 years old, and its interaction with the Primate Specialist Group (PSG) of the Species Survival Commission (SSC) of the World Conservation Union (IUCN). Others are better able to talk of the achievements of the American Society of Primatologists (ASP), which is comparable in its activity level to PSGB. The national societies in Japan, Australia, Italy, France, Germany, Brazil and Mexico are also forces with which to be reckoned, as are the more recent regional societies in Latin America and Europe. We must also refer to interactions with conservation funding agencies, such as Conservation International (CI), the Wildlife Conservation Society (WCS) of the New York Zoological Society (NWZS), Fauna and Flora International (FFI), the World Wide Fund for Nature (WWF), and Wildlife Preservation Trust International (WPTI).

The role of primate societies has been mainly (1) to promote good science in the field, laboratory, museums and zoos, (2) to derive information on status and behavior in the wild, thereby identifying differing degrees of threat to the survival of primate species and sub-species, (3) to promote conservation education at home and abroad, (4) to publicize illegal activities and bad practices with

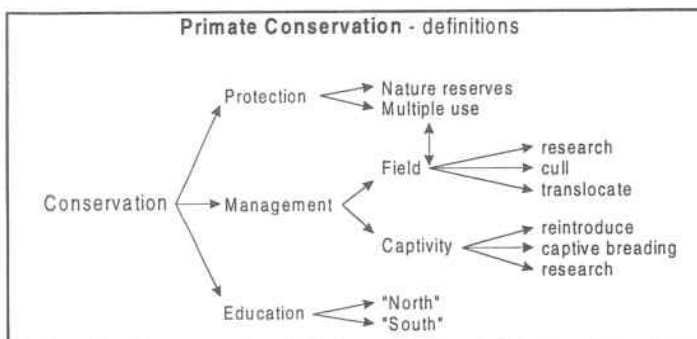
wild and captive primates, and pressurize appropriate governments and agencies, and (5) to develop collaborative conservation programs and projects to save species from extinction (Fig. 1).

## Primate Society of Great Britain (PSGB)

Formed in 1967, the Society has at least two meetings each year, often on the ecology and behavior of primates and conservation issues, and sometimes in collaboration with other organizations, such as the Mammal Society and the Association for the Study of Animal Behaviour (ASAB). Council meets at least three times annually, as do the Conservation and Captive Care Working Parties, whose convenors are co-opted to Council. Since 1972, the Society has produced a newsletter (three times a year), *Primate Eye*, reporting on the activities of the Society and especially those of the Working Parties.

Conservation activities, in the sense of collating baseline data, started in 1974 with the compilation of a list of primate field studies, that has continued at least biennially ever since (Fig. 2). In 1976, the Conservation Working Party (CWP) was formed, with Vernon Reynolds as its first convenor. The main aim was to develop Resolutions for the VIth Congress of International Primatological Society, to be held in Cambridge that year. The resolutions focused on U.K. import rules and monitoring, adding chimpanzees to the endangered listing, pressurizing the Medical Research Council to publish their report on needs for laboratory primates, and urging the IUCN/PSG to collate data on wild primates. In 1979, Robin Dunbar took over as convenor and at the IPS Congress in Bangalore in that year, the CWP pressed particularly for the enforcement of import controls. CWP activities at that time centered on (1) monitoring laws and regulations about primate use in the U.K., (2) establishing links with other organizations with similar objectives, and (3) monitoring events relevant to primate conservation and use world-wide and in the UK.

In 1980, David Chivers became the CWP convenor. A list was produced of primate species threatened with extinction, and UK legislation on the primate trade was reviewed along with CITES. Support was given to the Mountain Gorilla Project, developed by



**Figure 1.** The role of primate societies: approaches and tools for primate conservation.

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as well as to increase the focus on those primate taxa most seriously threatened with extinction. With any luck at all, we will come through the 20<sup>th</sup> Century without having lost a single primate taxon - an enviable record indeed considering the number of reptiles, birds and other mammals known to have disappeared already during this period - but we will do so only by the "skin of our teeth" and with several species and subspecies still in jeopardy.

Much of the groundwork for developing a more-focused conservation strategy has already been done. The 1996 IUCN Red List of Threatened Animals (Baillie and Groombridge 1996) provides a good starting point for identifying the highest priority taxa. To it, the authors will work with regional experts of the IUCN/SSC Primate Specialist Groups to re-evaluate species and subspecies of conservation concern, and then consider taxonomic uniqueness to establish priority rankings for conservation action. The results of this analysis will be presented in 1999 in the form of a global action plan for the world's most endangered primates.

With such a plan in hand, serious work can begin to amass both the human and financial resources needed for implementation. Fortunately, several new sources of support for primate conservation have materialized over the last decade. While the World Wildlife Fund-U.S. Primate Program no longer exists, many other traditional non-governmental sources still offer grants for field, captive and laboratory programs. Academic institutions continue to provide funds for primate field studies that have significant conservation impact, and government-supported efforts such as the Indo-U.S. Primate Project provide excellent models for international cooperation. A growing number of zoos have joined forces to focus on regional primate faunas, generating funds not only for captive breeding programs, but for support for *in situ* projects as well. In addition, at least two new significant sources of philanthropic support dedicated to primates were established in the 1990s: Primate Conservation, Inc. and the Margot Marsh Biodiversity Foundation. Together, these organizations and agencies represent the core of funding necessary to move ahead with a global action plan for the world's most endangered primates, and it is hoped that such a plan will help uncover new sources of support as well.

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uakari (*Cacajao calvus*), masked titi (*Callicebus personatus*), Central American squirrel monkey (*Saimiri oerstedii*), Diana monkey (*Cercopithecus diana*), red-eared monkey (*Cercopithecus erythrotis*), and gorilla (*Gorilla gorilla*).

### Primate Conservation Over the Past 20 Years

The International Union for Conservation of Nature and Natural Resources (IUCN), now the The World Conservation Union, was established in 1948 to promote and carry out scientifically-based action for the conservation and sustainable use of living natural resources. IUCN enrolls sovereign states, governmental agencies, research institutions and non-governmental organizations to conserve the world's natural heritage. The Species Survival Commission (SSC), founded in 1949, is the largest of IUCN's six commissions with more than 7,000 volunteer member scientists, field researchers, government officials, and conservation leaders from 188 countries. SSC works principally through its more than one hundred Specialist Groups, of which the Primate Specialist Group is one of the largest.

The founding mission of the Primate Specialist Group is to maintain the current diversity of the order Primates, with dual emphasis on: 1) ensuring the survival of endangered and vulnerable species wherever they occur, and 2) providing effective protection for large numbers of primates in areas of high primate diversity and/or abundance.

Although activities underway in many parts of the world make it inevitable that a proportion of the world's forests and the primates living in them will disappear, the role of the Primate Specialist Group is to minimize this loss wherever possible by:

- setting aside special protected areas for critically endangered, endangered and vulnerable species;
- creating national parks and reserves in areas of high primate diversity and/or abundance;
- maintaining parks and reserves that already exist and enforcing protective legislation in them;
- determining ways in which human and non-human primates can coexist in multiple-use areas;
- establishing conservation-oriented captive breeding programs for threatened taxa;
- ending all illegal and otherwise destructive traffic in primates;
- ensuring that research institutions using primates are aware of conservation issues and the status of species they use, that they use primates as prudently as possible, and that they make every attempt to breed in captivity most or all of the primates they require; and,
- creating public awareness of the need for primate conservation and the importance of primates as a natural heritage in the countries in which they occur.

In late 1977, the chairman of the Primate Specialist Group, in collaboration with group members, put together a 325-page *Global Strategy for Primate Conservation* (Mittermeier 1978). This document was an attempt to organize primate conservation activities based on the highest international priorities and to ensure that

the limited funds available for primate conservation were put to the best possible use. The first draft of the *Global Strategy* included 65 projects for Africa, Asia, and South and Central America. Each project was categorized as *highest priority*, *high priority*, *priority*, and *desirable*, based mainly on the status of focal species and how likely the project would be to bring about the desired conservation action. The *Global Strategy* quickly led to a substantial increase in funding for primate conservation activities and, in 1979, to the establishment of a special Primate Program and Primate Action Fund by the World Wildlife Fund-U.S. In addition to major projects supported as a result of this program, the Primate Action Fund provided rapid support for small primate conservation projects (ranging from \$500-\$3,000). The Primate Action Fund functioned for more than a decade, contributing several hundred thousand dollars to more than 100 projects. Other key institutions that contributed significantly to primate conservation during this period include the New York Zoological Society (now the Wildlife Conservation Society), the Fauna and Flora Preservation Society (now Fauna and Flora International), the Rare Animal Relief Effort, Jersey Wildlife Preservation Trust, Wildlife Preservation Trust International, the National Geographic Society, and a number of others.

Almost a decade after the *Global Strategy* was launched, the first regional primate conservation action plans were prepared by the IUCN/SSC Primate Specialist Group. First to be published was the *Action Plan for African Primate Conservation: 1986-90* (Oates 1986), which was quickly followed by *the Action Plan for Asian Primate Conservation: 1987-91* (Eudey 1987), and several years later by *Lemurs of Madagascar, An Action Plan for their Conservation: 1993-1999* (Mittermeier *et al.* 1992). The last plan to appear was *African Primates: Status Survey and Conservation Action Plan* (Oates 1996), an update of the 1986 document, and that for the Mesoamerican Region was recently prepared by Rodríguez-Luna *et al.* (1996). These action plans have effectively focused conservation activities in three of the four major regions in which primates occur, and are useful measures with regard to the success of proposed strategies.

The first vehicle for regular and effective communication among the world's primate conservationists was the *IUCN/SSC Primate Specialist Group Newsletter*, which was launched in 1981. Changed to *Primate Conservation* in 1985, it has appeared on more or less an annual basis ever since. In addition, the four regional sections of the Primate Specialist Group subsequently began publishing their own periodic newsletters to meet the growing need for more timely information. *Asian Primates* appeared in 1991, *Neotropical Primates* and *Lemur News* in 1993, and *African Primates* in 1995, with *Neotropical Primates* and *Asian Primates* appearing with the greatest frequency and regularity. Although they have achieved varying success with regard to frequency of publication, in combination they have significantly increased the amount, quality, and timeliness of information available to primate conservationists throughout the world.

### Outlook for the Future

For the years ahead, there is a need to sustain conservation activities based on recommendations of the original *Global Strategy for Primate Conservation* and subsequent regional action plans,



to African and Asian subspecies, to ensure that all the distinct, threatened populations have been given proper consideration. We also feel that the *Red List* is sometimes misleading by assigning the lowest level of threat to a given species when one or more of its subspecies is, in fact, more endangered. For example, Verreaux's sifaka (*Propithecus verreauxi*) is listed as *Vulnerable* even though two of its subspecies, Coquerel's sifaka (*P. v. coquereli*) and the

crowned sifaka (*P. v. coronatus*) are considered *Endangered* and *Critically Endangered*, respectively. Similar situations exist for the gentle lemur (*Hapalemur griseus*), black lemur (*Eulemur macaco*), ruffed lemur (*Varecia variegata*), diademed sifaka (*Propithecus diadema*), brown howling monkey (*Alouatta fusca*), night monkey (*Aotus lemurinus*), long-haired spider monkey (*Ateles belzebuth*), brown-headed spider monkey (*Ateles fusciceps*), bald

**Table 6.** Critically Endangered and Endangered primates, according to the 1996 IUCN *Red List of Threatened Animals* (Baillie and Groombridge, 1996).

Critically Endangered	Endangered
Hairy-eared dwarf lemur ( <i>Allocebus trichotis</i> )	White-collared lemur ( <i>Eulemur fulvus albocollaris</i> )
Sclater's lemur ( <i>Eulemur macaco flavifrons</i> )	Black-and-white ruffed lemur ( <i>Varecia variegata variegata</i> )
Alaotran gentle lemur ( <i>Hapalemur griseus alaotrensis</i> )	Indri ( <i>Indri indri</i> )
Golden bamboo lemur ( <i>Hapalemur aureus</i> )	Diademed sifaka ( <i>Propithecus diadema diadema</i> )
Broad-nosed gentle lemur ( <i>Hapalemur simus</i> )	Milne-Edwards' sifaka ( <i>Propithecus diadema edwardsi</i> )
Red ruffed lemur ( <i>Varecia variegata rubra</i> )	Coquerel's sifaka ( <i>Propithecus verreauxi coquereli</i> )
Silky sifaka ( <i>Propithecus diadema candidus</i> )	Aye-aye ( <i>Daubentonia madagascariensis</i> )
Perrier's sifaka ( <i>Propithecus diadema perrieri</i> )	Buffy-tufted-ear marmoset ( <i>Callithrix aurita</i> )
Tattersall's sifaka ( <i>Propithecus tattersalli</i> )	Buffy-headed marmoset ( <i>Callithrix flaviceps</i> )
Crowned sifaka ( <i>Propithecus verreauxi coronatus</i> )	Golden-headed lion tamarin ( <i>Leontopithecus chrysomelas</i> )
Black-faced lion tamarin ( <i>Leontopithecus caissara</i> )	Bicolored tamarin ( <i>Saguinus bicolor bicolor</i> )
Black lion tamarin ( <i>Leontopithecus chrysopygus</i> )	Cotton-top tamarin ( <i>Saguinus oedipus</i> )
Golden lion tamarin ( <i>Leontopithecus rosalia</i> )	Coiba Island howling monkey ( <i>Alouatta coibensis coibensis</i> )
Red-handed howling monkey ( <i>Alouatta belzebul ululata</i> )	Night monkey ( <i>Aotus lemurinus griseimembra</i> )
Coiba Island howling monkey ( <i>Alouatta coibensis trabeata</i> )	White-bellied spider monkey ( <i>Ateles belzebuth brunneus</i> )
Northern brown howling monkey ( <i>Alouatta fusca fusca</i> )	Hybrid spider monkey ( <i>Ateles belzebuth hybridus</i> )
Brown-headed spider monkey ( <i>Ateles fusciceps fusciceps</i> )	Grizzled spider monkey ( <i>Ateles geoffroyi grisescens</i> )
Azuero spider monkey ( <i>Ateles geoffroyi azuerensis</i> )	Panamanian spider monkey ( <i>Ateles geoffroyi panamensis</i> )
Northern Bahian brown titi ( <i>Callicebus personatus barbarabrownae</i> )	White-whiskered spider monkey ( <i>Ateles marginatus</i> )
White-fronted capuchin ( <i>Cebus albifrons trinitatis</i> )	Southern muriqui ( <i>Brachyteles arachnoides</i> )
Margarite Island tufted capuchin ( <i>Cebus apella margaritae</i> )	Northern muriqui ( <i>Brachyteles hypoxanthus</i> )
Buffy-headed tufted capuchin ( <i>Cebus xanthosternos</i> )	Bald uakari ( <i>Cacajao calvus calvus</i> )
Yellow-tailed woolly monkey ( <i>Lagothrix flavicauda</i> )	Bald uakari ( <i>Cacajao calvus novaesi</i> )
Colombian woolly monkey ( <i>Lagothrix lagotricha lugens</i> )	Red uakari ( <i>Cacajao calvus rubicundus</i> )
Central American squirrel monkey ( <i>Saimiri oerstedii citrinellus</i> )	Black bearded saki ( <i>Chiropotes satanas satanas</i> )
Miss Waldron's red colobus ( <i>Procolobus badius waldroni</i> )	Central American squirrel monkey ( <i>Saimiri oerstedii oerstedii</i> )
Mentawai macaque ( <i>Macaca pagensis</i> )	White-collared mangabey ( <i>Cercocebus atys lunulatus</i> )
Tonkin snub-nosed monkey ( <i>Rhinopithecus avunculus</i> )	Sanje mangabey ( <i>Cercocebus galeritus sanjei</i> )
Delacour's langur ( <i>Trachypithecus delacouri</i> )	Tana River mangabey ( <i>Cercocebus galeritus galeritus</i> )
Silvery gibbon ( <i>Hylobates moloch</i> )	Roloway monkey ( <i>Cercopithecus diana roloway</i> )
Nigerian gorilla ( <i>Gorilla gorilla</i> )	Red-eared monkey ( <i>Cercopithecus erythrotis erythrotis</i> )
Mountain gorilla ( <i>Gorilla gorilla berengei</i> )	Golden monkey ( <i>Cercopithecus mitis kandti</i> )
	Preuss's monkey ( <i>Cercopithecus preussi insularis</i> )
	Preuss's monkey ( <i>Cercopithecus preussi preussi</i> )
	Sclater's guenon ( <i>Cercopithecus sclateri</i> )
	Drill ( <i>Mandrillus leucophaeus leucophaeus</i> )
	Drill ( <i>Mandrillus leucophaeus mundamensis</i> )
	Bouvier's red colobus ( <i>Procolobus badius bouvieri</i> )
	Niger Delta red colobus ( <i>Procolobus badius epieni</i> )
	Uhehe red colobus ( <i>Procolobus badius gordonorum</i> )
	Zanzibar red colobus ( <i>Procolobus badius kirkii</i> )
	Pennant's red colobus ( <i>Procolobus badius pennanti</i> )
	Preuss's red colobus ( <i>Procolobus badius preussi</i> )
	Tana River red colobus ( <i>Procolobus badius rufomitratu</i> )
	Temminck's red colobus ( <i>Procolobus badius temmincki</i> )
	Japanese macaque ( <i>Macaca fuscata</i> )
	Moor macaque ( <i>Macaca maura</i> )
	Sulawesi black macaque ( <i>Macaca nigra</i> )
	Lion-tailed macaque ( <i>Macaca silenus</i> )
	Grizzled leaf monkey ( <i>Presbytis comata</i> )
	Douc langur ( <i>Pygathrix nemaus</i> )
	Yunnan snub-nosed monkey ( <i>Rhinopithecus bieti</i> )
	Guizhou snub-nosed monkey ( <i>Rhinopithecus brelichi</i> )
	Pig-tailed snub-nosed monkey ( <i>Simias concolor</i> )
	Francois' langur ( <i>Trachypithecus poliocephalus</i> )
	Black gibbon ( <i>Hylobates concolor</i> )
	Western lowland gorilla ( <i>Gorilla gorilla gorilla</i> )
	Grauer's gorilla ( <i>Gorilla gorilla graueri</i> )
	Eastern chimpanzee ( <i>Pan troglodytes schweinfurthi</i> )
	Central chimpanzee ( <i>Pan troglodytes troglodytes</i> )
	Western chimpanzee ( <i>Pan troglodytes verus</i> )

A final reason for hunting primates considered here is as agricultural pests which, for some African and Asian species, can represent a significant drain on wild populations. The most striking example is that of government-sponsored "monkey drives" that were common in Sierra Leone several decades ago. Eleven of the country's 14 primate species were routinely shot or driven into nets and clubbed to death during such drives; only three species were considered harmless to farm crops. According to government records, close to a quarter of a million monkeys were destroyed in such drives between 1949 and 1962, and these were only the ones actually counted. Bounties were paid for primate heads or tails, and there was no control over the species killed (Jones 1950; Tappen 1964).

The major primate crop raiders are usually the more adaptable and widespread species such as the savanna baboons (*Papio* spp.) in Africa and the macaques (*Macaca* spp.) in Asia, but there are also instances on record of orangutans being killed for raiding fruit trees and gorillas for destroying crops. The only Neotropical species regarded as agricultural pests are the capuchins (*Cebus* spp.), whose common names sometime reflect their crop-raiding habits. For example, the common name for the tufted capuchin (*Cebus apella*) in Colombia is *maicero* and one of the Surinamese names for the weeper capuchin (*Cebus olivaceus*) is *nyan-karu mongi*, both of which translate as "corn-eater" (Mittermeier 1977).

It is difficult to assess how much damage primates actually do to crops in different parts of the world. It is equally difficult to determine how effective pest control efforts have been or to what degree they have contributed to the decline of wild primate populations. However, as primate habitats continue to be encroached upon, resulting in shortages of other food sources, it is likely that the more adaptable primate species will continue to raid crops and perhaps become more dependent upon them as a regular food source. This, unfortunately, will likely result in increased conflict between man and non-human primates.

### Live Capture of Primates

Primates routinely have been captured alive for export (the international trade to supply zoos, biomedical research and pharmaceutical testing) or to serve local pet trades. The height of the international primate trade began at the end of the 1950s and continued through the early 1960s, during which time hundreds of thousands of monkeys were taken from the wild each year (Mack and Mittermeier 1984). The trade consisted largely of rhesus macaques (*Macaca mulatta*) exported from India and used in laboratory tests as part of the effort to develop a vaccine for polio, and squirrel monkeys (*Saimiri sciureus*) imported by the United States from several Amazonian countries. Subsequently, the imposition of export bans by habitat countries, import restrictions by user countries, and a decreased demand from biomedical research and zoological parks contributed to a significant decline in the international traffic of primates.

In 1982, in recognition of the serious effect that live capture for export can have on wild primate populations, the IUCN/SSC Primate Specialist Group prepared a *Policy Statement on Use of Primates for Biomedical Purposes*, which includes the recommendation that endangered, vulnerable and rare species be consid-

ered for use in biomedical research projects *only* if they are obtained from existing, self-sustaining captive breeding colonies (Mittermeier *et al.* 1982). This policy statement was subsequently adopted by the World Health Organization (WHO) and the Ecosystem Conservation Group (ECG) of the United Nations, which includes UNESCO, the Food and Agricultural Organization (FAO), UNEP and IUCN. It is still valid to this day.

### Conservation Status of Primates

The most recent, comprehensive conservation status assessment of the world's primates is included in the *1996 IUCN Red List of Threatened Animals* (Baillie and Groombridge 1996), a collaborative effort of the IUCN Species Survival Commission, the World Conservation Monitoring Centre and BirdLife International. This document differs significantly from past Red Lists in its use of new categories and criteria for threat. All primate taxa were included in this assessment and have been identified either as *Threatened* (a designation which includes the categories *Critically Endangered*, *Endangered* and *Vulnerable*), *Lower Risk: Conservation Dependent*, *Lower Risk: Near Threatened*, *Extinct and Extinct in the Wild*, and *Data Deficient*. In general terms, a taxon is defined as:

- *Critically Endangered* if the extent of its occurrence is estimated to be less than 100 km<sup>2</sup>, if its population is estimated to be less than 250 mature individuals, and quantitative analysis indicates the probability of extinction in the wild is at least 50% within 10 years or three generations;
- *Endangered* if the extent of its occurrence is estimated to be less than 5,000 km<sup>2</sup>, if its population is estimated to number less than 2,500 individuals, and if quantitative analysis shows the probability of extinction in the wild is at least 20% within 20 years or five generations; and
- *Vulnerable* if the extent of its occurrence is estimated to be less than 20,000 km<sup>2</sup>, if its population is estimated to number less than 10,000 individuals, and if quantitative analysis shows the probability of extinction in the wild is at least 10% within 100 years.

As a result of this assessment, 204 (roughly one-third) of the world's 620 or so primate taxa are currently considered *Critically Endangered*, *Endangered* or *Vulnerable* (Table 5). Of these, 104 taxa (16.6%) are listed as *Critically Endangered* or *Endangered* - 34 in the Neotropics, 29 in Africa, 17 in Madagascar, and 24 in Asia (Table 6). Nine genera - *Allocebus*, *Varecia*, *Indri*, *Daubentonia*, *Leontopithecus*, *Brachyteles*, *Simias*, *Pan* and *Gorilla* - are considered *Endangered*, as is the monotypic family Daubentoniidae.

Although the *1996 IUCN Red List of Threatened Animals* is comprehensive and identifies a significant number of taxa as threatened, we feel that revisions are required, particularly with regard

Table 5. Threatened primates by region.

