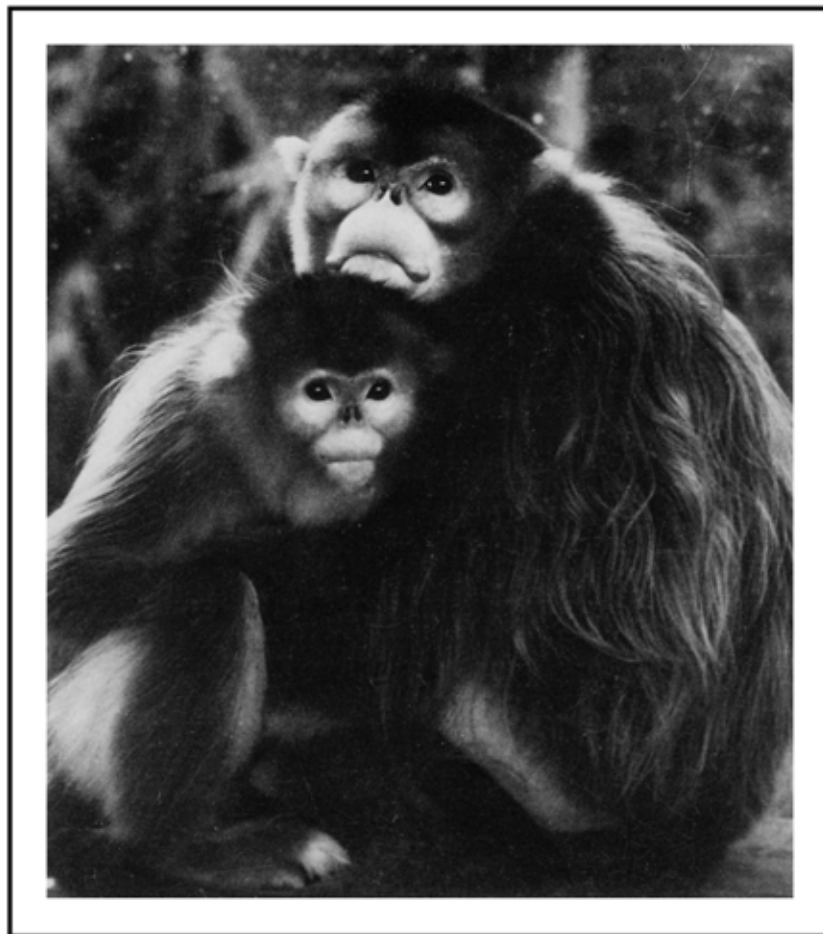


IUCN/SSC PRIMATE SPECIALIST GROUP
ACTION PLAN FOR
ASIAN PRIMATE
CONSERVATION:
1987-91



Compiled by
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University of California, Riverside