Region	Taxa	Threatened	Per Cent	CR + E	Per Cent
Neotropics	202	69	34.2	34	16.8
Africa	190	41	21.1	29	14.7
Madagascar	51	35	68.6	17	33.3
Asia	176	60	34.1	24	13.6

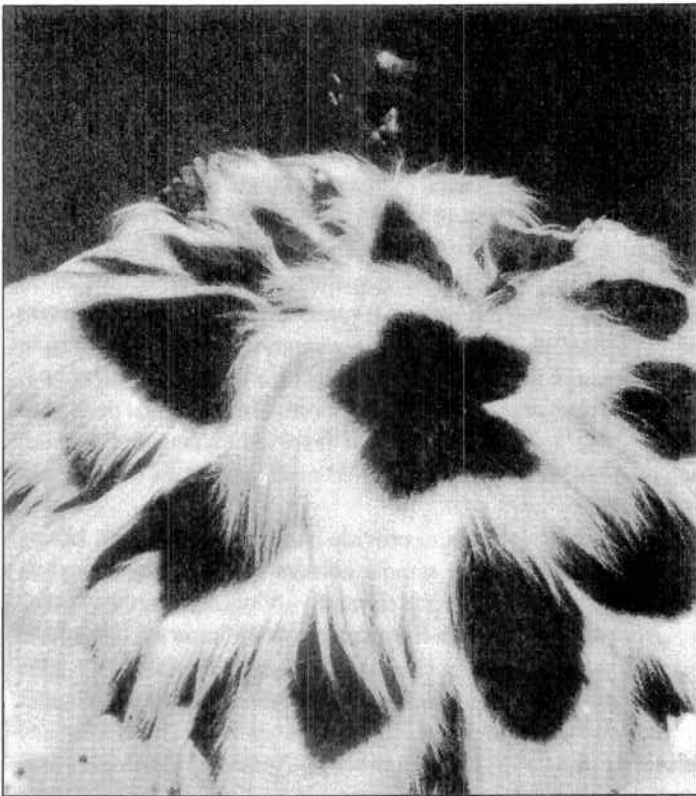


Figure 7. A black-and-white colobus monkey rug for sale in a tourist shop. Photo by Russell A. Mittermeier.



Figure 9. A white-faced saki, *Pithecia pithecia*, tail used as a duster in the Brazilian Amazon. Photo by Russell A. Mittermeier.



Figure 8. A hat made from a *Pithecia* pelt in Peru. Photo by Russell A. Mittermeier.

colobus coats were still being sold in Europe and Japan (Mittermeier 1973; Oates 1977).

Throughout much of Amazonia, tourist shops still offer stuffed monkeys, monkey skulls, monkey-skin hats (Fig. 8), monkey-tail dusters (Fig. 9), and necklaces fashioned from monkey teeth, bones, hands, feet, or tails. However, these activities are typically carried out on a small scale and almost always as a by-product of hunting for food.

Nonetheless, the demand for primate body parts for sale to tourists can be a very serious matter indeed if it involves endangered species. The most striking example of this would be the slaughter of mountain gorillas in Rwanda and the Democratic Republic of the Congo, which produces hands and skulls for sale to European tourists (Fossey 1983). Although relatively rare, this practice still occurs despite effective, long-term conservation programs in the region.

Hunting primates for sport is fortunately rare and a minor threat to wild populations. It appears to be most prevalent around logging camps and within military zones in remote areas of developing countries, where arms are plentiful and law enforcement basically non-existent. Children armed with slingshots and air rifles are often among the worst offenders. More prestigious trophy hunting has also played a role (albeit a minor one) in primate decline. Species such as the gorilla were especially desirable quarry for 19<sup>th</sup> century and early 20<sup>th</sup> century trophy hunters, and the tales of their exploits are recounted in a number of books (e.g., Hastings 1922; Burbridge 1928; Du Chaillu 1930; Gatti 1932; Merfield and Miller 1956). On the whole, however, such sport hunting must be considered a very minor factor, unless an endangered species happens to be involved, in which case the activity is almost always illegal as well.

Brazil, so little suitable forest habitat remains that any further loss constitutes a grave threat to primates and other wildlife. In contrast to this situation, in the vast forest regions of Amazonia and the Zaire basin, which along with the island of New Guinea represent two of the three remaining major tropical wilderness areas of our planet, the effects of habitat destruction are only starting to be felt.

### Hunting of Primates for Food and Other Purposes

The hunting of primates by human populations takes place for a variety of reasons, but by far the most important is to acquire food (Fig. 4). Although primate hunting is prohibited by law in many countries, enforcement of such protective legislation is typically rare and often nonexistent in the remote areas where this activity almost always takes place.

Hunting of primates as a source of food is a significant threat in at least three parts of the world: the Amazon region of South America, West Africa and Central Africa. In each region, primates are among the animals most frequently hunted and they are regularly sold in markets, except where this is prohibited by law. However, even in areas where primate hunting is common, it by no means affects all species equally. In Amazonia, for example, the larger monkeys such as *Lagothrix*, *Ateles*, *Alouatta* and *Cebus* are heavily hunted and among the more desirable food species (Fig. 5), while smaller monkeys such as *Saguinus* and *Saimiri* are rarely shot for food because they barely provide enough meat to recompense the hunter for the cost of his shotgun shell. The same situation holds true in West Africa, where hunters much prefer to shoot the larger-bodied *Colobus* than the smaller *Cercopithecus* species.

In areas where the hunting of primates for food is common, it can sometimes represent a threat even more severe than forest destruction. For example, in some parts of Amazonia there are large tracts of primary forest remaining where populations of *Lagothrix*, *Ateles*, *Alouatta* and *Cebus* have effectively been exterminated by excessive hunting (Mittermeier and Coimbra-Filho 1977; Soini 1982). In areas where food hunting and deforestation both are prevalent, populations of all forest primates and other game species can evidently disappear very quickly.

It is important to note that, in some parts of the world, religious restrictions or other cultural factors prohibit (or inhibit) the killing and eating of primates. In India, for example, primates are rarely hunted for food because they are linked to the monkey god Hanuman, which occupies an important role in the Hindu religion (Fig. 6), while in strictly Muslim countries primates are not eaten because their flesh is considered unclean and unfit for human consumption. Indeed, in India Hindu people refuse to kill rhesus monkeys or even resist translocating them even when populations have become so high that they constitute a menace to humans. In other countries, such as Madagascar, local taboos may exist against eating certain primates (e.g., *Indri*), while other species (e.g., *Eulemur* and *Varecia*) may be the most popular food items for a given tribe or village.

Primates are also hunted to supply a number of other products in addition to food: traditional medicines, bait, body parts for ornamentation and trophies. Primate hunting to supply medicinal products may be nothing more than a by-product of food hunting in

most cases, and usually involves the use of specific body parts for their supposed medicinal value. In south India, for example, the meat of the Nilgiri langur (*Presbytis johnii*) and the critically endangered lion-tailed macaque (*Macaca silenus*) is regarded as an aphrodisiac and thought to contain other medicinal properties. The blood of leaf monkeys, such as Phayre's langur (*Presbytis phayrei*) in Thailand, is believed to impart vigor to the drinker, especially when mixed with local whiskey. And, in various South American countries, drinking from the cup-shaped hyoid apparatus of an adult male howling monkey (*Alouatta*) is reported to cure goiters and stuttering, as well as to ease a mother's labor pains during birth. Although the hunting of primates for medicinal purposes is considered a relatively minor factor overall in the global decline of wild primate populations, when it involves endangered species, such as in the case of the lion-tailed macaque, it can be a serious threat indeed.

Primates are also shot to provide bait for capturing and killing other animals, mainly in remote corners of the Amazon region. There, spotted-cat hunters preferentially shoot larger monkeys such as *Lagothrix* and *Ateles* to bait crude wooden traps set for jaguars and ocelots, which are caught live and then either shot in the head or strangled. Dispatching the cat in this manner provides the hunter a more valuable skin without any bullet holes (Mittermeier and Coimbra-Filho 1977). Any number of Amazonian primates may also be shot for fish or turtle bait, and in Sri Lanka, monkeys often serve as bait for crocodiles (R. Rudran pers. comm.). While the use of primates as bait is a relatively minor threat, comparable to hunting for medicinal products, it can and does add to the pressures faced by over-exploited, large-bodied species such as *Lagothrix* and *Ateles*.

In some countries, primates may be killed for their skins or to provide other body parts used in ornamentation. Perhaps the most striking case of this is in Africa, where the skins of black-and-white colobus (*Colobus guereza*) and related species have been used to fashion cloaks and headdresses for native African peoples, but have also figured significantly in the international fur trade. For example, in 1899, a reported 223,599 monkey skins were auctioned in London alone, and at least 2.5 million probably were exported to Europe between 1880 and 1900 (Brass 1925; Oates 1977) especially Germany, where they were used to make capes, muffs, and rugs. As recently as the early 1970s, colobus monkey rugs were still common in East African tourist shops (Fig. 7), and

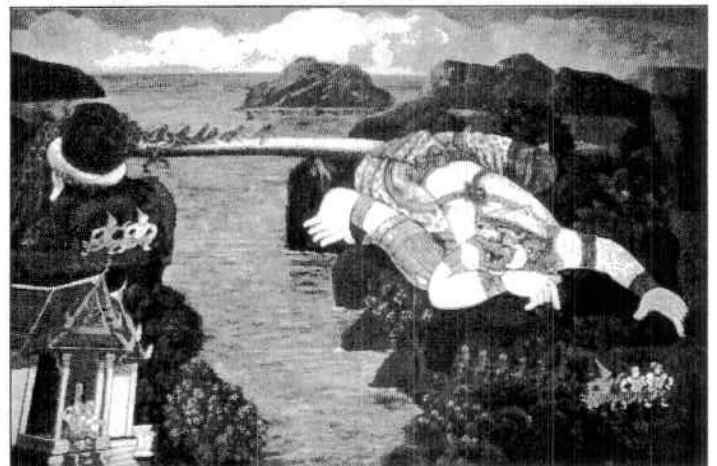


Figure 6. The Hindu monkey god, Hanuman. Photo by Russell A. Mittermeier.

tation as was previously thought (Ferrari and Lopes 1996), but its range is within the most densely populated and developed areas of the Brazilian Amazon. The Tucuruí hydroelectric dam flooded approximately 2,400 km<sup>2</sup>, about 70% of which was habitat for black sakis. Major development projects in the region include mining, cattle farming, eucalyptus plantations, the Carajás-São Luís railroad, and the installation of iron-ore smelting plants. Since its creation in 1988, a large part of the forests in the Gurupí Biological Reserve (341,650 ha) have been destroyed for timber and cattle pasture.

Threats to the uakaris listed as endangered arise more from hunting than from habitat loss. The white uakari, *Cacajao calvus calvus* has a minute distribution between the Rios Solimões and Japurá, limited in the west by the Auatí-Paraná. Hunting and logging, along with its specialization for seasonally flooded white-water várzea forest are the main threats (Ayres 1986; Ayres and Johns 1987), although it is now protected in the Mamirauá Sustainable Development Reserve of 1,124,000 ha, which covers its entire range. The red uakari, *C. calvus rubicundus*, has a very restricted distribution occurring to the west of the Auatí-Paraná, on the north and south banks of the Rio Solimões in the upper Amazon of Brazil (Hershkovitz, 1987b). *C. calvus novaesi*, first described by Hershkovitz in 1987, also has a small range, probably restricted to the region between the Rios Eiru and Tarauacá in the south-west of the state of Amazonas, Brazil.

The white-whiskered spider monkey, *Ateles marginatus*, occurs between the Rios Tapajós and Xingu, south of the Rio Amazonas. The only protected area containing this species is the Tapajós National Forest (600,000 ha), which however is a reserved area for sustainable logging and silviculture. It is the least known and most threatened of the Amazonian spider monkeys (Martins *et al.* 1988; Ferrari and Lopes 1996). Although it probably occurs south as far as the north of the state of Mato Grosso, its range is relatively small, cut by major highways such as the Transamazon and the Cuiabá-Santarém, and in many parts subject to active and widespread deforestation (especially in the south), and, as in all spider monkeys, *A. marginatus* is particularly susceptible to hunting (Konstant *et al.* 1985).

#### Atlantic Forest

Three callitrichids, *Leontopithecus rosalia*, *L. chrysopygus* and *L. caissara*, are considered "critically endangered". The fourth species, *L. chrysomelas* is categorized as "endangered". All of the lion tamarins are restricted to the largely destroyed lowland Atlantic forest in Brazil: *L. rosalia* in the state of Rio de Janeiro, *L. chrysomelas* in the south of the state of Bahia, *L. chrysopygus* in the state of São Paulo, and *L. caissara* in the states of Paraná and São Paulo. Their population densities are always low, and in the case of *L. rosalia* and *L. chrysopygus*, habitat fragmentation is extreme. The golden lion tamarin, *L. rosalia*, is now restricted to five localities, which, including the Poço das Antas Biological Reserve (5,500 ha), cover a total forested area of 9,617 ha, along with 12 groups in nine isolated forests of 20-250 ha each, and a further 1700 ha where groups have been reintroduced (Kierulff and Oliveira 1994). Kierulff and Oliveira (1994) estimated the total population in the wild to be about 131 groups, or a little over 500 animals. None of the populations are considered viable in the long term (Ballou *et al.* 1997). *L. chrysopygus* is now known to survive

in six localities in the state of São Paulo. The Morro do Diabo State Park contains 23,800 ha of forest and a population estimated at approximately 820 individuals. The Caetetus Reserve contains about 2,000 ha of forest (population estimated at 69), but the other four localities consist of fragments of between 400 and 800 ha, and together harbor about 114 individuals. The total population is estimated at about 1000 (Valladares-Padua and Cullen, Jr. 1994; Valladares-Padua *et al.* 1994). The black-faced lion tamarin, *L. caissara*, was discovered in 1990 in the north-east of the state of Paraná. It occurs in the Superagüi National Park (21,400 ha) and reportedly also in the Jacupiranga State Park (150,000 ha) in São Paulo, but total population estimates for this species do not exceed 52 groups or about 260 individuals. Available habitat totals about 17,300 ha (Lorini and Persson 1990, 1994). The golden-headed lion tamarin, *L. chrysomelas*, survives in more localities than the other lion tamarin species, and has the largest wild population, estimated at between 4,000 and 6,000 (Pinto and Rylands 1997). However, the remaining forests are being destroyed at an unprecedented rate for the region and the populations surviving are seriously depleted and fragmented. Recent surveys have indicated that the Una Biological Reserve (7,059 ha) has an estimated population about 240 animals (well below a previous estimate in Pinto and Rylands 1997), not large enough to be considered viable (Ballou *et al.* 1997).

The two "endangered" marmosets, *Callithrix aurita* and *C. flaviceps*, have restricted distributions in the montane regions of the Atlantic forest of south-east Brazil. Recent evidence indicates that the distribution of *C. aurita* is even smaller than was previously thought (Olmos and Martuscelli 1995). *C. flaviceps* occurs in the state of Espírito Santo, south of the Rio Doce, and in the east of the state of Minas Gerais along the Rio Manhuaçu valley. Both species suffer mainly from the extreme fragmentation of their habitat in regions which have a long history of human occupation (Coimbra-Filho 1984, 1986a, 1986b, 1991; Mendes 1993; Diego *et al.* 1993).

Barbara Brown's titi monkey, *Callicebus personatus barbarabrownae*, is known from a few localities in the northern interior of the state of Bahia where the forests have been almost entirely destroyed (Rylands 1994; Coimbra-Filho and Câmara 1996). An as yet undescribed species has also been found in six localities in forest fragments in the Atlantic forest of the coast of the state of Sergipe, Brazil (Kobayashi and Langguth 1994). Both these titi monkeys are restricted to very few, small and degraded remnants of the once widespread forests of the region.

The buff-headed capuchin monkey, *Cebus xanthosternus*, is to date believed to be restricted to the Atlantic forest of coastal southern Bahia, although the taxonomic status of capuchin populations inland is not known. Due to its larger size and larger home ranges it is suffering more severely from hunting, both for food and as pets, and habitat fragmentation than *L. chrysomelas*, which has a similarly restricted distribution. Population estimates are not available but it has become extinct throughout a large part of its former range (Coimbra-Filho 1986c; Santos *et al.* 1987; Oliver and Santos 1991; Coimbra-Filho *et al.* 1991-1992).

The taxonomy and distribution of the brown howling monkey, *Alouatta fusca*, is discussed in Rylands *et al.* (1988) and Coimbra-Filho *et al.* (1995). The northern brown howler, *A. f. fusca*, once occurred throughout a large part of the state of Bahia and extreme

northern Minas Gerais, probably extending as far north as the Rio São Francisco, but has been decimated by forest destruction and hunting. Today it is restricted to a very few isolated forests in southern Bahia and north-eastern Minas Gerais. It is possible that some populations still survive inland in Bahia (for example, the Chapada de Diamantina), but no definite localities have been recorded.

Recent studies by Lemos de Sá *et al.* (1990, 1993) and Lemos de Sá and Glander (1993) have indicated strongly that there are two species of miqui, *Brachyteles* (see, however Leigh and Jungers 1994). *B. arachnoides* is the southern form, occurring in the states of São Paulo and Paraná, and *B. hypoxanthus* is the northern form, in the states of Minas Gerais, Espírito Santo, Rio de Janeiro, and, at least formerly, Bahia. The two forms seem to be separated by the Serra da Mantiqueira which extends east-west in the south of Minas Gerais. Hunting and forest destruction and fragmentation have severely reduced the number of populations, and despite the fact they occur in a number of protected areas populations in the majority of localities are evidently extremely low (Mittermeier *et al.* 1987; Oliver and Santos 1991; Fonseca 1994; Martuscelli *et al.* 1994; Strier and Fonseca 1997).

### The Neotropical Section of the Primate Specialist Group

The Primate Specialist Group (PSG) was formally divided into four regional sections, with vice-chairpersons appointed for each, in 1981 (Mittermeier 1981). A fifth section deals mainly with captive breeding issues. Currently there are 91 of the PSG members, from 16 countries, who are specifically associated with the Neotropics or captive breeding programs for Neotropical primates.

The principal activities of the Primate Specialist Group (PSG), following the mandate of the IUCN Species Survival Commission, are the assessment of patterns of diversity and distribution and the threatened status of the species and subspecies, and the elaboration of action plans to guide investment in primate conservation, based on priorities established by the PSG members. The PSG is concerned not only with the conservation of wild populations, but also captive breeding programs as a tool for the conservation of genetic diversity *ex situ*, the latter particularly in collaboration with the Conservation Breeding Specialist Group (CBSG/SSC).

### Communication Network

The establishment of effective communication networks between primatologists and those concerned with captive breeding and the protection of primate habitats is also a key element of the Group's activities, and this is done through the publication of newsletters by each of the four regional sections, Africa, Madagascar, Asia and the Neotropics, and an annual journal, *Primate Conservation*, as well as the organization of seminars and symposia at primatological meetings.

The newsletter *Neotropical Primates* has been published quarterly since 1993. It is tri-lingual (Portuguese, Spanish and English), and includes short articles and notes which deal with general and specific aspects of Neotropical primate ecology, behavior and conservation, tropical forest ecology and conservation, forest destruction and protected areas, along with news items on events, conservation groups, field studies, captive breeding programs, the

publication of studbooks, funding sources, awards, action plans, new journals, library services, training courses, theses, and job vacancies, amongst others, and activities specifically related to primatological societies involved with New World Primates, as well as information on publications and meetings. It is distributed free of charge thanks to sponsorship from Conservation International, Washington, D. C. and Conservation International do Brasil, Belo Horizonte, Brazil. Donations for its production have been received from: Earthkind (the international arm of the Humane Society), Petrópolis, Rio de Janeiro; the Houston Zoological Society, Texas; the Columbus Zoo, Ohio; Wildlife Preservation Trust International, Pennsylvania; the Jersey Wildlife Preservation Trust, Jersey; Pencynor Wildlife Park, Wales; the Detroit Zoological Institute, Michigan; the Margot Marsh Biodiversity Foundation, Virginia; the Brazilian National Biodiversity Working Group (GTB), under the auspices of the Brazil Science Council (CNPq); and the Primate Society of Great Britain (PSGB).

Three supplementary issues have been published. The first was concerned with research, captive breeding and conservation measures for the lion tamarins (*Leontopithecus*); the proceedings of a symposium, held in May 1994 and organized by the international committees for the four species (Rylands and Rodríguez-Luna 1994). This supplement was sponsored by Wildlife Preservation Trust International, Philadelphia, and the Jersey Wildlife Preservation Trust, Jersey. The second reported on the assessment of the threatened status of all the platyrrhines using the Mace-Lande categories adopted by the IUCN in 1994, and included a listing of all taxa in each country and in each of seven phylogeographic regions identified by Gentry (1982) (Rylands and Rodríguez-Luna 1995). The third supplement dealt with the conservation and management of the MesoAmerican primates, with three papers summarizing the results of a workshop on Mexican primates held in 1995 (Rodríguez-Luna *et al.* 1996a), the Action Plan for the Mesoamerican primates (Rodríguez-Luna *et al.* 1996b), and a Population and Habitat Viability Assessment (PHVA) Workshop held for *Alouatta palliata mexicana*, the Mexican howling monkey (Cortés-Ortiz *et al.* 1996).

### Action Plans

Action Plans for specific taxonomic groups or regions are an important means of assessing and documenting conservation status and formulating guidelines and priorities for future action. Three have been produced for primates in recent years, for the lemurs of Madagascar (Mittermeier *et al.* 1992b), African primates (Oates 1996) and Mesoamerica (Rodríguez-Luna *et al.* 1996d). They involve an evaluation of the taxonomic status of the group in question, a ranking of the species in terms of their threatened status and priority for action (including parameters such as taxonomic uniqueness and occurrence in protected areas), an analysis of the principal communities, and proposals for the principal action in terms of research and direction conservation measures to be taken in the future.

The Action Plan for the Mesoamerican Primates (Rodríguez-Luna *et al.* 1996b, 1996d) dealt with the six genera and 23 species and subspecies, 18 of them endemic, of the eight countries comprising the region. Following an introduction of general aspects of Mesoamerica and the principal vegetation formations, each taxon

**Table 9.** Conservation priority ranking for Mesoamerican primates (Rodríguez-Luna *et al.* 1996d).

Priority	High Priority	Highest Priority
<i>Saguinus geoffroyi</i>	<i>Aotus lemurinus griseimembra</i>	<i>Saimiri oerstedii citrinellus</i>
<i>Cebus capucinus imitator</i>	<i>Saimiri oerstedii oerstedii</i>	<i>Alouatta coibensis coibensis</i>
<i>Alouatta palliata palliata</i>	<i>Cebus capucinus limitaneus</i>	<i>Alouatta coibensis trabeata</i>
<i>Alouatta palliata aequatorialis</i>	<i>Alouatta palliata mexicana</i>	<i>Ateles geoffroyi azuerensis</i>
<i>Alouatta pigra</i>	<i>Ateles geoffroyi geoffroyi</i>	<i>Ateles geoffroyi grisescens</i>
	<i>Ateles geoffroyi frontatus</i>	<i>Ateles geoffroyi pan<sup>1</sup></i>
	<i>Ateles geoffroyi panamensis</i>	<i>Ateles geoffroyi ornatus</i>
	<i>Ateles geoffroyi vellerosus</i>	<i>Ateles geoffroyi robustus<sup>2</sup></i>
	<i>Ateles geoffroyi yucatanensis</i>	

<sup>1</sup> The validity *A. g. pan* is in question (see Konstant *et al.* 1985; Silva Lopes *et al.* 1995, 1996).

<sup>2</sup> Listed as *Ateles fusciceps robustus* in Table 2.

was discussed in terms of its distribution and status and its occurrence in more than 375 protected areas. The point was emphasized that occurrence in a protected area does not necessarily guarantee or even contribute to the survival of a species, and that the status of the protected areas themselves needs to be evaluated. From this, each taxon was given a priority rating by a point system for endemism, threat, occurrence in protected areas, and the extent to which it had been studied in the wild (distribution, demography and ecology). Eight taxa were given highest priority for action, nine were listed as of high priority and five were listed as priority for action (Table 9). Proposals for measures and programs, including research were then drawn up, and included such general aspects as the need for surveys, training, environmental education and the promotion of inter-institutional links at the government level as well between government and non-governmental organizations.

#### Conservation Assessment Management Plans (CAMPs)

Conservation Assessment Management Plans (CAMPs), a workshop exercise of the CBSG designed to assess and compile the status and degree of threat of a group of taxa or the taxa of a particular region and "provide strategic guidance for the application of intensive management and information collection techniques to threatened taxa" (Seal *et al.* 1994), have been carried out for the endemic species of Costa Rica (in 1994, see Matamoros and Seal 1994), the endemic mammals and birds of Panama (in 1994, see Alvarez-Cordero *et al.* 1994), and the Mexican primates (in 1995, see Rodríguez-Luna *et al.* 1995, 1996a).

For Costa Rica, the CAMP workshop included a preliminary PHVA for *Saimiri oerstedii citrinellus*, which resulted in the recommendation of a second PHVA carried out the following year (Matamoros 1995; Matamoros *et al.* 1996; see below). *Ateles geoffroyi ornatus* was not considered. The Panama CAMP provided data sheets, assessments of threatened status, and recommendations for 38 mammals (including some species occurring also in Colombia and Costa Rica). Primates included in the Panama CAMP included: *Saguinus geoffroyi* (Panama, northern Colombia), *Saguinus oedipus* (north-central Colombia and Darien in Panama), *Saimiri oerstedii oerstedii* (Panama, Costa Rica), and *Alouatta coibensis coibensis* and *A. c. trabeata* (endemic). The endemic spider monkey *Ateles geoffroyi azuerensis* was not included.

Four primates occur in Mexico: the howling monkeys, *Alouatta palliata mexicana* and *A. pigra*, and two spider monkeys, *Ateles geoffroyi vellerosus* and *A. g. yucatanensis*. A full review by CBSG, in collaboration with the Neotropical section of the PSG, was car-

ried out for each of these primates with regard to their remaining habitats, including the protected areas where they occur, and the (precarious) status of each in captivity. Besides providing an important overview of conservation problems in Mexico and a series of recommendations regarding protected areas, captive breeding and research and monitoring of primates in the wild, the CAMP for Mexican primates resulted in the establishment of a monitoring program for primates in the protected areas, the setting-up of a specialization course in primate ecology and behavior by the Universidad Veracruzana, and the preparation of a manual for the captive management of *Alouatta* and *Ateles*, sponsored by Africam Safari Zoo.

Finally, in June 1997, a camp workshop for Middle American primates was held in the Simón Bolívar Zoo, San José, Costa Rica (report in preparation). It was organized by FUNDAZOO, in collaboration with AMAZOO, the St. Louis Zoo, Missouri, CBSG and PSG. Specialists from all of the Middle American countries, except for Nicaragua, reviewed the status of all of the 23 primate taxa of the region, taking the Action Plan for Mesoamerican Primates as the principal reference (Rodríguez-Luna *et al.*, 1996d). The participants emphasized the lack of information on most of the taxa, and although not all were classified as threatened ("critically endangered", "endangered" or "vulnerable"), all primate populations were considered to be at risk in the medium to long-term because of widespread habitat loss and degradation. Recommendations were made concerning the study, management and conservation of the threatened taxa, which included PHVAs and a training course for the region's primatologists in order to set-up a monitoring program for the principal populations of each.

#### Population and Habitat Viability Assessment (PHVA) Workshops

Population and Habitat Viability Assessment workshops are organized through the Conservation Breeding Specialist Group (CBSG). They bring together biologists and other professionals with relevant expertise in a collaborative effort to assess the extinction risk and develop better management strategies for particular endangered species (Lacy 1993, 1993-1994). The *Global Captive Action Plan for Primates* (Stevenson *et al.* 1991, 1992) recommended workshops for 30 Neotropical primates (listed in Table 10), except for *Lagothrix flavicauda*, for which no breeding program was considered. PHVA workshops have been carried out for the lion tamarins (*Leontopithecus*), the Costa Rican squirrel monkey (*Saimiri oerstedii citrinellus*), and the Mexican howling monkey (*Alouatta palliata mexicana*); in all cases in close collaboration with members of the Neotropical section of the PSG (Table 10).

Two PHVA workshops have been carried out for the four lion tamarin species, *Leontopithecus*, endemic to the Atlantic forest of south-east Brazil; in both cases in collaboration with PSG. The first was in 1990 (Seal *et al.* 1990) and involved an evaluation of the status of the species in captivity and the wild, the elaboration of specific recommendations for future action, and an evaluation through computer simulation of the viability of the wild populations in protected areas, based on genetic aspects and population parameters, potential and current threats, and the known or estimated size of the populations. All of the species, excepting the black-faced lion tamarin, *L. caissara* discovered only in 1990, had been subject to varying degrees of research and conservation efforts during the previous 10 years, and so a limited amount of information was available concerning the principle parameters used for the PHVA, including principle threats, their occurrence in protected areas, distributions, population sizes, densities, and group sizes, although estimations of reproductive parameters and group sizes in the wild depended mainly on the information available for the golden lion tamarin in Rio de Janeiro (Rylands 1993/1994). The recommendations of this workshop formed the basis for the activities of the international management committees for each species, which are responsible for advising on the interactive management of the captive and wild populations (see Mallinson 1989, 1994, 1996; Rylands 1993/1994). In 1997, a second PHVA Workshop was carried out to reassess the status of the species after seven years of numerous conservation measures and a considerable amount of research on both wild and captive populations (Ballou *et al.* 1997). An important aspect which arose during this second workshop was that a number of important demographic parameters used in the PVHA of 1990 varied significantly between the species and even between populations of the same species. Recommendations were drawn up regarding metapopulation management (a particularly important strategy for the black lion tamarin, *L. chrysopygus*), research directions, measures for the conservation of their habitats, and environmental education. Computer analyses using the VORTEX program re-evaluated the viability of populations in captivity and in the wild using a substantially improved data base compared to that available in the 1990 workshop.

The Costa Rican squirrel monkey, *Saimiri oerstedii citrinellus*, surviving in forest fragments in the low foothills and mangroves on the Pacific coast, was subjected to a PHVA during a CAMP workshop for Costa Rican endemics in 1994 (Matamoros and Seal, 1994) and subsequently a PHVA workshop in 1995 (Matamoros 1995; Matamoros *et al.* 1995). *S. o. citrinellus* occurs in the small Manuel Antonio National Park (683 ha) as well as about thirty other isolated sites in Costa Rica. It is considered critically endangered, with highly fragmented populations, totaling between 500-1000 individuals (Boinski 1985, 1987; Boinski and Sirot 1997). The computer analyses pointed to the high degree of susceptibility of the populations to adult female mortality, and also indicated that populations of 100 animals or less show considerable demographic instability and populations of less than 50 animals were not viable. Catastrophes such as disease epidemics and hurricanes were found to be an important factor determining the viability of the squirrel monkey populations, most pronounced evidently in the smaller populations. Yellow fever was also considered a particularly significant threat. Research and management priorities were outlined in the PHVA report, with highest priority being given to improving

the infrastructure and protection of the Manuel Antonio National Park, and to demographic studies, especially concerning dispersal patterns and female mortality of the various populations.

The Mexican howling monkey, *Alouatta palliata mexicana*, is found in a variety of forest types, from sea level to 1,100 m, originally in the states of Veracruz, Tabasco, Oaxaca, and Chiapas in Mexico, and possibly also in Belize and Guatemala. It was the subject of a PHVA Workshop in 1995 (Cortés-Ortiz *et al.* 1996; Rodríguez-Luna *et al.* 1996c). Recommendations arising from the results of the VORTEX analysis included: the need for further demographic research, concerning especially mortality patterns of the various age groups connected with environmental variation; the need for further research on inbreeding depression, even though this was not found to be a serious factor in determining population viability; and the development and evaluation of management strategies to reduce adult mortality and supplement declining small populations. Taking into account the accelerated disturbance, fragmentation, and loss of habitat that this howling monkey is facing, the PHVA resulted in recommendations for an extensive research and management program, including such topics as taxonomy, geographic distribution, variation in habitats occupied, population densities, group sizes and home range size, demographic monitoring, and the effects of fragmentation, hunting, capture and commerce. Recommendations for conservation action ranged from the improvement of protected areas and the establishment of new ones, to specific management procedures such as translocation and metapopulation management, to control and reduction of trade, education projects, inter-institutional collaboration, and the setting-up of regional conservation programs.

#### *Captive Breeding*

The scientific management of captive populations has become an increasingly important instrument for species conservation (IUDZG/CBSG 1993) and a number of New World primates are benefiting from captive breeding programs (Table 10). The aims are fundamentally to secure self-sustaining populations which can guarantee at least a high proportion of the genetic variability of the species, supporting and interacting demographically and genetically with wild populations (Mallinson 1995). Action on the part of the PSG in this sense has involved collaboration with the Conservation Breeding Specialist Group (CBSG) and a number of regional zoo organizations, notably in the formation of Taxon Advisory Groups (TAGs).

The *Global Captive Action Plan for Primates* (Stevenson *et al.* 1991, 1992) was prepared between 1987 and 1992, and included a workshop involving members of the PSG and the Conservation Breeding Specialist Group (CBSG) in Minnesota in March 1991. The aims were to provide a strategic review and framework for the efficient and effective application and allocation of captive resources to contribute effectively to the conservation of, most especially, the primates considered threatened in the wild. The Plan included a briefing book reviewing the status of the taxa in the wild (using for the first time the Mace-Lande system [Mace and Lande 1991; IUCN 1994]) and in captivity. Sixteen taxa were considered "critically endangered", 26 "endangered", and 21 "vulnerable" (see Table 2). Four priorities for captive breeding programs were used: 90%/100 years I (the establishment a population sufficient to preserve 90% of the average heterozygosity of the wild



**Table 10.** Captive breeding recommendations in the *Global Captive Action Plan for Primates* (Stevenson *et al.* 1991, 1992), international and regional programs and CBSG/PVHA workshops for Neotropical primates. The following priority categories were drawn up: 1) *90%/100 years I* (the establishment of a population sufficient to preserve 90% of the average heterozygosity of the wild gene pool for 100 years as soon as possible), including all taxa identified as "critically endangered" by Stevenson *et al.* (1991, 1992) (see Table 2), with the addition of *Saguinus oedipus* and *Callimico goeldii*; 2) *90%/100 years II* (the same as *I* but with less urgency) including all taxa categorized as "endangered" by Stevenson *et al.* (1991, 1992) (see Table 2), except for *Lagothrix flavicauda*; 3) *Nucleus I* recommended captive population of 50-100 individuals emphasizing the maintenance of genetic heterozygosity; 4) *Nucleus II* recommended captive population of 25-100 individuals of taxa not of conservation concern (II).

Taxa	Priority	International and regional captive breeding programs and CBSG/PVHA workshops
<i>Cebuella pygmaea</i>	Nucleus II	Int. studbook, AZA reg. studbook, EEP breeding program, ASMP reg. studbook
<i>Callithrix argentata</i>	Nucleus II	FZG management program
<i>Callithrix intermedia</i>	90%/100 years II	None in captivity. PHVA recommended <sup>1</sup>
<i>Callithrix leucippe</i>	90%/100 years II	None in captivity. PHVA recommended <sup>1</sup>
<i>Callithrix melanura</i>	Nucleus II	
<i>Callithrix chrysoleuca</i>	Nucleus I	None in captivity
<i>Callithrix jacchus</i>	Nucleus II	
<i>Callithrix geoffroyi</i>	Nucleus II	AZA reg. studbook, EEP breeding program, FZG management program
<i>Callithrix kuhli</i>	Nucleus II	AZA reg. studbook
<i>Callithrix aurita</i>	90%/100 years II	Captive populations in CPRJ and MBML, Brazil. PHVA recommended <sup>1</sup>
<i>Callithrix flaviceps</i>	90%/100 years I	Captive populations in CPRJ and MBML, Brazil. PHVA recommended <sup>1</sup>
<i>Callithrix penicillata</i>	Nucleus II	
<i>Saguinus fuscicollis weddelli</i>	Nucleus II	
<i>Saguinus fuscicollis illigeri</i>	Nucleus II	
<i>Saguinus mystax mystax</i>	Nucleus II	
<i>Saguinus labiatus labiatus</i>	Nucleus II	FZG management program
<i>Saguinus imperator imperator</i>	Nucleus II	Int. studbook, AZA reg. studbook, EEP breeding program, FZG management program
<i>Saguinus imperator subgriseus</i>	Nucleus II	Int. studbook, AZA reg. studbook, EEP breeding program, FZG management program
<i>Saguinus midas midas</i>	Nucleus II	
<i>Saguinus bicolor bicolor</i>	90%/100 years II	Int. studbook, AZA reg. studbook, EEP breeding program. PHVA recommended <sup>1</sup>
<i>Saguinus leucopus</i>	90%/100 years II	
<i>Saguinus geoffroyi</i>	Nucleus II	AZA reg. studbook
<i>Saguinus oedipus</i>	90%/100 years I	Int. studbook, AZA reg. studbook, EEP breeding program, FZG management program, ASMP studbook. PHVA recommended <sup>1</sup>
<i>Leontopithecus rosalia</i>	90%/100 years I	Int. studbook, EEP breeding program, FZG management program, ASMP reg. studbook. PHVA Workshops 1990, 1997 (Seal <i>et al.</i> 1990; Ballou <i>et al.</i> 1997)
<i>Leontopithecus chrysomelas</i>	90%/100 years I	Int. studbook, EEP breeding program. PHVA Workshops 1990, 1997 (Seal <i>et al.</i> 1990; Ballou <i>et al.</i> 1997)
<i>Leontopithecus chrysopygus</i>	90%/100 years I	Int. studbook. PHVA Workshops 1990, 1997 (Seal <i>et al.</i> 1990; Ballou <i>et al.</i> 1997)
<i>Leontopithecus caissara</i>	90%/100 years I	None in captivity. PHVA Workshops 1990, 1997 (Seal <i>et al.</i> 1990; Ballou <i>et al.</i> 1997)
<i>Callimico goeldii</i>	90%/100 years I	Int. studbook, AZA reg. studbook, FZG and EEP breeding program
<i>Saimiri sciureus sciureus</i>	Nucleus II	ASMP management program (for genus)
<i>Saimiri boliviensis boliviensis</i>	Nucleus II	ASMP management program (for genus)
<i>Saimiri oerstedii oerstedii</i>	90%/100 years II	
<i>Saimiri oerstedii citrinellus</i>	90%/100 years I	PHVA recommended <sup>1</sup> . CAMP and PHVA Workshop 1994, PHVA Workshop 1995 (Matamoros and Seal 1994; Matamoros <i>et al.</i> 1996)
<i>Aotus lemurinus lemurinus</i>	90%/100 years II	AZA reg. studbook (for genus), FZG management program (for genus). PHVA recommended <sup>1</sup>
<i>Aotus lemurinus griseimembra</i>	90%/100 years II	AZA reg. studbook (for genus), FZG management program (for genus). PHVA recommended <sup>1</sup>
<i>Aotus miconax</i>	90%/100 years II	AZA reg. studbook (for genus), FZG management program (for genus)
<i>Aotus trivirgatus</i>	Nucleus II	AZA reg. studbook (for genus), FZG management program (for genus)
<i>Aotus vociferans</i>	Nucleus II	AZA reg. studbook (for genus), FZG management program (for genus)
<i>Callicebus moloch</i>	Nucleus II	AZA reg. studbook (for genus)
<i>Callicebus donacophilus donacophilus</i>	Nucleus II	AZA reg. studbook (for genus)
<i>Callicebus torquatus medemi</i>	Nucleus I	AZA reg. studbook (for genus)
<i>Callicebus personatus personatus</i>	90%/100 years II	AZA reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Callicebus personatus melanochir</i>	90%/100 years II	AZA reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Callicebus personatus nigrifrons</i>	Nucleus I	AZA reg. studbook (for genus)
<i>Callicebus personatus barbarabrownae</i>	90%/100 years I	AZA reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Cebus apella robustus</i>	90%/100 years II	Int. breeding program set up in 1991. PHVA recommended <sup>1</sup>
<i>Cebus apella xanthosternus</i>	90%/100 years I	Int. breeding program set up in 1991. PHVA recommended <sup>1</sup>
<i>Pithecia albicans</i>	Nucleus I	
<i>Pithecia pithecia pithecia</i>	Nucleus II	AZA reg. studbook, FZG and EEP breeding programs
<i>Chiropotes albinasus</i>	90%/100 years II	PHVA recommended <sup>1</sup>
<i>Chiropotes satanas satanas</i>	90%/100 years I	PHVA recommended <sup>1</sup>
<i>Chiropotes satanas utahicki</i>	90%/100 years II	PHVA recommended <sup>1</sup>
<i>Cacajao calvus calvus</i>	90%/100 years II	PHVA recommended <sup>1</sup>
<i>Cacajao calvus rubicundus</i>	Nucleus II	
<i>Ateles geoffroyi geoffroyi</i>	90%/100 years II	AZA reg. studbook (all ssp.), EEP reg. studbook (for genus), ASMP studbook
<i>Ateles geoffroyi frontatus</i>	90%/100 years II	AZA reg. studbook (all ssp.), EEP reg. studbook (for genus)
<i>Ateles geoffroyi vellerosus</i>	Nucleus I	AZA reg. studbook (all ssp.), EEP reg. studbook (for genus), ASMP studbook
<i>Ateles geoffroyi azuerensis</i>	90%/100 years I	AZA reg. studbook (all ssp.), EEP reg. studbook (for genus). PHVA recommended <sup>1</sup>

Cont.

Table 10. Cont.

<i>Ateles geoffroyi panamensis</i>	90%/100 years II	AZA reg. studbook (all ssp.), EEP reg. studbook (for genus)
<i>Ateles fusciceps fusciceps</i>	90%/100 years I	AZA reg. studbook for sp., EEP reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Ateles fusciceps robustus</i>	90%/100 years II	AZA reg. studbook for sp., EEP reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Ateles paniscus</i>	Nucleus II	AZA reg. studbook, EEP studbook (for genus)
<i>Ateles marginatus</i>	90%/100 years I	EEP studbook (for genus). PHVA recommended <sup>1</sup>
<i>Ateles chamek</i>	Nucleus II	EEP studbook (for genus)
<i>Ateles belzebuth belzebuth</i>	Nucleus I	AZA reg. studbook (all ssp.), EEP studbook (for genus)
<i>Ateles belzebuth hybridus</i>	90%/100 years II	AZA reg. studbook (all ssp.), FZG studbook (for genus). PHVA recommended <sup>1</sup>
<i>Lagothrix lagotricha lagotricha</i>	Nucleus I	AZA reg. studbook (all ssp.), EEP breeding program (all ssp.)
<i>Lagothrix lagotricha cana</i>	Nucleus I	AZA reg. studbook (all ssp.), EEP breeding program (all ssp.)
<i>Lagothrix lagotricha lugens</i>	90%/100 years II	AZA reg. studbook (all ssp.), EEP breeding program (all ssp.). PHVA recommended <sup>1</sup>
<i>Lagothrix lagotricha poeppigii</i>	Nucleus I	AZA reg. studbook (all ssp.), EEP breeding program (all ssp.)
<i>Alouatta fusca fusca</i>	90%/100 years I	AZA reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Alouatta coibensis coibensis</i>	90%/100 years II	AZA reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Alouatta coibensis trabata</i>	90%/100 years I	AZA reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Alouatta palliata mexicana</i>	90%/100 years II	AZA reg. studbook (for genus), PHVA Workshop 1995 (Rodríguez-Luna <i>et al.</i> 1996c)
<i>Alouatta seniculus</i>	Nucleus II	AZA reg. studbook (for genus)
<i>Alouatta sara</i>	Nucleus II	AZA reg. studbook (for genus)
<i>Alouatta palliata palliata</i>	Nucleus II	AZA reg. studbook (for genus)
<i>Alouatta belzebul ululata</i>	90%/100 years I	AZA reg. studbook (for genus). PHVA recommended <sup>1</sup>
<i>Alouatta caraya</i>	Nucleus II	Int. studbook, AZA regional studbook, EEP reg. studbook
<i>Brachyteles arachnoides</i>	90%/100 years I	PHVA recommended <sup>1</sup> and planned for 1998. Captive populations in CPRJ (Coimbra-Filho <i>et al.</i> 1993) and the Curitiba Zoo, Paraná, Brazil

Sources: Anon. (1993), Baker (1994), Brouwer *et al.* (1993), Embury (1993, 1997), Jacobsen and Hamel (1996), Santos and Lernoold (1993a, 1993b), Shoemaker (1995).

Abbreviations: AZA = American Association of Zoological Parks and Aquariums; ASMP = Australasian Species Management Program; EEP = European Endangered Species Programme; FZG = Federation of Zoological Gardens of Great Britain and Ireland; CPRJ = Centro de Primatologia do Rio de Janeiro, Brazil; MBML = Museu de Biologia Mello Leitão, Santa Teresa, Espírito Santo, Brazil; CBSG = Conservation Breeding Specialist Group; PHVA = Population and Habitat Viability Assessment (workshops organized by the Conservation Breeding Specialist Group).

<sup>1</sup> PHVA Workshops recommended by Stevenson *et al.* (1991, 1992).

gene pool for 100 years as soon as possible) and 90%/100 years II (the same as I but with less urgency); *Nucleus I* (a captive nucleus of 50-100 individuals, emphasizing the maintenance of a high level of heterozygosity) and *Nucleus II* (a well-managed population of 25-100 animals of taxa not of conservation concern but already present in captivity). The first category included all the taxa identified as "critically endangered" by Stevenson *et al.* (1991) (see Table 2), with the addition of *Saguinus oedipus* and *Callimico goeldii*. The second category included all taxa categorized as endangered (see Table 2), except for *Lagothrix flavicauda*. The *Nucleus I* priority included nine taxa (all "vulnerable") and the *Nucleus II* priority 29 taxa, all but one (*Callicebus donacophilus donacophilus* - "vulnerable") of which had not entered the ranks of threatened but for which it was felt that an organized captive breeding program was desirable for diverse reasons (see Table 10).

In recent years, a number of regional zoo organizations have set up programs for the coordination of captive populations and the maintenance of studbooks of New World primates, which include volunteer-based Taxon Advisory Groups (TAGs) (Anon. 1993; De Boer 1994; Shoemaker 1995). In 1991, a New World Primate Taxon Advisory Group (NWPTAG) was set up in the U.S. through cooperation between the CBSG and the American Association of Zoological Parks and Aquaria (AZA), and involving the collaboration of a number of PSG members who serve as advisors (Baker *et al.* in press). Its aim was not only to coordinate and facilitate North American captive breeding efforts but also to identify priorities and research needs and to support *in situ* conservation.

The European Endangered Species Program (EEP) was formed in 1985 to stimulate and coordinate the endeavors of European Zoos for the conservation of endangered species (Brouwer *et al.*

1993). An associated Primate Taxon Advisory Group was set up in 1992 (Stevenson 1993). Breeding programs, including regional studbooks, were established for more than 80 species, including seven Neotropical primates (Table 10). More than 350 zoos from 32 countries participate in the EEP. A Primate TAG was also set up by the Joint Management Species Committee (JMSC) of the Federation of Zoological Gardens of Great Britain and Ireland (FZG), working in close collaboration with the PSG and the CBSG (Anon. 1993).

The Australasian Regional Primate TAG was created in 1989 for zoos in Australia and New Zealand, under the auspices of the Australasian Species Management Program (ASMP) of the Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA) (Embury 1993). It produces a newsletter (*Primate T. A. G. News*), and although focusing on species from South-east Asia, priority management programs are maintained for *Leontopithecus rosalia* and *Saguinus oedipus*, and regional studbooks are also kept for squirrel monkeys, *Saimiri*, and spider monkeys (*Ateles geoffroyi geoffroyi* and *A. g. vellerosus*). A regional studbook is also being developed for *Cebuella pygmaea* (Embury 1997).

Currently, of the 79 Neotropical primates listed as threatened and priority for captive breeding in the *Global Captive Action Plan for Primates* (Stevenson *et al.* 1991, 1992), 12 (15%) have international management programs and studbooks. Forty-six (58%) are the subject of regional management programs of the Association of Zoological Parks and Aquaria (AZA) in the US, 13 (16%) of the European Endangered Species Program (EEP), 24 (30%) of the Federation of Zoological Gardens of Great Britain and Ireland (FZG), and seven (9%) of the Australasian Species Management Program (ASMP). Overall, 57 (72%) of the primates given priority by Stevenson *et al.* (1991, 1992) are subject to interna-

tional and/or regional captive management programs (Table 10).

Of the 18 primates given top priority by Stevenson *et al.* (1991, 1992), six have specific international management programs, and a further seven are included in management programs at the genus or species level, although in some cases, for example, *Callicebus personatus barbarabrownae* and *Alouatta belzebul ululata*, there are none in captivity. To our knowledge, only one species has a current regional management program which was not included in the recommendations of Stevenson *et al.* (1991, 1992): an FZG regional program for *Cebus capucinus*. The top priority primates lacking either captive populations or programs for the small numbers in captivity include *Callithrix flaviceps*, *Leontopithecus caissara*, *Saimiri oerstedii citrinellus*, *Chiropotes s. satanas*, and *Brachyteles arachnoides* (Table 10).

These management programs have been important not only in creating viable populations of taxa which were previously inexistent or incipient in captivity (a good example is the golden-headed lion tamarin, *Leontopithecus chrysomelas*; see Mallinson 1987, 1989; Ballou 1989), but also in dealing with problems of hybridization, notable for such as the emperor tamarins (Ruivo *et al.* 1996), spider monkeys, *Ateles*, the woolly monkeys, *Lagothrix*, and the tufted capuchins, *Cebus apella*, in captivity.

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# The State of Lemur Conservation in Madagascar

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## Introduction

The island of Madagascar separated from Africa some 136 million years ago. Due to its long isolation and independent evolutionary history, the majority of plant and animal species are endemic (Rabinowitz *et al.* 1983; Storey *et al.* 1995; contributors to Lourenço 1996; Krause *et al.* 1997). This is particularly relevant for lemurs, which represent a monophyletic radiation of African origin which might have reached Madagascar as early as some 54 million years ago (Yoder *et al.* 1996). Naturally, all species of this lineage occur only in Madagascar. After the arrival of humans on the island some 2,000 years ago, all species bigger than about 7 kg went extinct, leaving some 50 lemur species and subspecies behind (Richard and Dewar 1991; Martin 1995; Dewar 1997; Godfrey *et al.* 1997; see Table 1). Due to anthropogenic pressure on their natural habitats and their small geographic range, most of the extant lemur species in Madagascar are under greater risk of extinction than the majority of other primate species in the world (Fig. 1).

## Major Threats

The major threats to the survival of lemurs are habitat destruction and hunting. Hunting may locally be severe and actually eliminate some of the larger species from a given area (Rigamonti 1996; Vasey 1996, 1997). In addition, lemur densities increase with increasing distances from villages (Tomiuk *et al.* 1997; Smith *et al.* 1997). This gradient is apparent only for the "edible" species and not for the smaller or more secretive ones, indicating that it is actually hunting by humans which is responsible for these correlations (Ganzhorn 1996, unpubl.). There are very few lemur species which are not eaten on a regular basis. They include *Daubentonia madagascariensis* and the smallest species, such as *Microcebus* spp. Although the effect of hunting deserves more attention than given at present, this paper will focus on habitat destruction as the main and major force affecting all lemur species.

In Madagascar, there are three main types of vegetation in which lemurs occur. They are the eastern evergreen rain forest, the western dry deciduous forest and the spiny forest in the south and southwest (Fig. 2). Some habitat specialists, such as the Alaotran gentle lemur (*Haplemur griseus alaotrensis*) and a newly discovered population of ring-tailed lemur (*Lemur catta*; Goodman and Langrand 1996) also occur in non-forest habitats such as marshes or open areas with cliffs at high altitudes.

The main reasons for forest destruction are subsistence agriculture, and charcoal and timber production (mainly for the local market). In most parts, these impacts are directly linked to the subsistence needs of the local human population. The disastrous speed of destruction is the immediate consequence of escalating human population growth (at present 3.2%). Average human population density is not very high, but the distribution of human settlements is very uneven. Human populations concentrate on the forest edge, where natural resources are still available, and move along with the retreating forest. The process can be accelerated by substantial human migrations in search of work and/or suitable agricultural land (Fig. 3). In the north-east of Madagascar in particular, the forest is cleared for planting cash crops. But, by and large,

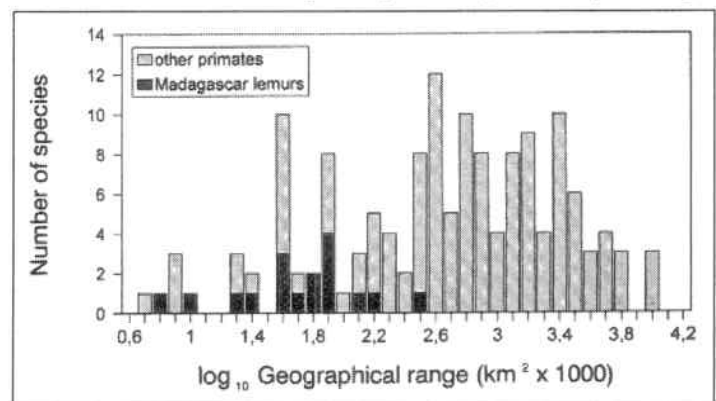


Figure 1. Estimated geographical range of lemurs compared to other primate species (modified from Martin 1995).

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the forest is cleared because people have to survive and alternatives to forest clearing are not available to them.

Recently, commercial mining has become a major issue. In 1997, the Reserve of Ankarana was and still is under threat by local miners, who arrived in the course of a few days to mine for sapphires. Within three weeks a village of about 3000 people developed at the edge of the reserve. Even though the majority of the mining operations took place outside the reserve, people gathered wood and hunted lemurs and birds inside the protected area. Over large parts of Madagascar during the last ten years, prospecting for new sapphire, ruby, titanium, nickel and cobalt mining possibilities has occurred, and many mining operations are pending. Similar to the situation at Ankarana, gold rushes or uncontrolled mining for precious stones are recent phenomena in the regions around Daraina and Marojejy. Environmental assessment projects will reveal the potential impact on lemur populations, beyond the damage caused by habitat destruction.

In general it is assumed that the forest cover, as depicted in Figure 2a, has undergone severe reduction since the arrival of humans. We actually do not know the original extent of forest cover and cannot provide, therefore, accurate figures on the rate of forest loss since the arrival of people. However, between the vegetation surveys of Humbert in 1950, Faramalala (data from 1972 - 1979, published in 1981 and 1995) and survey results from 1985 and 1990 (Green and Sussman 1990; Nelson and Horning 1993a, 1993b; Du Puy and Moat 1996; Smith 1997), the forest cover has declined steadily and substantially. For the situation in 1990, Nelson and Horning (1993a, 1993b) estimated the total forest cover of Madagascar to be about 61,000 km<sup>2</sup>, with 34,000 km<sup>2</sup> of eastern rain forest, 17,000 km<sup>2</sup> of southern spiny forest and less than 7,000 km<sup>2</sup> of western dry deciduous forest, with some 3,000 km<sup>2</sup> left among the central grassland.

Ground-truthing of some of these maps is alarming, considering that they were published in 1995 and 1996 but based on the vegetation cover of the seventies. These maps are an essential basis for future reference and documentation of changes in forest cover. It seems ironical that, with the remote-sensing technology currently available, conservation arguments at the end of the century are still based to a large extent on data bases of the 1970s!

Among the forest types, the dry deciduous forest was, and still is, the easiest to clear, and has the highest potential for human cultivation (Lamprecht 1986). Vast areas of this vegetation type had, therefore, probably been cleared long before the present awareness of the need to preserve the forests. Whatever is left, thus, has to be considered to be under the heaviest pressure (Nelson and Horning 1993a,b), and the demise of large areas of dry forest has not received the attention it deserves (Murphy and Lugo 1986; Janzen 1988; Lerdaun *et al.* 1991). Other types of forest, such as the evergreen lowland rain forest of the east, are not represented in the protected areas' system (Du Puy and Moat 1996), but at present it is not known whether or not these vegetation formations are home for specific lemurs.

The problem is not only forest loss, but also the very severe fragmentation in the west and in the east. Analyses of the degree of fragmentation for the eastern rain forest have not been published in detail. However, the ratio of forest edge to forest area increased from 17,700 km/76 000 km<sup>2</sup> (= 0.23 km of edge per 1 km<sup>2</sup> of forested area) in 1950 to 15,600 km/38,000 km<sup>2</sup> (= 0.41

km of edge per 1 km<sup>2</sup> of forested area) in 1985 (Green and Sussman 1990). This marked increase in forest edge per km<sup>2</sup> reflects substantial fragmentation in the east over the last few decades.

Analyses are more complete for the western dry deciduous forest (Smith 1997). Classification of forest types from aerial photographs or satellite data still poses problems, and errors in the figures on the classification of secondary and primary forest exist, especially in defining primary or secondary vegetation (Hawkins 1994a; Smith 1997). However, even with this in mind, it is clear that Madagascar's dry deciduous forests have been severely reduced over the last 40 years. Smith (1997) estimated that in 1990 only 15 blocks of primary dry deciduous forest were larger than 32-64 km<sup>2</sup> (Fig. 4).

The spiny bush of southern Madagascar was long considered to be under reduced pressure due to adverse conditions for agriculture. However, this vegetation formation went from a fairly stable state in the 1980s to a very dynamic situation in the early 1990s. Severe drought and consequent famine pushed people to migrate and/or exploit even the succulent spiny forest to make charcoal in order to make some money for survival (Jolly 1993). Migrations have been a factor working against the protection of Madagascar's forests in general, but have been most pronounced in the spiny forest.

In northern Madagascar, the effects of forest fragmentation are already reflected in reduced genetic variation in isolated populations of *Eulemur macaco* (Arnaud *et al.* 1992; Rabarivola *et al.* 1996). In western Madagascar, small populations of *Lepilemur ruficaudatus* which have been isolated during the last 50 years, do not yet show any signs of reduced genetic variability (Tomiuk *et al.* 1997). More detailed information on natural gene flow and genetic differentiation is needed urgently. Screening of individuals from different populations of *Varecia variegata* revealed different clades which appear genetically distinct (Amato and DeSalle unpubl.). Since we have no idea about the genetic structure of natural populations for most lemur species, and individuals even of a contiguous population of *Lepilemur ruficaudatus* show signs of assortative matings based on protein polymorphisms (Tomiuk *et al.* 1997), it is difficult to interpret the biological importance of genetic differentiation on the DNA level. Nevertheless, in concert with monitoring of diseases and parasite loads, these issues are most important for future management decisions and introduction programs (Junge and Garell 1995; Welch 1996; O'Connor 1996). It is questionable, however, whether or not genetic drift and erosion of genetic variability represent a significant threat to the survival of lemurs in Madagascar. The forest just goes too quickly for genetic deficits to have any effect.

Reforestation could be one important way of creating buffer zones and reducing the fragmentation processes. Over the past few decades knowledge about the suitability of native and introduced tree species for reforestation has accumulated, and a substantial number of tree species has been identified for plantations (e.g., Blaser *et al.* 1993; Deleporte *et al.* 1996; Randrianasolo *et al.* 1996; Ferraro and Rajamamonjy unpubl.). However, efforts to plant trees as buffer zones, for fuel or other purposes, have declined substantially over the last few years. Given that many lemur species do quite well in tree plantations and that wood might be one of the most precious, though very basic, resources in Madagascar in the near future, tree planting, especially of native trees,

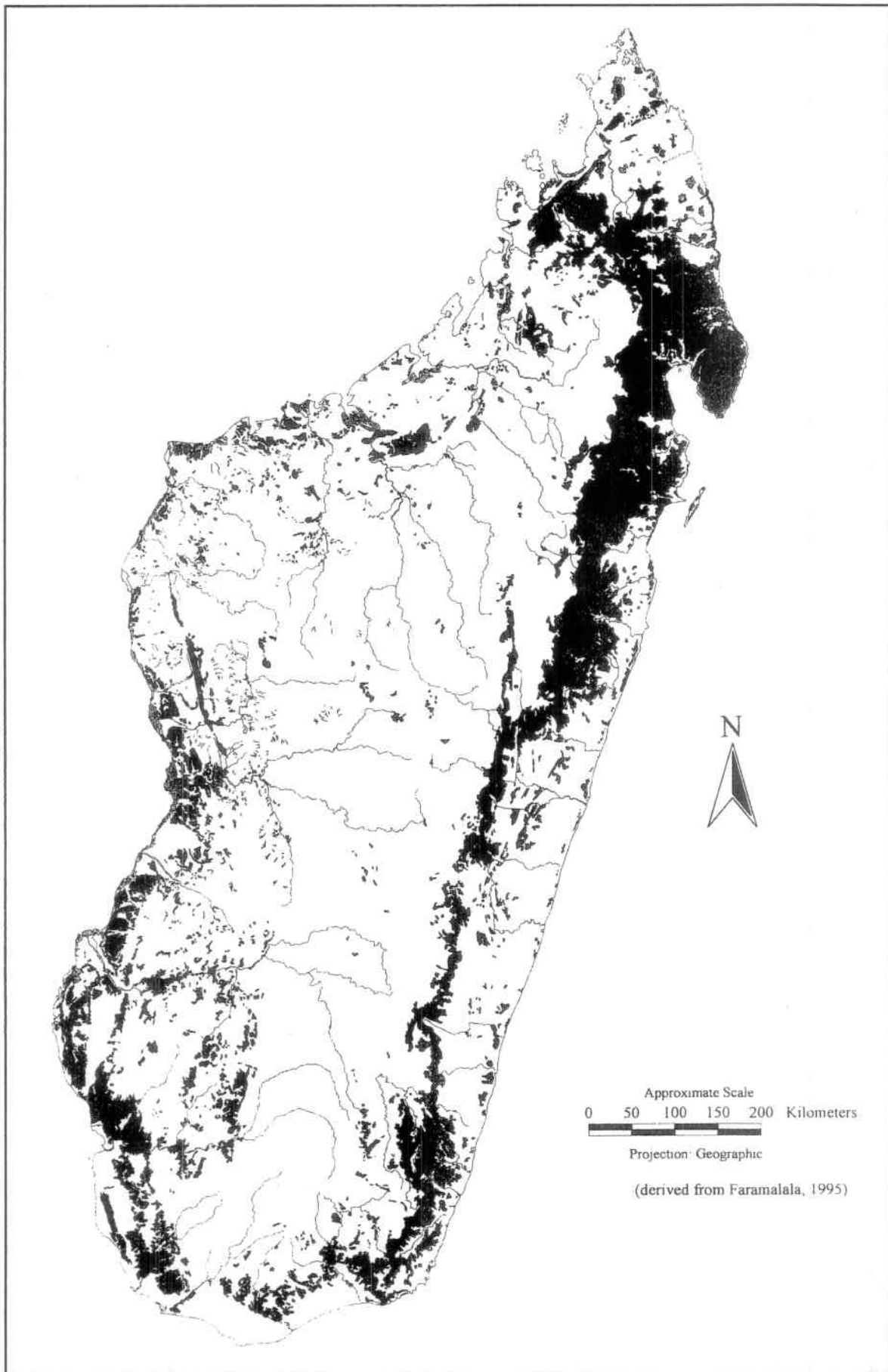


Figure 2a. Vegetation types in Madagascar. Modified from Dy Puy and Moat (1996). Different shading represents different types of primary forest.

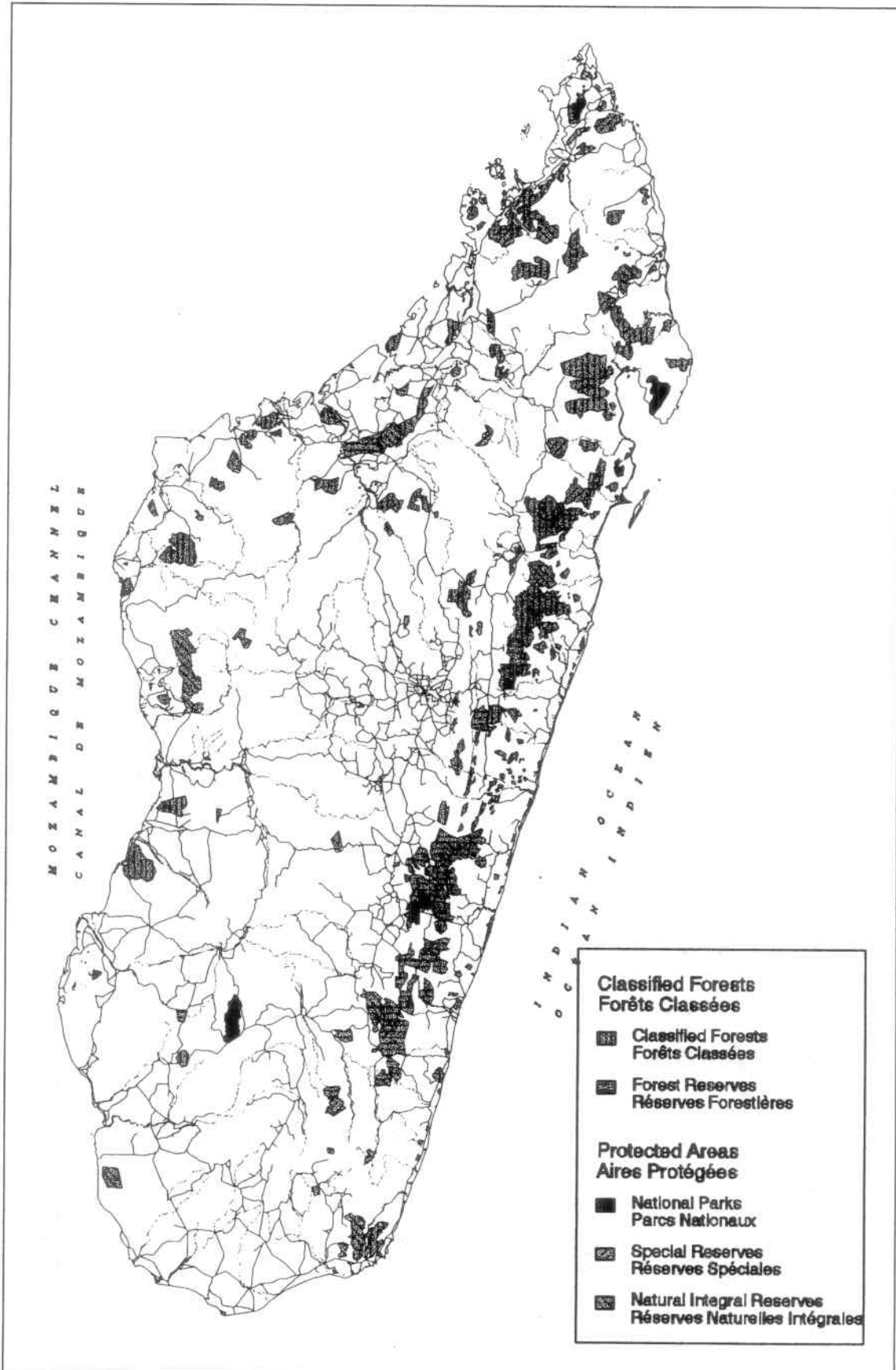


Figure 2b. Location of protected areas. Map by Conservation International, modified from Ganzhorn *et al.* (1997).

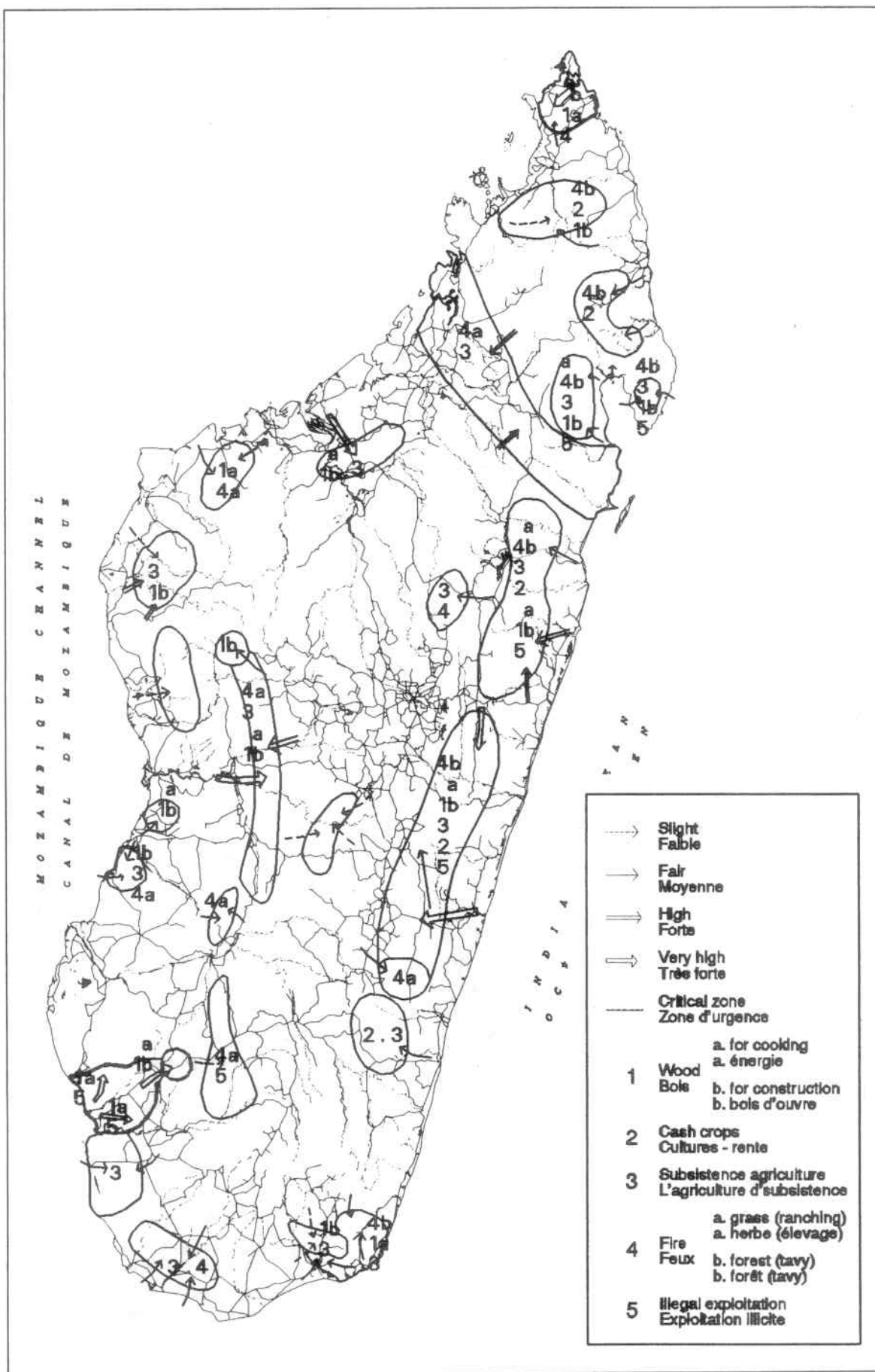


Figure 3. Summary of human pressures contributing to forest destruction. Map by Lata Iyer, from Ganzhorn *et al.* (1997).

should be incorporated in almost any development project in Madagascar.

### Conservation Status of Lemur Species

Figure 1 and Table 1 show that a number of lemur species not only have restricted ranges but also occur in only one or a few protected areas, which are not always connected by forest corridors. For most species, therefore, even the protected populations contain few individuals, and thus have to be considered vulnerable, rare or endangered, based on the old, as well as on the recently revised, IUCN categories of threat (Harcourt and Thornback 1990; Mittermeier *et al.* 1992, 1994; IUCN categories of 1994 listed in Oates 1996). This is particularly relevant for species which are known only from one or two locations, which may or may not be in protected areas. Small population size and limited geographic range make these isolated species vulnerable to any kind of stochastic event such as fire, cyclones, or increased parasite loads under crowded conditions. The pending danger of these stochastic events was recently illustrated by the cyclone which hit Manombo Reserve in February, 1997. Until the discovery of *Eulemur fulvus albocollaris* in Andringitra (Sterling and Ramarosan 1996), Manombo was the only place where this subspecies was known to occur. More than 85% of the canopy within the 5,000 ha reserve was destroyed during 12 hours of high winds. The chances of Manombo Reserve burning by the end of the dry season are high. A less destructive cyclone had already hit, and partly destroyed, Manombo in 1956. Since then, the forest had recovered, but possibly only because by that time, the army had been called in to protect the reserve from fires. Regardless of the outcome of this recent event, if reserves are known to be devastated by high winds once every 40 years, we should not talk about "stochastic, unpredictable events", but rather of known and predictable threats to the survival of some lemur species.

The problems of fragmentation and range reduction are further illustrated with two lemur species which are known to occur only outside the protected area system: Tattersall's sifaka (*Propithecus tattersalli*), a species described only in 1988 (Simons 1988), and a subspecies of the gentle lemur (*Hapalemur griseus alaotrensis*), restricted to the marsh vegetation of Lac Alaotra.

*Propithecus tattersalli* is probably the lemur species most urgently in need of conservation action. It is known only from a very restricted area in the northeast of Madagascar, where the western dry deciduous forest extends to the east. Today there are only a few isolated forest fragments which are inhabited by this species, and the total population size is estimated to be a few thousand (Meyers 1993). Despite the relatively high number of animals, their survival is highly threatened by habitat destruction for gold and quartz mining.

The Alaotran gentle lemur is confined to natural marsh vegetation around Lac Alaotra, the largest lake in Madagascar, where it lives exclusively in reed and papyrus beds. Between 1961 and 1994, this type of vegetation was reduced by about two-thirds, from an estimated 55,000 ha in 1961 to 35,000 ha in 1984, and to about 20,000 ha in 1994, with an estimated total population of about 7,500 *H. g. alaotrensis* (Mutschler and Feistner 1995; Mutschler *et al.* 1996). Furthermore, the remaining marsh vegetation is subdivided into three fragments. The total number of animals would

still be adequate if the population were contiguous and it would not be considered as endangered following the 1994 IUCN criteria. However, the rate of habitat destruction is astronomical, the human population around the lake has doubled within 10 years, and the species and the habitat are in urgent need of protection, as human pressure continues to increase (Pidgeon 1996).

### In Situ Lemur Conservation Since 1992

The Lemur Action Plan of 1992 assigned conservation priorities to species based on population size and taxonomic uniqueness. The priority rating was upgraded if the taxon in question was not known to occur in any protected area (Mittermeier *et al.* 1992). In 1992, six species or subspecies of high conservation priority occurred only outside protected areas and thus needed some sort of conservation activity (Tables 1 and 2). Five of them are from Madagascar, the sixth is the Mayotte brown lemur which is not considered further here.

Since 1992, *Varecia variegata rubra* on Masoala has benefited from a proposal, which achieved national and international backing, for a national park, which was finally declared in 1997 (Kremen *et al.* in press). The park area and the whole region around it have the highest conservation priority according to the recommendations of a workshop on defining conservation and research priorities for Madagascar, held in Antananarivo in April 1995 (Rakotosamimanana and Ganzhorn 1995; Hannah *et al.* 1996; Ganzhorn *et al.* 1997).

Plans to establish a protected area for *Eulemur macaco flavifrons*, a subspecies restricted to the northwest of Madagascar, are being followed up. In collaboration with the Ministry for Water and Forests in Madagascar, a consortium of universities and zoological gardens have made substantial progress in delimiting an area for future protection (Meier *et al.* 1996). Unsolved problems here comprise severe degradation of the remaining forest through human action and the presence of a substantial human population within the projected park boundaries (D. Rakotondravony, M. Thelen, pers. comm.).

Protection of *Hapalemur griseus alaotrensis* in its present natural habitat is very difficult due to the fact that it lives in an area which

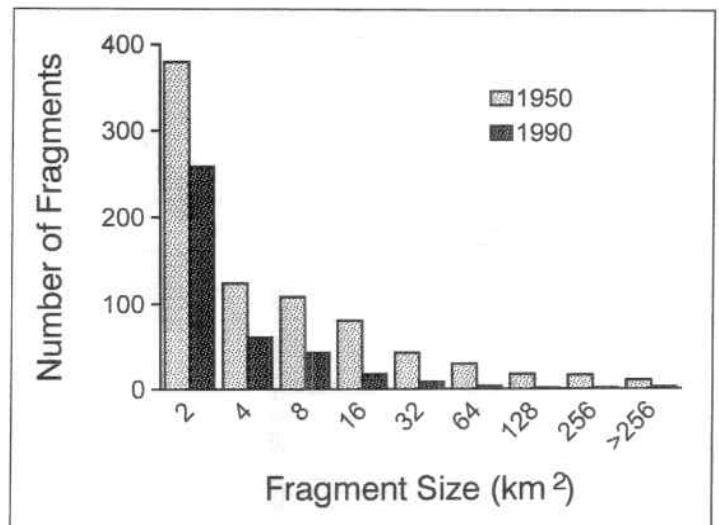


Figure 4. Size of forest fragments in the dry deciduous forest in 1950 and 1990. Modified from Smith (1997).

is under tremendous human pressure and used intensively for rice and fish production. However, community education programs and socio-economic research are underway. Successful captive breeding in zoos is likely to play an important role, by creating a 'safety net', for the conservation of this taxon.

The urgent case of *Propithecus tattersalli* has already been described above. Finally, *Propithecus verreauxi coronatus*, a subspecies with a distinct pelage coloration, is still not included in any protected area. However, the taxonomic status of this subspecies is unclear and still disputed, and it might possibly be pooled with *P. v. deckeni*, a subspecies occurring in several protected areas in western Madagascar. The situation of *P. v. coronatus* is, however, critical, and this population might actually be one of the most threatened subspecies due to its very restricted range. Until the correct taxonomy of these forms is decided, it may be wise to consider them as proper subspecies and initiate appropriate conservation

activities to secure their survival.

Projects specifically aimed at lemur conservation in their natural habitat are rarer than expected given the popularity of these primates. Figure 7 shows the location of some of the major projects aiming at Integrated Conservation and Development (ICDP). As of July 1, 1997, several of these ICDPs have been revised, including Ranomafana, Montagne d'Ambre, Mantadia and Andohahela. The protected areas will be managed and funded as such, while a regional approach is being taken for the economic development of the areas. Most of these have positive consequences for lemur conservation. There is only one project, however, which carries the name of a lemur in its title. This is the "Black Lemur Forest Project" in Lokobe, which is based on a private initiative (J. Andrews). Certainly, conservation organizations are considering lemurs as high priority in their conservation strategies, but conservation in Madagascar is no longer driven by emotion, but by

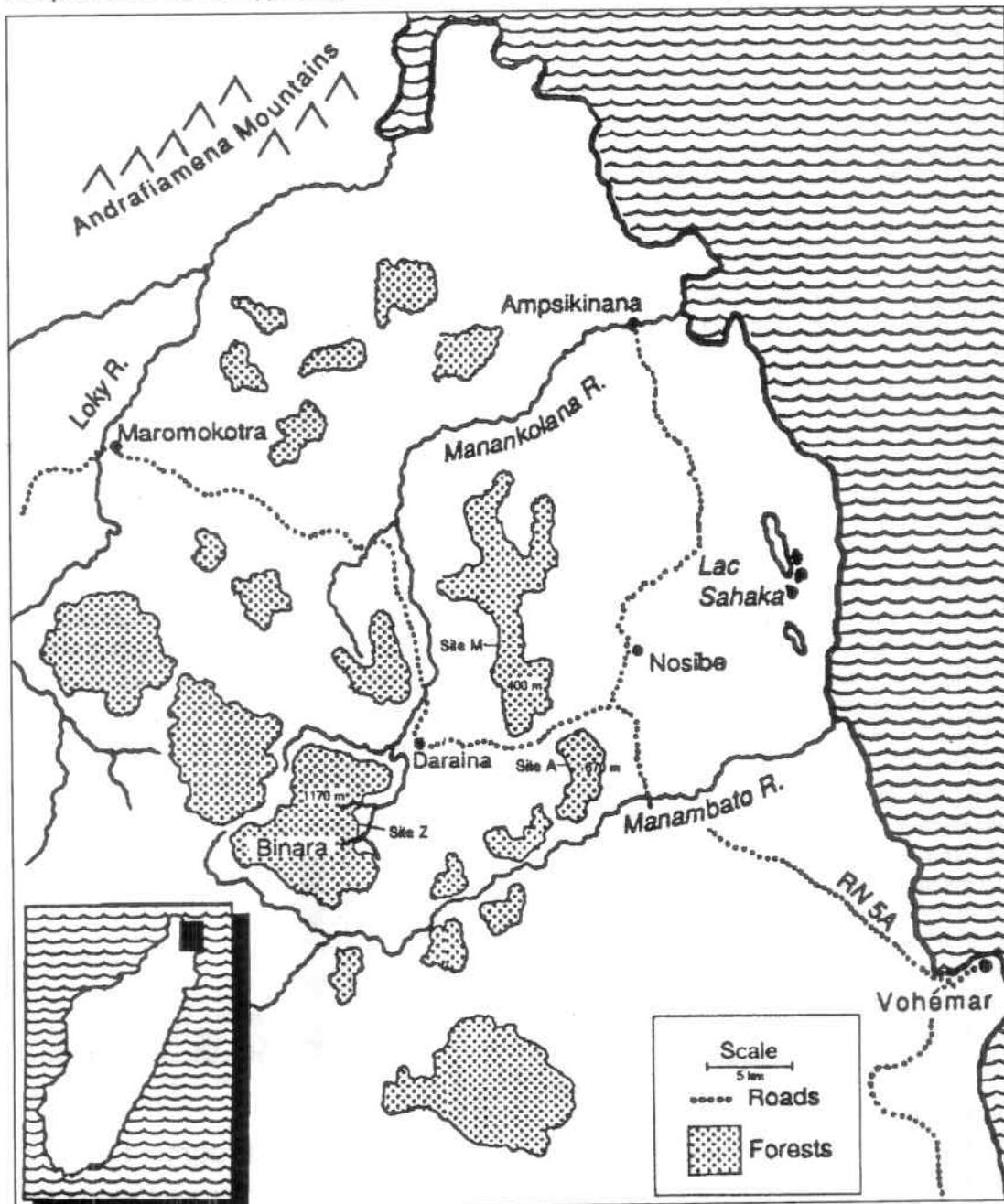


Figure 5. Distribution of *Propithecus tattersalli*. (Map by Stephen Nash, from Meyers 1993.)



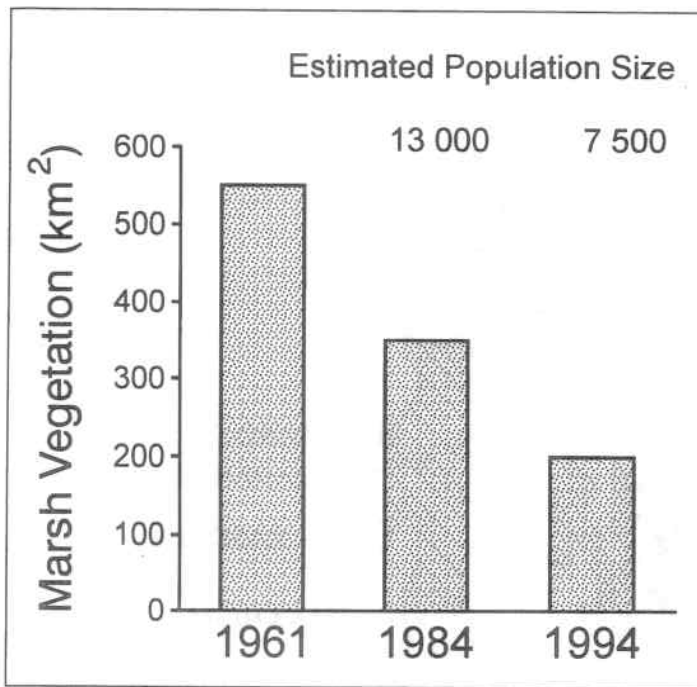


Figure 6. Destruction of native marsh vegetation and estimated population size of *Hapalemur griseus alaotrensis* around Lac Alaotra. (Data from Mutschler and Feistner 1995; Mutschler *et al.* 1995.)

clearly established conservation priorities based on general ecological criteria. Internally, and outside Madagascar, lemurs are still used as flagship species, but the vast knowledge acquired on other taxa such as plants, reptiles and amphibians, birds, small mammals and ecosystem functioning in general, provide conservationists with the opportunity to present a much more comprehensive picture and to use landscape ecology rather than a species specific approach. Although lemurs are no longer the final image seen, biotic elements (including lemurs) have never before been so important to the international donors, conservation organizations and the Malagasy Government.

### Evolution, Prospects and Unsolved Problems in Lemur Conservation

#### Background Information

Major compendia of lemur and prosimian biology, and Madagascar's environmental situation, have been compiled at decreasing intervals. They began with a conference on prosimians in 1972, and there was an unprecedented concentration of conferences dealing with lemurs and their environmental situation in 1995 and 1996 (summaries by Martin *et al.* 1974; Sussman and Tattersall 1975; Petter *et al.* 1977; Doyle and Martin 1979; Charles-Dominique *et al.* 1980; Tattersall 1982; Harcourt and Thornback 1990; Kappeler and Ganzhorn 1993; Alterman *et al.* 1995; Rakotosamimanana and Ganzhorn 1995; Ganzhorn and Sorg 1996; Goodman 1996; Lourenço 1996; Goodman and Patterson 1997; Ganzhorn *et al.* 1997; Crompton and Harcourt in press). Except for *Propithecus verreauxi coronatus*, doctoral theses have been compiled or are in progress on many lemur species listed as targets for conservation priorities in 1992, e.g., Meyers on *Propithecus tattersalli* (1993); Vasey on *Varecia variegata rubra* (in prep.); Mutschler on *Hapalemur griseus alaotrensis* (in prep.); and Chia

Tan on *Hapalemur simus* and *H. aureus* (in prep.). It should also be emphasized that it is not only major international, government or NGO funding which is essential for conservation. Even comparatively small research grants and graduate student funding can be vital for conservation projects. They often represent the starting point for growing awareness and may provide continuity during periods when donor organization and commitments are revised.

In addition to these more academically-oriented exercises, some major organizations have arisen, including Madagascar's Primatological Society (Groupe d'Etude et de Recherche sur les Primates de Madagascar: GERP), the Madagascar Fauna Group (MFG) and the Society of Prosimian Research (SPR). Future goals have to include collection of basic data, especially on demography, genetic structure, gene flow, parasites, and diseases, but also on behavioral aspects of social systems and physiology. Data of this sort are not only vital for our understanding of lemur biology in general, but also help to integrate the results of field work with captive and *in situ* conservation activities. Such basic data can then be incorporated in Population and Habitat Viability Analyses (PHVA) to promote the definition of priorities for conservation action (e.g., contributors to *Primate Conservation* 14-15, 1993-1994).

#### Setting Conservation Priorities

Since 1985, setting of conservation priorities in Madagascar has followed an approximately five-year cycle. It began with the Conference on Conservation for Development in 1985 (Mittermeier *et al.* 1987; Jenkins 1987; Rakotovoao *et al.* 1988; Nicoll and Langrand 1989), and was followed by the National Environmental Action Plan in 1990 (French acronym: PAE) and more recently the Global Environment Facility/Environment Program 2 (GEF/PE2) of 1995. Following the 1985 and 1990 planning exercises, major donors responded by providing funding for new conservation activities (Kull 1996; Richard and O'Connor 1997; Wright 1997). The annual budgets of WWF and Swiss Aid to Madagascar might serve as examples. From 1985 to 1990 WWF expenditure tripled, and Swiss Aid's increased eight-fold within the same time period. Other organizations increased their conservation budgets in a similar way and many new non-government organizations (NGO) entered the scene (data from Kull 1996).

This donor response led to the need to reassess the PAE after several years of implementation. This need has most recently been filled by the GEF/PE2. With the help of the Global Environmental Facility (GEF), an interdisciplinary workshop took place in Antananarivo in 1995, and set the geographical research and conservation priorities for the second phase of the Environmental Action Plan (PE2) to begin in 1997. The workshop covered many major taxonomic groups, including mammals, birds, reptiles, amphibians, fish, invertebrates and plants. It also included a socio-economic and a paleontology group in order to put the biological questions in a social, historical and evolutionary context. The products of this workshop included a series of maps and other documents that define research and conservation priorities for the various taxonomic groups (Fig. 8; Rakotosamimanana and Ganzhorn 1995; Hannah *et al.* 1996; Ganzhorn *et al.* 1997). Also important was the consensus building process for Madagascar and international players.

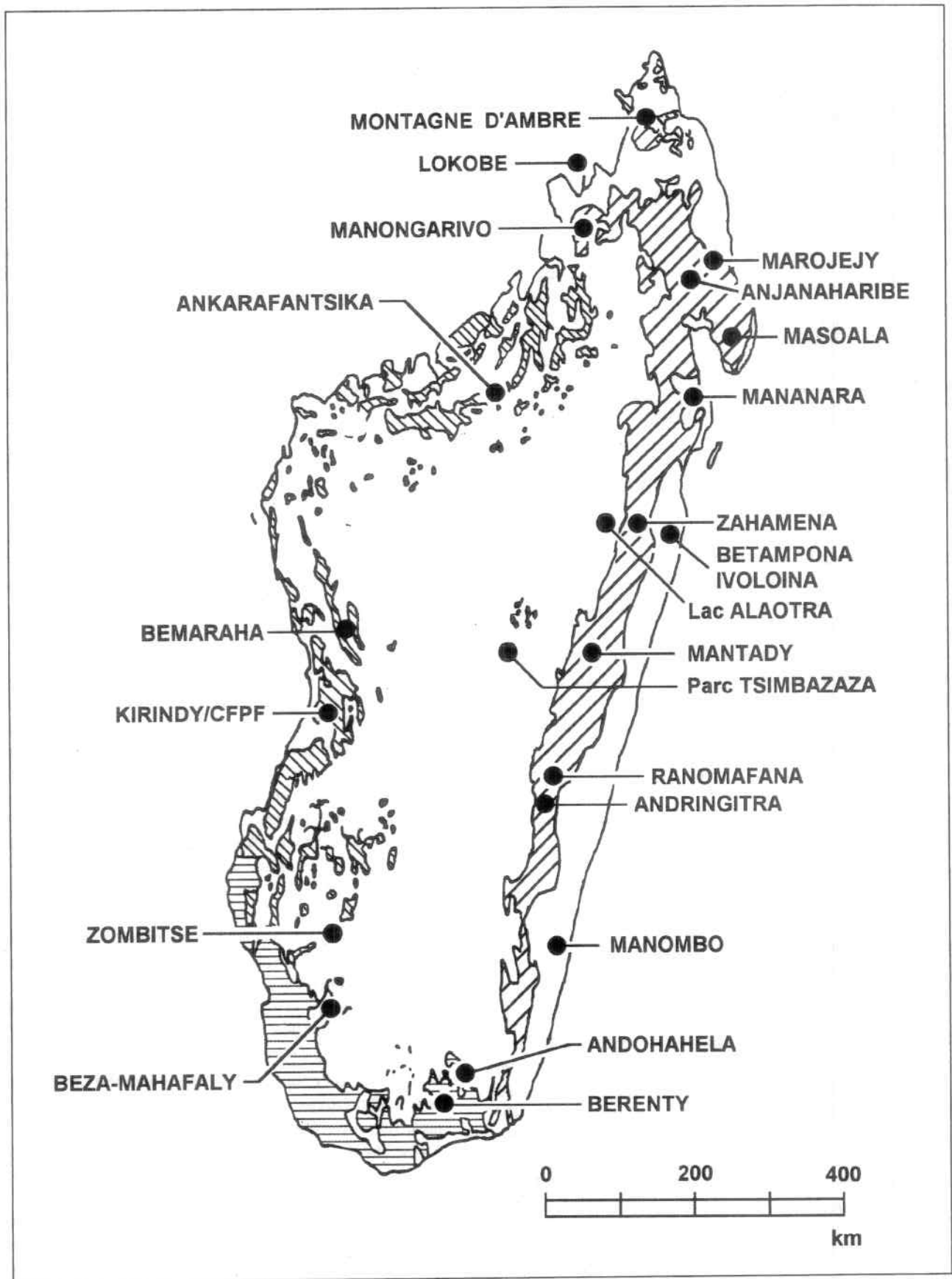


Fig. 7. Location of projects contributing to lemur conservation. The different shading indicates the forest formations covered by these conservation projects (eastern rain forest, western dry deciduous forest, southern spiny forest).

**Table 1.** Matrix of protected areas and lemur species occurring in these areas. Domain: C = Central, E = East, S = South; W = West, Sam = Sambirano. Occurrence: + = present, (+) = introduced, # = recorded as present but subspecies not definitely known. Data from Mittermeier *et al.* 1992; Ganzhorn 1994, in press; Hawkins 1994b; Rakotoarison *et al.* 1993, 1996; Sterling and Ramarison 1996; Schmid and Smolker in press).

Protected Area	Size (ha)	Domain	<i>Microcebus murinus</i>	<i>Microcebus myoxinus</i>	<i>Microcebus ravelobensis</i>	<i>Microcebus rufus</i>	<i>Microcebus sp.</i>	<i>Mirza coquereli</i>	<i>Cheirogaleus medius</i>	<i>Cheirogaleus major</i>	<i>Allocebus trichotis</i>	<i>Phaner. f. furcifer</i>	<i>P. f. electromontis</i>	<i>P. f. parienti</i>	<i>P. f. pallescens</i>	<i>Lepilemur dorsalis</i>	<i>Lepilemur edwardsi</i>	<i>Lepilemur leucopus</i>	<i>Lepilemur microdon</i>	<i>Lepilemur mustelinus</i>	<i>Lepilemur ruficaudatus</i>	<i>Lepilemur septentrionalis</i>	<i>Lemur catta</i>	<i>Eulemur coronatus</i>	<i>Eulemur m. macaco</i>	<i>E. m. flavifrons</i>
<b>National Park</b>																										
Isalo	81 540	C	+					+	+												+		+			
Ranomafana	41 600	C				+				+								#								
Verezantsoro	23 000	E				+				+	+									+						
Montagne d'Ambre	18 200	C				+				+			+									+		+		
Mantady	10 000	C				+				+	+								+							
Masoala	230 000	E				+					#	+	#								+					
<b>Strict Nature Reserves</b>																										
Tsingy de Bemaraha	152 000	W	+				+	+	+	+					+		+									
Andohahela Parcel 1	63 100	E, C				+				+										+			+			
Andohahela Parcel 2 + 3	12 920	S	+						+			#						+					+			
Zahamena	73 160	E, C				+				+		+														
Ankarafantsika	60 520	W	+	+					+								+									
Marojejy	60 150	E, C, M				+				+										+						
Tsaratanana	48 622	E, C, M								+		#									+				+	
Tsimanampetsotsa	43 200	S	+															+					+			
Andringitra	31 160	E, C, M				+				+									+				#			
Namoroka	21 742	W	+																							
Betampona	2 228	E				+				+		+									+					
Lokobe	740	Sam				+										+									+	
<b>Special Reserves</b>																										
Ambatovaky	60 050	E, C				+				+										#						
Marotandrano	42 200	C																								
Manongarivo	35 250	Sam				+		+		+			#		+										+	
Analamera	34 700	W	+										+									+		+		
Anjanaharibe-Sud	32 100	E, C				+				+	+								#							
Kalambatritra	28 250	C																								
Ambohijanahary	24 750	C																								
Kasijy	18 800	W																								
Ankarana	18 220	W	+			+			#				+									+		+		
Analamaitso	17 150	C																								
Mangerivola	11 900	E																								
Bemarivo	11 570	W																								
Maningoza	7 900	W														+										
Andranomena	6 420	W	+	+				+	+												+					
Ambohitantely	5 600	C				+																				
Manombo	5 020	E				+				#																
Foret d'Ambre	4 810	C				+				+			+									+		+		
Bora	4 780	W																								
Pic d'Ivohibe	3 450	M																								
Cap Sainte-Marie	1 750	S	+																							
Analamzaotra	1 180	E, C				+				+	+								+							
Beza-Mahafaly	600	S	+				+		+									+					+			
Nosy Mangabe	520	E				+				+																
<b>Private Reserves</b>																										
Berenty	265	S	+							+													+			
St. Luce	200																									
<b>Sites of Interest with reasonable protection</b>																										
Zombitse		W	+					+	+													+		+		
Kirindy/CFPF		W	+	+				+	+							+						+				
Present in number of Proteted Areas			14	2	1	20	2	6	10	20	5	5	4	1	4	2	3	4	4	9	4	4	8	4	3	0

Table 1. Cont.

Protected Area	<i>Eulemur mongoz</i>	<i>Eulemur rubriventer</i>	<i>Eulemur f. fulvus</i>	<i>E. f. albifrons</i>	<i>E. f. albocollaris</i>	<i>E. f. collaris</i>	<i>E. f. mayottensis</i>	<i>E. f. rufus</i>	<i>E. f. sanfordi</i>	<i>Varecia v. variegata</i>	<i>V. v. rubra</i>	<i>Hapalemur g. griseus</i>	<i>H. g. alaoensis</i>	<i>H. g. occidentalis</i>	<i>Hapalemur aureus</i>	<i>Hapalemur sinus</i>	<i>Avahi l. laniger</i>	<i>A. l. occidentalis</i>	<i>Indri indri</i>	<i>Propithecus d. diadema</i>	<i>P. d. candidus</i>	<i>P. d. edwardsi</i>	<i>P. d. perrieri</i>	<i>Propithecus tattersalli</i>	<i>Propithecus v. verreauxi</i>	<i>P. v. coquereli</i>	<i>P. v. coronatus</i>	<i>P. v. deckeni</i>	<i>Daubentonia mad/xis</i>	No Species																			
<b>National Park</b>																																																	
Isalo								+																		+							7																
Ranomafana	+							+		+		+			+	+	+															+	12																
Verezantsoro			#							+		+								+	+											+	>11																
Montagne d'Ambre									+																								+	7															
Mantady	+	+								+		+								+	+												+	12															
Masoala				+							+	+																					+	>10															
<b>Strict Nature Reserves</b>																																																	
Tsingy de Bemaraha								+						+				+																+	+	12													
Andohahela Parcel 1												+					+								+									+	10														
Andohahela Parcel 2 + 3																									+										6														
Zahamena		+	#							+		+						+		+	+													+	>12														
Ankarafantsika	+		+																															+	8														
Marojejy		+		+																		+												+	9														
Tsaratana		+	+																																>7														
Tsimanampetsotsa																										+									>4														
Andringitra		+			#	#	#			+		+			#	#	+																	+	13														
Namoroka			#																															+	>4														
Betampona			#							+		+								+	+													+	11														
Lokobe																																			3														
<b>Special Reserves</b>																																																	
Ambatovaky		+	#							+		+					+			+	+													+	11														
Marotandrano																																			?														
Manongarivo			+									#	#																					+	>9														
Analamera									+																									+	>7														
Anjanaharibe-Sud		+		+								+								+														+	11														
Kalambatri								+												+		+												+	11														
Ambohijanahary																																		+	>1														
Kasijy																																			?														
Ankarana									+					+																				+	11														
Analamaitso																																																	
Mangerivola																																																	
Bemarivo																																																	
Maningozo																																																	
Andranomena								+																			+								8														
Ambohitantely			+																																3														
Manombo					+																+													+	6														
Foret d'Ambre									+																									+	7														
Bora			+																															#	>2														
Pic d'Ivohibe								+																										+	>2														
Cap Sainte-Marie																																			1														
Analamzaotra		+	+							+		+								+														+	11														
Beza-Mahafaly																											+								6														
Nosy Mangabe					+					(+)																								(+)	5														
<b>Private Reserves</b>																																																	
Berenty								(+)																												6													
St. Luce																																																	
<b>Sites of Interest with reasonable protection</b>																																																	
Zombitse								+																											+	8													
Kirindy/CFPP								+																											+	8													
Present in number of Proteted Areas	1	9	12	4	2	2	-	9+1	4	8+1	1	15	0	3	2	2	14	3	7	5	2	4	2	0	9	2	0	3	1	19+																			

The most significant recommendations of the workshop were as follows:

- Many areas of outstanding biological importance, with exceptionally high research and conservation priorities, are located outside protected areas. Thus, the protected area system needs to be extended. So far, most research and conservation action has concentrated on the existing protected areas. This ignores many aspects of potentially very high biological interest (for example, almost the entire south and southwestern part of Madagascar, and many coastal areas). This emphasizes the need for the development of a program for biological research outside protected areas.
- Forest fragmentation threatens all the forest ecosystems. Corridors of protected areas between remaining blocks of forest, and between existing protected areas, are required to maintain gene flow and exchange of species (e.g., northeastern region: Mananara-Marantsetra-Sambirano).
- Typical lowland eastern rain forest is now considered to extend only up to an altitude of about 500-600 m. This new classification substantially reduces the potential surface for this type of unique ecosystem, and thus any remaining lowland evergreen rain forest needs immediate protection.
- Littoral forests in the east represent unique ecosystems which are highly threatened but as yet insufficiently protected. Other unique habitats not sufficiently included in the present system of protected areas are dunes, wetlands and inselbergs.
- Recommendations were made for the institution of several regional museums and a National Museum of Natural History.

Primatologists would possibly have set different priorities, but it has to be accepted that these recommendations were derived from a consensus-building process based on the expert knowledge of a large number of biologists from different fields. Activities for lemur conservation have now to be seen within this framework. For the second phase of the Environmental Action Plan (PE2), from 1997 to 2001, Madagascar is set to receive approximately 155 million US\$ from international donors. This action plan will promote the creation of new reserves, but its main emphasis is "regionalization". By addressing the environmental problems on a regional basis, the management and development of the existing protected areas could actually be improved, and the root causes of environmental degradation could be addressed in a way suited to local requirements. This policy of consolidation is essential for many conservation projects, but it may have negative consequences for the protection of the restricted-range species mentioned earlier. To date, there is no protected area planned for *Propithecus tattersalli* which may make this species one of the most vulnerable of the Malagasy lemurs. Efforts organized by individuals and NGOs working outside the mainframe of the Environmental Action Plan, but in close collaboration with the Malagasy Ministry of

Water and Forests and the local human population, may be the only way to help this species to survive in the next millennium.

### Need for Action

Due to the growing awareness of conservation needs, and the activities of national and international organizations, the majority of lemur species would appear to be fairly well protected, as all but a very few (Tables 1 and 2) of those identified to date occur in at least one protected area. However, on the ground, there are few signs of growth or improvement in the rather desperate socio-economic situations of rural communities. Human population growth continues to be a concern, and the need for additional agricultural land is as high as ever, without much progress towards sustainable agriculture, forestry or restoration of fallow land. The problems here are manifold, with a strong cultural component and sometimes substantial discrepancies between legislation and the actual potential to enforce the law on site (Cuvelier 1996; Cuvelier and Raonintsoa 1996; Raonintsoa 1996; Genini 1996; Kull 1996; Richard and O'Connor 1997). Most urgent is the improvement of means by which local human communities and conservation activities are integrated. This is the premise of the PE2.

Assuming that these anthropogenic problems can be resolved in a reasonable time frame, there are still a number of measures required to ensure better protection of Madagascar's unique lemur fauna.

- The most urgent need is to stop habitat destruction and forest fragmentation.
- The quality of lemur inventories must be improved. So far, only visual inventories have been done at most sites, possibly leaving a large number of species undescribed. This may apply especially to the small nocturnal species which cannot be identified in the field when seen at a distance of several meters at night. Where lemur traps have been allowed, new species have turned up, even in areas where people have worked for decades, such as around Morondava, Perinet and Ampijoroa (Schmid and Kappeler 1994, Rakotoarison *et al.* 1996, Zimmermann *et al.* in press), as well as in more remote areas such as Bemaraha (Rakotoarison *et al.* 1993).
- So far, research on lemurs has taken place mainly within protected areas. If new species are found even in areas with long histories of research, what can be expected from new sites! Not all of Madagascar's vegetation types are covered by protected areas (Du Puy and Moat 1996; see also the uneven distribution of project sites in Fig. 7, with the low representation of western, dry, deciduous forest and the almost complete neglect of the southern, spiny forest). In addition, the most extensively used phytogeographic classification, that of Humbert and Cours Darné (1965), is not congruent with the patterns of vertebrate endemism, at least in eastern Madagascar

**Table 2.** Advances since 1992 in conservation for restricted-range species, which did not occur in any protected area in 1992.

Species	Lemur Action Plan 1992	Situation in 1996
<i>Varecia variegata rubra</i>	No protection	Protected in Masoala NP, created in 1997
<i>Eulemur macaco flavifrons</i>	No protection	Ground surveys for delimitation of protected area "Baie de Sahamalaza" under way (Meier <i>et al.</i> 1996)
<i>Haplemur griseus alaotrensis</i>	No protection	No protection; key species for ongoing activities of Jersey Wildlife Preservation Trust, Jersey
<i>Propithecus tattersalli</i>	No protection	No protection
<i>Propithecus verreauxi coronatus</i>	No protection	No protection

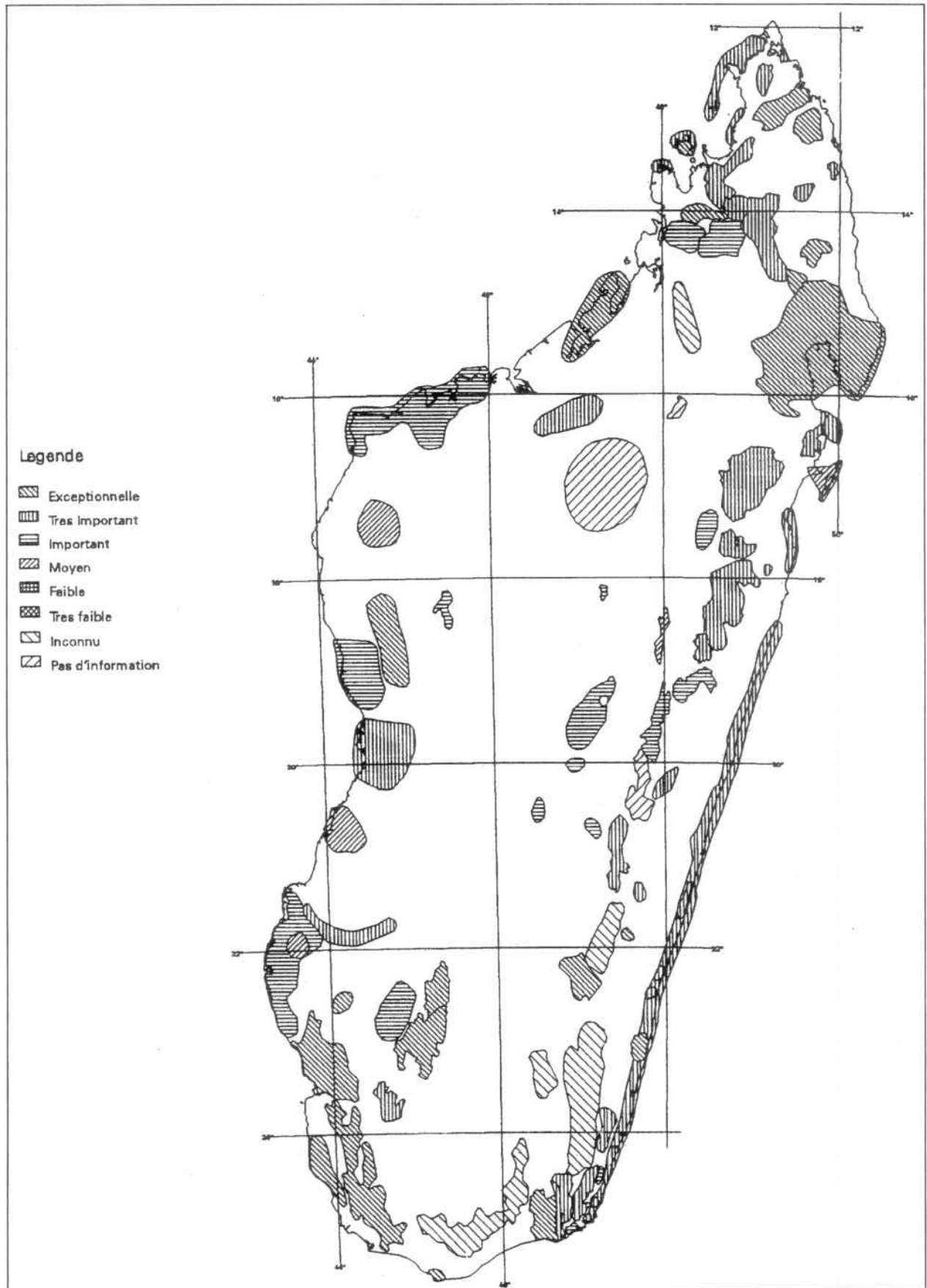


Fig. 8. Conservation priorities for Madagascar's biodiversity in general, as defined by the priority-setting workshop for Madagascar convened in April 1995 (map by Lata Iyer, from Hannah *et al.* 1996).

(Raxworthy and Nussbaum 1996, 1997). There is still substantial potential, therefore, for the discovery of new species in unprotected, and largely unexplored, areas. The need to identify precisely the full extent of the diversity of Madagascar's lemurs and their geographic ranges in order to implement comprehensive and realistic conservation measures is obvious.

- Except for a few sites, and some species in geographically-limited study areas (the results of which can not be extrapolated to the entire range of a species), we have neither clear ideas about population densities of the various lemur species, nor do we know the effective population size of any of the species. In addition, little is known about the genetic population structure, metapopulation dynamics, the minimum size of viable populations or about the possible consequences of disrupted gene flow and inbreeding in small populations for the long-term survival of lemurs (Arnaud *et al.* 1992; Rabarivola *et al.* 1996, in press; Leipoldt *et al.* 1996, in press; Tomiuk *et al.* 1997). This sort of information is desperately needed for future management of protected areas and for lemur action plans.
- Along a different line of argument, communication and public awareness about conservation projects, the role of ecosystem functioning, and the importance of lemurs for the Malagasy forests has to be improved. The creation of the Malagasy Primate Society (GERP), their activities and the growing number of dedicated Malagasy field primatologists are big steps towards this goal.
- National primatologists have to be promoted and supported so that they can spread the word about the importance of lemurs and natural Malagasy ecosystems to Malagasy public and government institutions.
- Finally, we need to learn more about possible ways of coexistence of humans and lemurs. One example is the understanding of the response of lemurs to disturbed and anthropogenic habitats, such as secondary forests and tree plantations. It is unlikely that sustainable use of the natural forests will cover the demands for fuel and construction wood arising from Madagascar's growing human population. Suitable alternatives to wood are unlikely to be found, at least in the short- to mid-term. There is an urgent need, therefore, for the establishment of tree plantations in Madagascar, not just on the high plateaux, but also around villages bordering natural forests. This measure has been neglected for far too long. Tree plantations, however, must not mean exclusively pine or Eucalyptus trees. There are a number of indigenous as well as exotic trees which could provide fuel, fruit, honey and timber for people, as well as suitable habitat for lemurs (e.g., Blaser *et al.* 1993). This is one of the major challenges and most important measures for the future, guaranteeing that pressure is removed from the few remaining natural forests. The bottom line is that lemur conservation can only be successful if economic improvement goes hand-in-hand with activities for forest protection. Everything else is essentially fiddling with symptoms rather than addressing the causes of the demise of the Malagasy forest ecosystems.

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# African Primate Conservation - The Species and The IUCN/SSC Primate Specialist Group Network

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## Introduction

Continental Africa's non-human primates range in size from the 70 g Demidoff's dwarf galago *Galagoides demidoffi*, to the 200 plus kg gorilla *Gorilla gorilla* (Figs. 1 and 2). Africa's primates are of particular interest and importance because they are key components of the continent's tropical forest ecosystems, often comprising a large proportion of the mammalian biomass in these ecosystems (Oates 1996a; Struhsaker 1997). They are widely used in biomedical research, are an important source of protein for many people in West and Central Africa, and are key to our understanding of hominid evolution. Man's three closest relatives, chimpanzee *Pan troglodytes*, pygmy chimpanzee (bonobo) *Pan paniscus*, and gorilla, all live in Africa, while other species, such as vervet monkey *Cercopithecus aethiops*, patas monkey *Erythrocebus patas*, and baboons *Papio* spp., live in environments that are believed to be similar to those in which our own species evolved. Primates are also the "flagship order" for the conservation of Africa's tropical forests and, in several places, a major source of tourism revenue (Butynski and Kalina 1998).

The Africa Section of the IUCN/Species Survival Commission (SSC) Primate Specialist Group (PSG) was formally established in 1981 (Mittermeier 1981) to help maintain the current diversity of primates in continental Africa, which is taken to include islands on the continental shelf (Bioko, Zanzibar, Pemba, etc.). A separate section was created for Madagascar, given the distinctiveness of the primate fauna there.

The PSG's Africa Section is now comprised of 105 members from 27 countries, 13 of which are African (Fig. 3). Approximately one-third (36) of the members live in Africa while most of the other members spend at least a few months each year on Africa-based primate research/conservation projects. The Section assists in the conservation of continental Africa's primates by: (1) establishing the current patterns of diversity and distribution of African primates; (2) assessing the threats to these primates; (3) establishing priorities for primate conservation projects; (4) helping to ensure that these projects are successfully implemented; and (5) promoting communication among those concerned with

the conservation of African primates. The principle underlying these activities is that information, habitat protection, and the support of local people are essential for successful *in situ* conservation of primates (Oates 1996a). This paper presents an overview on each of these five activities and describes the PSG's current "African primate conservation network".

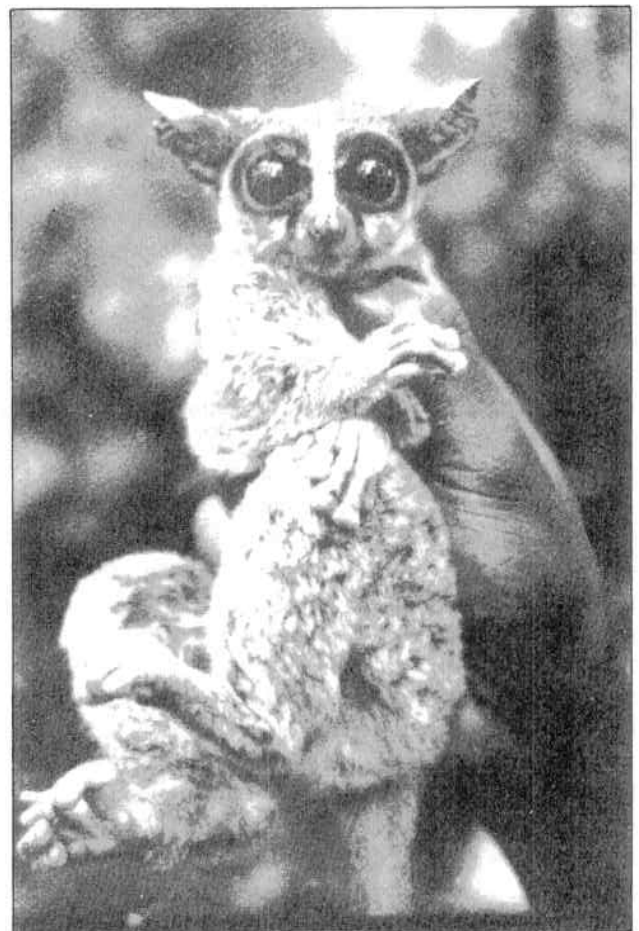


Figure 1. Eastern needle-clawed galago *Galago matschiei* in the Itombwe Forest, DRC. This is one of Africa's least known primates. Photograph by Tom Butynski.

## Patterns of Primate Diversity and Distribution

What is the diversity of African primates? Many important taxonomic questions remain unanswered (Gippoliti and Carpaneto 1995; Oates 1986, 1996a), but currently the generally accepted taxonomy, and the one used by the PSG's Africa-Section, recognizes three families, 20 genera, 64-68 species, and some 150-200 subspecies (IUCN 1996, Oates 1996a). Africa is one of the four major regions on earth for primate diversity with about 25% of the world's 268 or so species.

How are primates distributed over Africa? Most of Africa's tropical moist forests (Fig. 4), and therefore the vast majority of its primate species (Fig. 5), are found within 10 degrees of the equator. Forests within 10 degrees of the equator often have more than 10 sympatric species while some harbor 15 or more. The Ituri Forest in north-eastern Democratic Republic of Congo (DRC) (formerly Zaire), with 13 sympatric species of anthropoids, appears to have Africa's richest assemblage of diurnal primates (Hart *et al.* 1986). The number of prosimian species in the Ituri Forest is still uncertain but it would be surprising if fewer than three occur there.

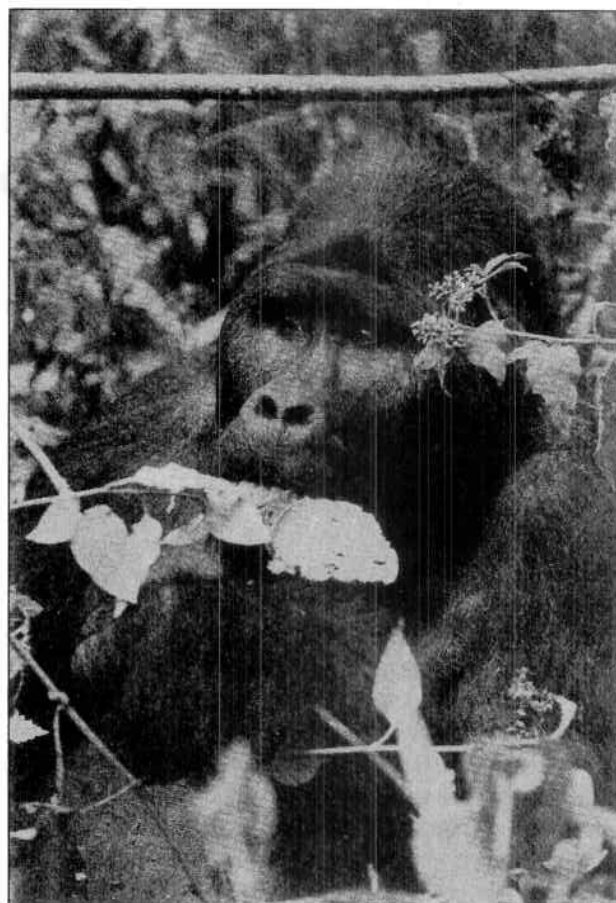
The country with the highest number of primate species is DRC with at least 33. DRC is followed by Cameroon with 31 species and Nigeria with 26. Countries in the southern quarter of Africa have five or fewer species of primates, while those in the northern quarter, where conditions are particularly dry and moist forests are absent, have one or no species. Morocco and Algeria, for instance, have only one species, the Barbary macaque *Macaca sylvanus*, while Tunisia, Libya and Egypt have none.

## Threats to Primate Populations

### Human Population Pressures

Human population growth rates are falling on all continents except Africa, where one-third of the people are already malnourished, the production of food per person continues to decline, and the scramble for scarce natural recourse (e.g., fertile farm land, moist forest) is giving rise to the breakdown of law and order, unmanageable conflict, and widespread human misery. Indeed, there is much evidence that the ecological carrying capacity of humans has been exceeded in several countries and regions in tropical Africa (e.g., Burundi, Rwanda, Uganda, eastern DRC).

At a growth rate of 2.9% per annum, Africa's population will double to more than one-and-a-half billion people by the year 2025 (WRI 1994) (Fig. 6). At that time, Africa's population will equal the combined populations of Europe, North America and South America (WRI/IIED 1988). This means that the demands for food, clothing, fuel and shelter will continue to grow rapidly. It also means that goals for education, health care, industrialization, self-sufficiency, and economic and political stability will become ever more difficult to achieve as the high population growth-rate consolidates the poverty, destroying the natural resource base and overwhelming efforts to achieve a sustainable future. In short, much of Africa is in a "demographic trap" wherein population growth and the concomitant environmental decline deny the people the economic growth that would enable them to reduce population growth (Myers 1993). Indeed, as Struhsaker (1997) puts it,



**Figure 2.** Adult male (silverback) eastern lowland (Grauer's) gorilla *Gorilla gorilla graueri* in Kahuzi-Biega National Park, DRC. Approximately 15,000 individuals of this species remain in several populations (Hall *et al.* in press). Photograph by Karl Ammann.

"One is faced with the dichotomy of allowing human populations to become even more impoverished, diseased, and malnourished through uncontrolled growth, or to provide incentives that discourage unsustainable growth and at least permit the possibility of better living standards".

The growth of human populations plays a prominent, probably predominant, role in environmental problems, serving as the main factor in tropical deforestation and in the loss of species (Myers 1993; Struhsaker 1997). Low density human populations have, for thousands of years, usually exploited primates and primate habitats sustainably. This changed during the 20th Century as Africa's human population increased rapidly and as the technologies for hunting primates and destroying their habitat continued to develop and expand. Today, most Africans are struggling to meet their short-term survival needs. In doing so, they are eroding primate populations directly through unsustainable hunting, and indirectly through habitat degradation and loss. Many species of African primates have suffered great declines in range and numbers, and this decline is occurring at an accelerating rate. One of the results for an increasing number of taxa is that they are confined to small, isolated populations. Such populations are susceptible to extinction not only from further habitat loss and over-exploitation, but also from stochastic events such as dis-



Figure 3. Nations of Africa.

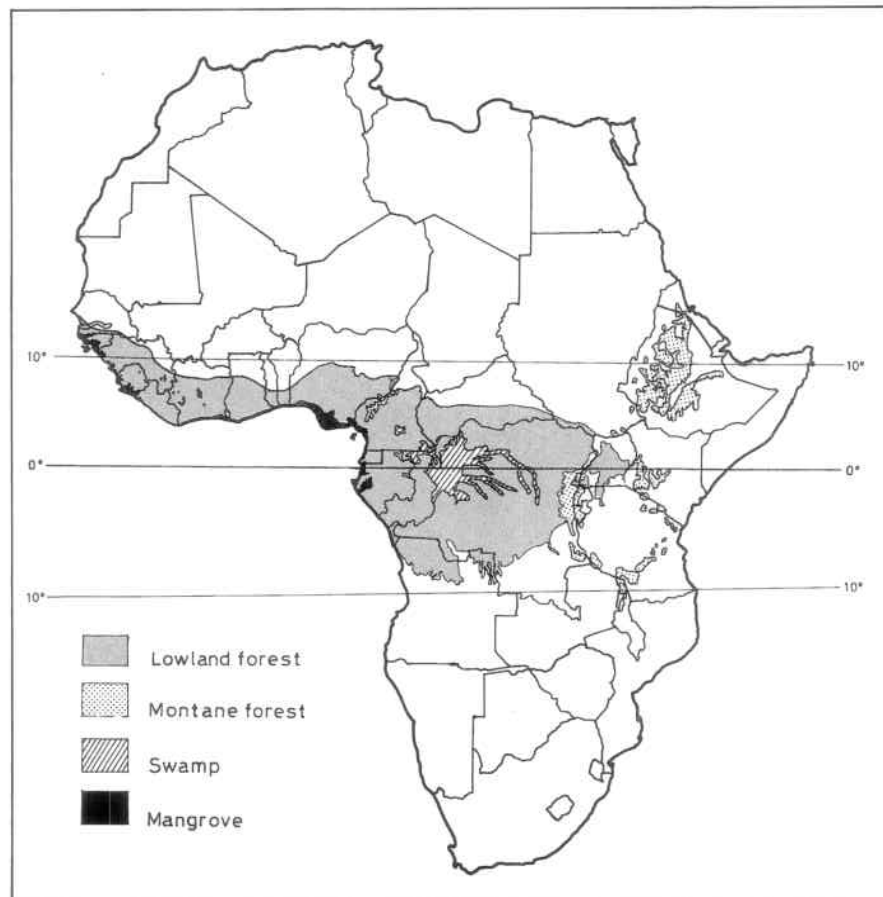


Figure 4. Distribution of tropical moist forests in Africa. Adapted from White (1983).

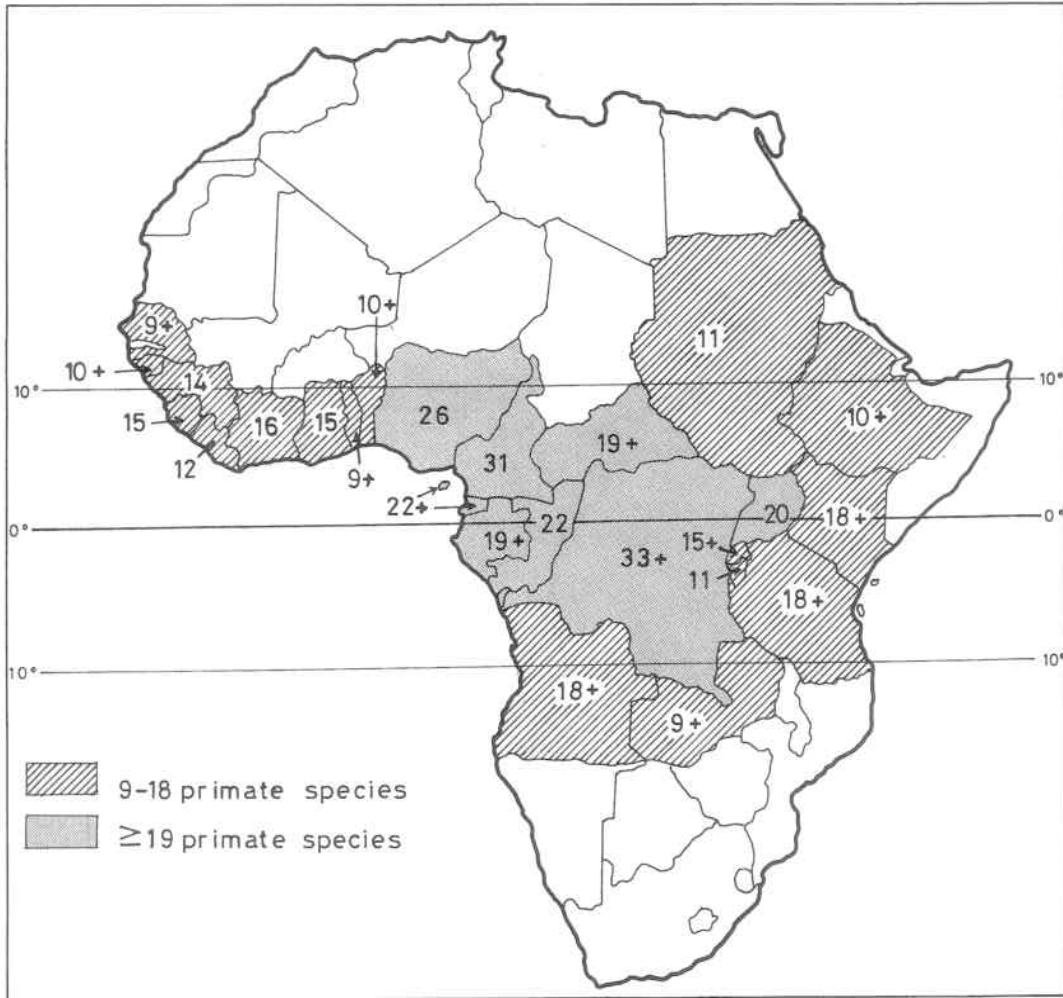


Figure 5. Approximate number of primate species in those African countries that hold nine or more species of primates. Data from Oates (1996a).

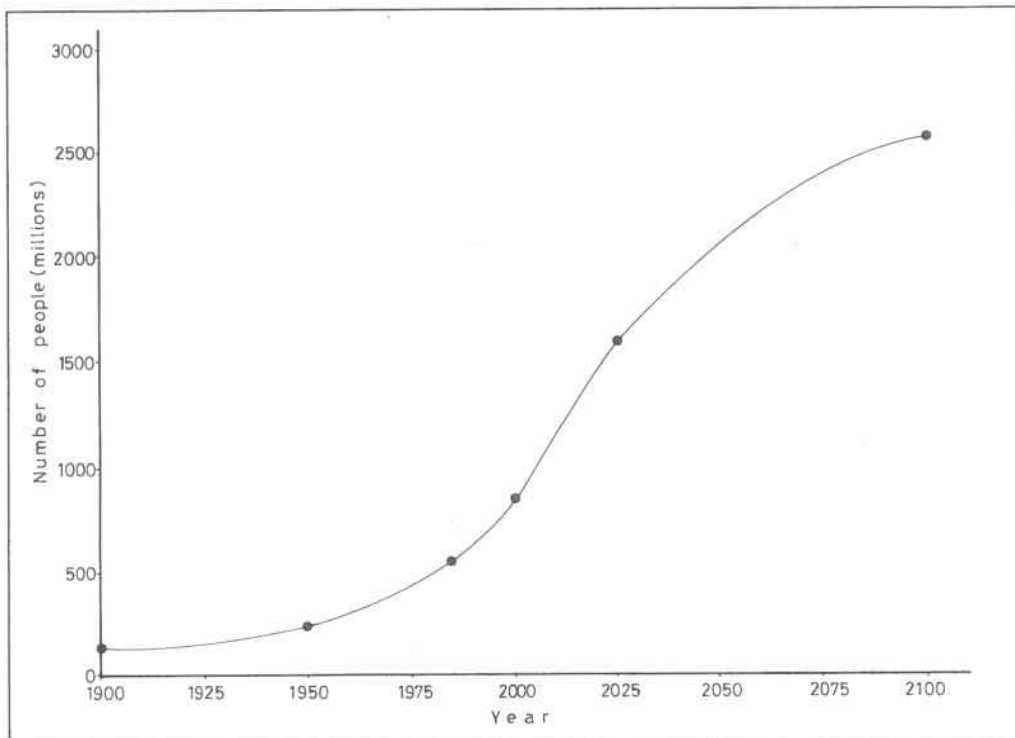
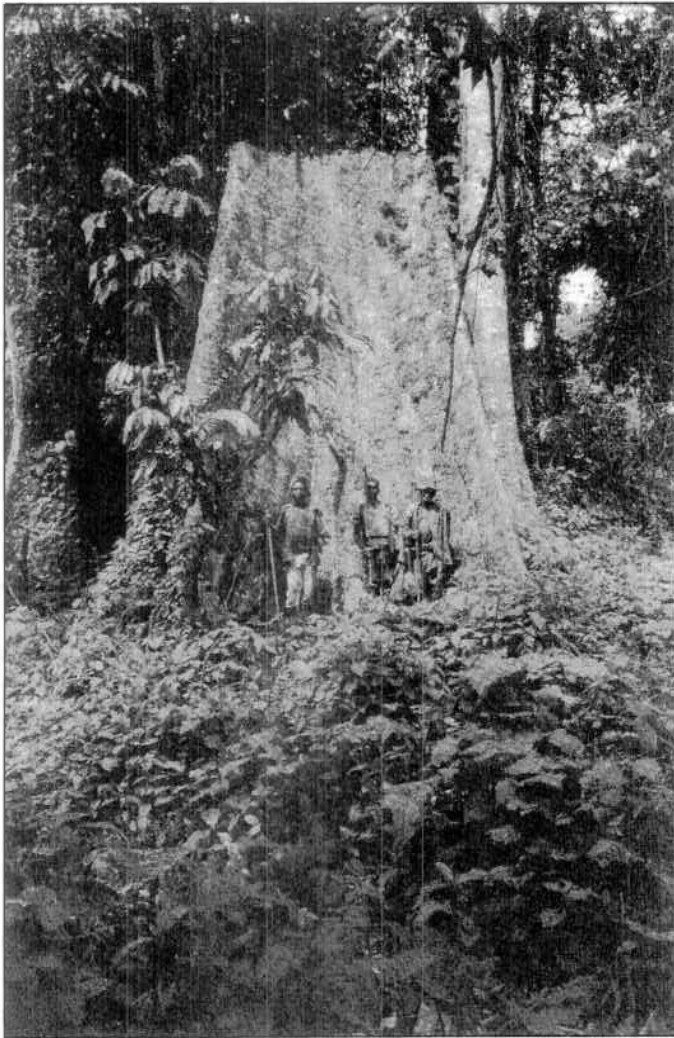


Figure 6. Human population trends in Africa: 1900-2100 (Merrick 1986).



**Figure 7.** Logging is often the first step in a process that leads to unsustainable hunting and complete loss of the forest. This is a specimen of the mahogany *Entandrophragma excelsum* cut by pit-sawyers in the Bwindi-Impenetrable National Park, Uganda. This tree was located at 1,700 m in an area used by gorillas, chimpanzees and five species of monkeys. Photograph by Tom Butynski.



**Figure 8** Destruction of gorilla habitat by farmers in the Bwindi-Impenetrable National Park, Uganda. This damage was preceded by logging and heavy hunting.

ease and fire (Gippoliti and Carpaneto 1995; Stevenson *et al.* 1992).

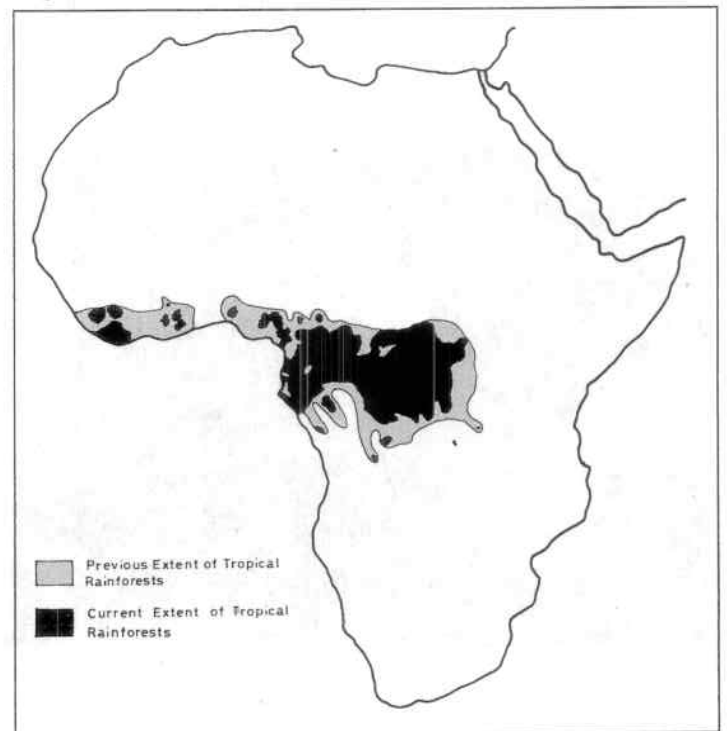
### Forest Loss

Tropical moist forests cover only about 10% (*c.* 2,170,000 km<sup>2</sup>) of Africa's land area. This is far less coverage than Asia's 32% or Latin America's 40% (WRI/IIED 1988). With deforestation exceeding reforestation in Africa by at least 13-fold (Deutscher Bundestag 1990), the destruction of forest habitat is a long-term threat to the survival of thousands of species, including the majority of primate species. The main proximate causes of this deforestation are logging (Fig. 7) and clearing for agriculture (Fig. 8). Contributing factors are the depletion of soil fertility and increased soil erosion that usually come with intensive agricultural use of already poor tropical soils. As soil fertility declines and crop yields fall, more forest must be cleared to maintain food production (WRI/IIED 1988). The net result is that the rate of tropical deforestation in Africa is higher than for any other continent (Fig. 9).

### Logging

Logging disturbs the composition and functioning of the forest ecosystem (Struhsaker 1997), while logging roads and logging trucks provide the means to get hunters and farmers into vast areas of remote forest and to export meat and crops (Bryant *et al.* 1997; Meder 1996b). These roads are often constructed by foreign logging companies working hand-in-hand with their governments' aid agencies. The countries of the European Union represent the most important market for tropical timber from Africa, accounting for 87% of exports in 1991 (Ammann and Pearce 1995). The United Kingdom and France are the two largest importers.

During the 1980s, timber exportation from the 10 countries supporting populations of gorillas increased four-fold (Kemf and Wilson 1997). Only six countries have more than 20% of their original forest cover remaining, while as many as 17 have less



**Figure 9.** Past and present distribution of tropical rainforests in Africa. Adapted from Hamilton (1976).

than 10% (Sayer 1992). Much of what remains is heavily degraded and fragmented (Bryant *et al.* 1997). Today, about 0.6% of Africa's tropical moist forest is destroyed annually, at which rate all will be completely cleared in 170 years. In Cote d'Ivoire and Nigeria, where tropical moist forest is being destroyed at an annual rate of roughly 5%, all moist forest could be lost by the year 2007 (WRI/IIED 1988).

There is no evidence that African forests can be successfully managed for the large-scale sustainable production of timber (Meder 1996b; Oates 1996b; Rietbergen 1992; Struhsaker 1997). One of the main problems is that the regulations governing forest exploitation are rarely, if ever, strong enough or effectively enforced to ensure that forests are managed sustainably. The problems for many African countries include political, social, demographic and economic instability, widespread weakness of law enforcement, bad economic policies, corruption, and short-sighted political decisions (Bryant *et al.* 1997; Rietbergen 1992; Terborgh 1992). The result is that the sustainable management of Africa's tropical moist forests has been ignored in favor of intensive exploitation that maximizes short term profits. This dictates that timber extraction is almost always an unmanaged and uncontrolled process that usually represents the first step in a series of events that end in the obliteration of the forest and its wildlife (Ammann and Pearce 1995, Meder 1996b).

### Hunting

Recent investigations have found that the bushmeat trade has increased significantly in Cameroon, DRC, Gabon and Congo, while European logging companies, mostly French, German, Italian, Belgian, Dutch and Danish, continue to increase their production of timber in the region (Ammann and Pearce 1995; Rose 1996). Heavy commercial hunting is today conducted at an unsustainable level in many places as hunters supply bushmeat to logging company workers and to expanding agricultural communities, as well as to people in distant towns and cities (Figs. 10 and 11). This trade is conducted without any scientific basis, legal controls or regard to wildlife protection laws (Kemf and Wilson 1997). Pri-



**Figure 10.** Spring-pole and wire snare monkey trap in the Bwindi-Impenetrable National Park, Uganda. In this forest these traps are primarily set to catch blue monkeys *Cercopithecus mitis stuhlmanni*, red-tailed monkeys *Cercopithecus ascanius schmidti*, and l'Hoest's monkeys *Cercopithecus lhoesti*. Photograph by Tom Butynski.

mates are among the most sought after species in many places.

At one logging concession in Gabon, 41% of the bushmeat provided to the workers came from primates (Ammann and Pearce 1995). Overall, primates appear to represent more than 20% of the bushmeat commerce in Gabon (Gippoliti and Carpaneto 1995; Steele 1994). Logging roads, the vehicles that use them, and firearms are the foundations of this trade (Blake 1994; Lahm 1996; Rose 1996; WSPA 1996). Logging companies, and agencies acting on their behalf, assist in every aspect of the bushmeat trade, often in direct contravention of the law (Ammann and Pearce 1995; Kemf and Wilson 1997; Wilkie *et al.* 1992).

The commercialization of the bushmeat trade is now probably a more significant and immediate threat than forest loss for several taxa of African primates, particularly colobus monkeys, drill *Mandrillus leucophaeus*, and mandrill *Mandrillus sphinx*, and the three great apes. In northern Congo, an estimated 400-600 gorillas are killed each year. In the 10,000 km<sup>2</sup> region of Kika, Moloundou and Mabele, Cameroon, roughly 25 hunters with shotguns kill an estimated 800 gorillas and 400 chimpanzees each year. The number of gorillas in this region is probably not more than 3,000. This level of off-take is not sustainable (Ammann and Pearce 1995; Kemf and Wilson 1997). Hunters have destroyed some primate populations and greatly reduced others. There are now large areas of suitable habitat where, as a result of hunting, primate densities have been greatly reduced and some primate species extirpated (Butynski and Koster 1995; Gippoliti and Carpaneto 1995; Lahm 1996; Oates 1996b; Rose 1996; Wilkie *et al.* 1992).

A recent World Society for the Protection of Animals (WSPA) campaign in the media has led to international protest against the frequent and widespread hunting of apes. The main focus of the campaign is to get the logging companies to account for the consequences of their activities on Africa's great apes and other wildlife, and to take measures to reduce the hunting. It is meeting with some success. For example, Congo has since banned the production of the shotgun cartridge used for hunting apes, and a loan by The World Bank to Cameroon to improve and expand its network of logging roads was put on hold because the effects of this project



**Figure 11.** The drill *Mandrillus leucophaeus* is Africa's most endangered primate. This species is heavily hunted throughout most of its small distributional range. This juvenile male drill was killed with a shotgun on Bioko Island, Equatorial Guinea, one of the last strong-holds for the species. Photograph by Tom Butynski.



on the environment remain unclear (Meder 1996a). WSPA is pushing for tougher controls on logging companies working in West and Central Africa, including tighter checks on the effects of European aid loans for road building in forest regions. Friends of the Earth is encouraging people buying lumber imported from the region to ensure that the timber comes from companies practicing sustainable forestry, including sustainable hunting. "The Bushmeat Project" is yet another international initiative which is trying to find ways to eliminate the over-hunting of Africa's wild animals, particularly primates (Rose 1996).

### Threatened Primates

There are four primary sources of information concerning the "degree of threat" for African primates. These are:

*Threatened Primates of Africa: The IUCN Red Data Book* (Lee *et al.* 1988) (referred to here as the "1988 Primate Red Data Book");

*The Conservation Assessment and Management Plan for Primates* (Stevenson *et al.* 1992) (referred to here as the "1992 Primate CAMP");

*African Primates: Status Survey and Conservation Action Plan* (Oates 1996a) (referred to here as the "1996 Primate Action Plan");

The 1996 IUCN Red List of Threatened Animals (IUCN 1996) (referred to here as the "1996 Red List").

The 1988 Primate Red Data Book reviews the conservation status of, and threats to, the more threatened African primates, as well as the measures needed or underway to reduce the threats. Although now nearly a decade old and in need of up-dating, the 1988 Primate Red Data Book remains one of the most important documents available for African primate conservationists.

The 1992 Primate CAMP is the product of collaboration among the PSG, IUCN/SSC Conservation Breeding Specialist Group (CBSG), the American Zoo and Aquarium Association's (AZA) Taxon Advisory Groups (TAGs), and others. This document: (1) reviews the wild and captive status of each primate taxon (i.e., species and subspecies); (2) assesses the degree of threat for each taxon according to the Mace and Lande (1991) Categories (note that this was the first draft of what eventually became the 1994 IUCN Red List Categories); and (3) recommends intensive management and information collection action to mitigate threats, such as population and habitat viability analysis (PHVA), *in situ* management, conservation oriented research, genome banking and

**Table 1.** Numbers of species and subspecies of African primates allocated to each category of threat as presented in the 1996 Red List (IUCN 1996). This listing is based on the 1994 IUCN Red List Categories (IUCN 1994).

Threat Category	No. Species (%) <sup>1</sup>	No. Subspecies
Extinct	0 (0)	0
Extinct in the wild	0 (0)	0
Critically endangered	0 (0)	3
Endangered	6 (9)	23
Vulnerable	7 (10)	5
Data deficient	5 (7)	14
Lower risk and near threatened	24 (35)	?
Lower risk and of least concern	26 (38)	?
<b>Total</b>	<b>68</b>	<b>?</b>

<sup>1</sup> Percentage of species in this category of threat.

captive breeding (see below).

The first *Action Plan for African Primate Conservation: 1986-90* was published in 1986 by the IUCN/SSC Primate Specialist Group (Oates 1986). The main objective of this plan was to "avert major losses in Africa's primate fauna". This well conceived and extremely useful action plan was recently replaced by the equally important 1996 Primate Action Plan (Oates, 1996a). These two documents not only summarize the primate conservation needs for Africa, they set priorities for conservation action. This is information vital to primate researchers and conservationists, as well as to those responsible for planning conservation strategies and allocating funds to projects that the PSG sees as necessary to protect the existing diversity of Africa's primate fauna.

In June 1995, IUCN asked the PSG's Africa Section to assist in the preparation of the 1996 Red List by reassessing the degree of threat status of all species of African primates using the new 1994 Red List Categories (IUCN 1994). The main objective of the 1996 Red List is to "highlight taxa threatened with extinction, and therefore promote their conservation." The 1996 Red List Categories are based on various kinds of information, including population size, extent of occurrence, degree of population fragmentation, and probability of extinction. This more rigorous and more quantitative system provides greater objectivity for assessing degree of threat of extinction.

Twenty-three members of the PSG's Africa Section reviewed and contributed information to the 1996 Red List. The total number of African primate species and subspecies assigned to each category of threat in the 1996 Red List is presented in Table 1. No species or subspecies of African primates has become extinct, and no species qualify for the category of "critically endangered", although three subspecies do. These are Miss Waldron's bay colobus *Procolobus badius waldroni*, mountain gorilla *Gorilla gorilla beringei*, and the possibly distinct, but as yet unnamed, form of gorilla on the Nigeria/Cameroon border. The world population for each of these three subspecies is believed to be fewer than 250 mature individuals. Six species (9% of 64), and 23 subspecies of African primates are now considered "endangered", while seven species (11%) and five subspecies are categorized as "vulnerable". Thus, the total number of threatened taxa of African primates currently stands at 41. There are five species and 14 subspecies considered "data deficient", some of which would probably qualify as threatened were adequate data on their status available (e.g., Dryas monkey *Cercopithecus dryas* and djam-djam monkey *C. aethiops djamdjamensis*). Nigeria harbors five of Africa's six endangered species of primates, while Cameroon, Equatorial Guinea and Zaire each have four endangered species.

Nineteen percent (13 of 68) of continental Africa's primate species are threatened whereas of the world's non-African pri-

**Table 2.** Numbers of threatened species of primates worldwide and in Africa according to the 1996 Red List (IUCN 1996). "Data deficient" species are not considered.

Threat Category	Worldwide	Africa (%) <sup>1</sup>
Extinct	0	0 (0)
Extinct in the wild	0	0 (0)
Critically endangered	13	0 (0)
Endangered	29	6 (21)
Vulnerable	54	7 (13)
<b>Total</b>	<b>96</b>	<b>13 (14)</b>

<sup>1</sup> Percentage of the world total in this category of threat.

mate species are threatened (IUCN 1996). Africa holds 14% of the world's 96 threatened species of primates (Table 2) and none of the world's 13 "critically endangered" primate species. This result is surprising as it suggests that, in spite of the lower coverage and more rapid loss of tropical moist forest in Africa than in Asia or the Neotropics, the overall situation for primate conservation in Africa may not be as critical as on these other two continents. I strongly suspect that this finding is more apparent than real, and that it is the result of the subjectivity (and, therefore, inconsistency) that is present in assessing "what is a species" and "what is a subspecies", as well as in the application of the 1994 IUCN Red List Categories. Whatever the case, we should all be concerned for the survival of primates in Africa as the situation is certainly rapidly worsening for all of those taxa that are dependent upon tropical moist forest.

The degree of threat category given to a particular species of African primate may differ depending on which reference source is used. This is primarily because the 1988 Primate Red Data Book, 1992 Primate CAMP, 1996 Primate Action Plan, and 1996 Red List all use (1) slightly different taxonomic classifications, (2) different criteria for assessing category of threat, and (3) different data sets. Here are a few examples. In 1988, Sclater's monkey *Cercopithecus sclateri* was not recognized as a species and its degree of threat was not, therefore, assessed by the 1988 Red Book. Today, the 1996 Primate Action Plan and 1996 Red List both recognized *C. sclateri* as "endangered". The Zanzibar red colobus is recognized as a full species (*Procolobus kirkii*) both by the 1988 Primate Red Data Book and 1992 Primate CAMP, and categorized as "endangered" and "critically endangered", respectively. The 1996 Primate Action Plan and 1996 Red List, however, give this animal subspecific status (*P. badius kirkii*). When viewed as but one of many subspecies of a widespread species, this mon-

key was assessed as "vulnerable".

There are some important differences between the 1996 Primate Action Plan and the 1996 IUCN Red List in terms of the degree of threat allocated to some species of primates. These are largely due to the use of different criteria. In particular, the 1996 Primate Action Plan employs much higher population thresholds than the 1996 Red List, while the 1996 Red List allows more for estimation, inference and projection where high quality data are not available.

One of the greatest concerns among African primatologists over the use of the 1994 IUCN categories criteria was that "its strict application would result in the down-grading of many taxa to lower threat categories than are widely felt to be reasonable." (Oates 1996a). As can be seen from Table 3, this did not occur; the 1996 Primate Action Plan lists two species of African primates as "endangered" while the 1996 Red List gives "endangered" status to six species.

Which are Africa's "endangered" primates? Once again, this depends to some extent on the list referred to. Table 4 shows that *M. leucophaeus* is listed as "endangered" on all four lists but that there are differences for the other species. The most obvious, and probably also the most important difference, is the listing of all three of Africa's great apes as "endangered" under the 1994 IUCN Red List categories criteria used in the 1996 Red Book. All three great apes qualify as endangered species because the majority of the PSG's Africa Section members working with these species believed that they met "Criterion A2". That is, based upon observed or suspected changes in area of occupancy, extent of occurrence, quality of habitat and levels of exploitation, they projected that the wild populations of these three apes would decline by at least 50% over the next three generations. For all three species of great ape, three generations is taken to be 75 years.

**Table 3.** Numbers of species of African primates allocated to each category of threat by the 1988 Primate Red Book (Lee *et al.* 1988), 1992 Primate CAMP (Stevenson *et al.* 1992), 1996 Primate Action Plan (Oates 1996a), and 1996 Red List (IUCN 1996).

Threat Category	Number of Species (%) <sup>1</sup>			
	1988 Red Book	1992 Primate CAMP	1996 Action Plan	1996 Red List
Critically endangered	nac <sup>2</sup>	4 (14)	0 (0)	0 (0)
Endangered	5 (23)	3 (11)	2 (17)	6 (46)
Vulnerable	13 (62)	21 (75)	10 (83)	7 (54)
Rare	3 (14)	nac	nac	nac
<b>Total</b>	<b>21</b>	<b>28</b>	<b>12</b>	<b>13</b>

<sup>1</sup> Percentage of threatened species in each threat category.

<sup>2</sup> nac = "not a category" used in the respective work.

**Table 4.** Endangered species of African primates as indicated in the 1988 Primate Red Book (Lee *et al.* 1988), 1992 Primate CAMP (Stevenson *et al.* 1992), 1996 Primate Action Plan (Oates 1996a), and 1996 Red List (IUCN 1996).

Species	1988 Red Book	1992 Primate CAMP	1996 Action Plan	1996 Red List
<i>Mandrillus leucophaeus</i> Drill	*	*	*	*
<i>Cercopithecus preussi</i> Preuss's monkey	*	*		*
<i>Cercopithecus erythrogaster</i> White-throated monkey	*	+		
<i>Cercopithecus erythrotis</i> Red-eared monkey	*			
<i>Cercopithecus sclateri</i> Sclater's monkey		+	*	*
<i>Cercopithecus solatus</i> Sun-tailed monkey		+		
<i>Colobus satanas</i> Black colobus	*			
<i>Procolobus kirkii</i> Zanzibar red colobus		+		
<i>Pan paniscus</i> Pygmy chimpanzee				*
<i>Pan troglodytes</i> Chimpanzee				*
<i>Gorilla gorilla</i> Gorilla				*
<b>Total</b>	<b>5</b>	<b>6</b>	<b>2</b>	<b>6</b>

+ "critically endangered" species

\* "endangered" species

**Table 5.** African primates listed as "conservation priority" species in the 1996 Primate Action Plan (Oates 1996a) and as "endangered" species in the 1996 Red List (IUCN 1996).

Species	1996 Action Plan	1996 Red List
<i>Mandrillus leucophaeus</i> Drill	*	*
<i>Cercopithecus preussi</i> Preuss's monkey		*
<i>Cercopithecus diana</i> Diana monkey	*	
<i>Cercopithecus sclateri</i> Sclater's monkey	*	*
<i>Pan paniscus</i> Pygmy chimpanzee	*	*
<i>Pan troglodytes</i> Chimpanzee	*	*
<i>Gorilla gorilla</i> Gorilla	*	*
<b>Total</b>	<b>6</b>	<b>6</b>

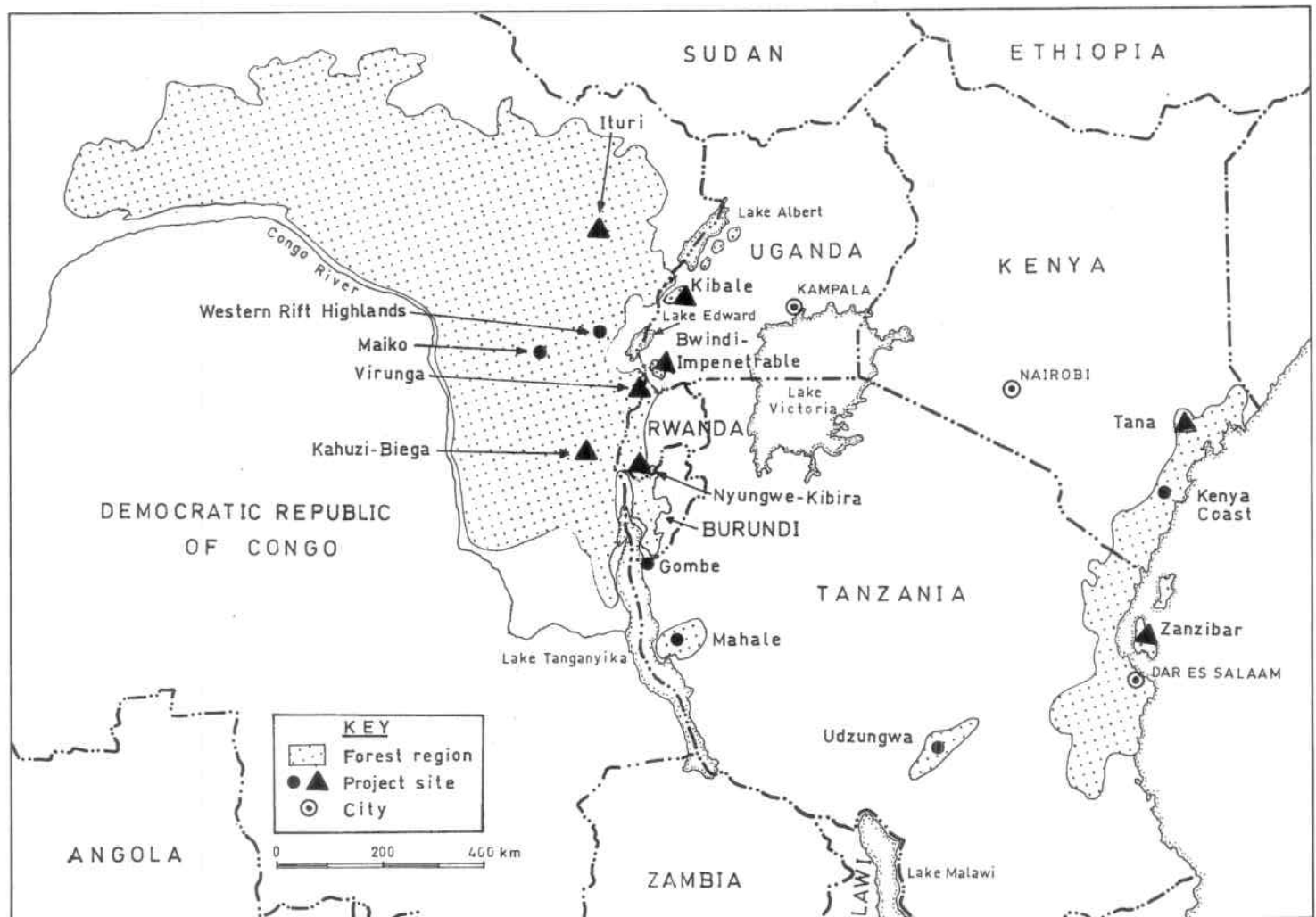
### Priority Species for Primate Conservation

The 1996 Primate Action Plan goes well beyond a listing of the degrees of threat to each species of African primate. Using a point rating system based on three parameters, the 1996 Primate Action Plan provides a priority rating for conservation action for each species. The three parameters are: (1) degree of threat for the species; (2) taxonomic uniqueness of the species; and (3) whether the species is present in an effective protected area.

Table 5 lists the six species of African primates indicated by the ranking system of the 1996 Primate Action Plan as in greatest need of conservation action. Interestingly, five of these species

are among the six that the 1996 Red Book lists as "endangered". In other words, the ranking system used for establishing conservation priorities for African primates in the 1996 Primate Action Plan provides a list similar to that obtained using the 1994 IUCN Red List Categories criteria for the category "endangered". This should not be surprising since the 1994 IUCN Red List Categories are designed to highlight "those species under higher extinction risk, so as to focus attention on conservation measures designed to protect them." That two different approaches and sets of criteria yield similar lists of species for priority action gives us confidence that we indeed have the correct suite of African primate species on which to focus conservation efforts.

The 1996 Primate Action Plan indicates that all but four of Africa's primate species presently occur in at least one effectively protected conservation area. The four "unprotected" species are Somali galago *Galago gallarum*, black mangabey *Lophocebus aterrimus*, *C. dryas* and *C. sclateri*. The absence of an effective sanctuary for *C. sclateri* is of particular concern as this is one of Africa's most endangered primates (Tables 3 and 4). Hunting and habitat loss have relegated this species to but a few small populations that are themselves under threat of further fragmentation (Tooze 1995).



**Figure 12.** Locations of the 14 priority primate conservation sites recommended for eastern Africa in the 1986 Primate Action Plan. Adapted from Oates (1996a). Not all of the forests in the region are shown on this map. The solid triangles depict the locations of nine sites that have received at least US\$ 1 million in conservation funds over the past decade.

### Priority *In Situ* Projects for Primate Conservation

The 1996 Primate Action Plan reviews the 42 priority African primate conservation projects that were recommended 10 years ago in the 1986 Primate Action Plan, summarizes what was accomplished and the problems encountered, makes recommendations for further action on these projects, and identifies three new project sites (southern Somalia, Benin, Niger Delta). Impressive progress has been made over the last decade.

- There was at least some achievement of objectives on 90% (38) of the proposed projects.
- For 21% (9) of the proposed projects, most or all of the objectives were achieved, at least in the short-term.
- For 45% (19) of the proposed projects, the objectives were partly achieved.
- War, civil unrest or political instability seriously affected 26% (11) of the proposed projects, either by disrupting a project in progress (10) or by making project initiation impossible (1).
- While complete sets of data on primate conservation efforts for Africa are not available, I am familiar with many of the ongoing primate and forest conservation projects in eastern Africa (i.e., Burundi, Kenya, Rwanda, Tanzania, Uganda, and eastern DRC). Of the 14 priority primate conservation sites (Fig. 12) recommended for eastern Africa by the 1986 Primate Action Plan, all have since received some conservation inputs and five (36%) have met the conservation objectives as outlined in that plan (Oates 1996a).

Over the last 10 years, at least nine (64%), perhaps 10 (71%), of the 14 sites have each received over US\$ 1 million in conservation, development and research funds, and no fewer than four of the sites have each obtained more than US\$ 5 million in funding. Although all of these areas have an important biodiversity and high conservation values, they were "sold to the donors" primarily because the primates within them served as effective "flagship" species. The major international donors supporting these efforts were the European Union (EU), the Finnish International Development Agency (FINNIDA), the German Technical Cooperation Agency (GTZ), the United States Agency for International Development (USAID), and The World Bank. Numerous secondary donors also contributed significant, and often timely, support to all sites.

Here I briefly describe the four priority primate conservation sites in eastern Africa that have received more than US\$ 5 million over the past decade. In what follows, (DD) = "data deficient"; (NT) = "near threatened"; (V) = "vulnerable"; and (E) = "endangered" (IUCN 1994).

*Kahuzi-Biega National Park, DRC (6,000 km<sup>2</sup>)*. Supports 13-15 species of primates, including owl-faced monkey *Cercopithecus hamlyni kahuziensis* (V), l'Hoest's monkey *Cercopithecus lhoesti* (NT), Angolan black-and-white colobus *Colobus angolensis prigoginei* (DD), *P. badius foai* (DD), *P. troglodytes schweinfurthi* (E), and *G. gorilla graueri* (E). GTZ is supporting a major integrated conservation and development project for Kahuzi-Biega. This includes improved protection, chimpanzee, gorilla and elephant censuses, guard training, extension and conservation education, and restructuring of the gorilla tourism program to lessen distur-

bance to gorillas (von Richter 1991).

*Kibale Forest National Park, Uganda (766 km<sup>2</sup>)*. Supports 11-12 species of primates, including eastern needle-clawed galago *Galago matschiei* (NT), *C. lhoesti* (NT), *P. badius tephrosceles* (NT), and *P. troglodytes schweinfurthi* (E). USAID, EU and the Wildlife Conservation Society have provided more than US\$ 7 million towards numerous research and conservation initiatives in this park. These include establishing the Makerere University Biological Field Station, development of primate and nature tourism, park protection, buffer zone management, community out-reach, and numerous research projects focused on primates, rodents, birds and the impact of selective logging on the forest ecosystem (Struhsaker 1997).

*Bwindi-Impenetrable National Park, Uganda (330 km<sup>2</sup>)*. Supports 10-11 species of primates, including *G. matschiei* (NT), *C. lhoesti* (NT), *P. troglodytes schweinfurthi* (E), and *G. gorilla* (subspecies probably *graueri*) (E). USAID, The World Bank, World Wildlife Fund and CARE have contributed to a wide range of conservation and development activities in and around this park. These funds have been used to establish the Institute of Tropical Forest Conservation, and to support the following activities: biological inventories, applied ecological research, training, conservation education, community conservation and extension, multiple-use of forest products, law enforcement, and development of gorilla tourism. The World Bank, through its Global Environmental Facility (GEF), has initiated a US\$ 5.5 million trust fund for this park and for the Mgahinga Gorilla National Park (Butynski 1985; Butynski and Kalina 1993).

*Tana Primate National Reserve, Kenya (171 km<sup>2</sup>)*. Supports eight species of primates, including Zanzibar galago *Galago zanzibaricus* (NT), Garnett's greater galago *Otolemur garnettii* (NT), *P. badius rufomitratu*s (E), and crested mangabey *Cercocebus galeritus galeritus* (E). The World Bank, through the GEF, has granted US\$ 6.2 million to support conservation efforts in and around the Tana Primate National Reserve. These funds, to be allocated over 5 years, are to support research, monitoring, community conservation, buffer zone development, and reserve protection, management and development activities (Butynski and Mwangi 1995).

I estimate that no less than 40 million dollars have been spent or allocated over the past 10 years towards the direct and indirect conservation of the 14 eastern Africa priority sites listed in the 1986 Primate Action Plan. Several more tens of millions of conservation dollars have gone into other eastern Africa forests over the past decade. All of these forests hold primate populations and important biodiversity.

Some of this money was put to good use as several priority primate conservation sites appear secure in at least the medium-term (e.g., Bwindi-Impenetrable National Park, Mgahinga Gorilla National Park, Kibale National Park, Tana River Primate National Reserve, Udzungwa Mountains National Park). On the other hand, some funds have done more harm than good (Oates 1996; Struhsaker 1997, pers. obs.). Unfortunately, a number of the primate and forest "conservation" projects in eastern Africa and elsewhere have been driven and misguided by politics and economics (both nationally and internationally), while research findings and the recommendations of trained, experienced, and independent professionals have often been ignored. This has frequently resulted

in the funding of exploitive activities that can neither be managed nor controlled over the longer-term. Such activities are extremely risky and, ultimately, unsustainable. The promotion of tourism on small, already highly endangered, populations of gorillas by African governments, international donors, "conservation" NGOs, and various interest groups is a prime example of this problem (Butynski and Kalina 1998).

The unwise use of conservation funds is one reason why countries in tropical Africa continue to lose their moist forests, and why many primate populations continue to be threatened. We need to find ways to do a better job with the increasingly large amounts of money available for primate and forest conservation.

### Priority *Ex Situ* Projects for Primate Conservation

As natural habitats and primate populations continue to be reduced and fragmented throughout Africa, increasing numbers of primate taxa will require support from *ex situ* (captive) programs. In general, captive populations and programs support conservation strategies for primates in four ways (Koontz 1997; Stevenson *et al.* 1992; Wiese and Hutchins 1997): (1) as living ambassadors that educate the public at all levels and generate funds for *in situ* conservation; (2) as scientific resources that provide information and technologies beneficial to the protection and management of populations in the wild; (3) as genetic and demographic reservoirs that reinforce survival of taxa in the wild, either by revitalizing populations that are languishing in natural habitats or by re-establishing populations that have become extinct; and (4) as fundraising programs that provide considerable financial support for *in situ* primate conservation.

Resources for implementing and sustaining captive management programs are, of course, limited. This means that priorities must be determined for the allocation of resources to these programs. The 1992 Primate CAMP (Stevenson *et al.* 1992) is a first attempt at developing a strategic overview and framework for the effective and efficient application and allocation of captive resources to the conservation of the world's primates. This plan reviews the wild status (see above) and captive status of all primate taxa and, based upon these assessments, provides a set of recommendations for conservation action. Specifically, the recommendations are in response to the following questions: (1) What taxa are in need of intensive attention involving the captive community? (2) How can taxa already in captivity be optimally managed to meet the conservation needs of the broad group of taxa under consideration? (3) How can responsibilities for captive programs be best distributed among organized regions of the global captive community?

The 1992 Primate CAMP resulted in the following findings.

- There are roughly 12,000 African primates in the world's zoos. The number that might be in laboratories and in private collections was not reported.
- There are now a total of 68 taxa of African primates in captivity.
- Of the 156 taxa of African primates that the 1992 Primate CAMP recognizes, 65 (42%) are threatened (44 species and 21 subspecies).
- The following are some of the more important recommendations of the 1992 Primate CAMP.
- That 46 species (70% of all African primate species) and four subspecies be managed in captivity. All but four of these taxa are already represented in captivity. The four unrepresented taxa are angwantibo *Arctocebus calabarensis*, *G. zanzibaricus*, *C. sclateri*, and *P. badius*. As of 1992, roughly 35 (70%) of these taxa were represented in captivity by fewer than 50 individuals.
- That population viability assessments (PVAs) be undertaken for six species and seven subspecies.
- That captive populations sufficient to preserve 90% of the average heterozygosity of the wild gene pool for 100 years be developed for 11 species and eight subspecies. This includes all seven of the species listed as "conservation priority" species in the 1996 Primate Action Plan and/or as "endangered" species in the 1996 Red List (Table 5).
- That for 21 species and 17 subspecies, a captive nucleus of 50-100 individuals, representing at least 98% of the wild gene pool, be developed and maintained in captivity.
- That *in situ* management and protection projects be implemented for 11 taxa, that field surveys be conducted for 42 taxa, and that taxonomic research be undertaken on 44 taxa.

### Communication

As indicated above, one of the primary activities of the PSG is to promote communication among people involved with the conservation of primates. Five important publications have already been described. Three other publications contributing significantly to the conservation of African primates are mentioned here.

*Primate Conservation*, The Journal of the Primate Specialist Group, was initiated in 1981. It maintains a section devoted to articles on the conservation of African primates. *The Action Plan for Pan paniscus* (Thompson-Handler *et al.* 1995) is the first "single species" action plan for any African primate. Similar action plans have been proposed for *P. badius* and *M. leucophaeus*. There will probably be a series of single species action plans published over the coming decade. These are much needed for all of Africa's endangered primate species. Lastly, in 1995, the PSG's Africa Section launched its biannual publication, *African Primates*. This 50 page newsletter is specifically designed to promote and support primate conservation in Africa. More than 3,100 copies of each issue are printed, and the mailing list now contains over 1,200 addresses.

### Recommendations

The ultimate cause of the decline of Africa's primate fauna is the continent's rapidly expanding human population and the related poverty. The main proximate causes of this decline are (1) unsustainable levels of hunting, and (2) habitat degradation and loss due to unsustainable logging and agricultural practices.

Until much more attention is given to the problem of over-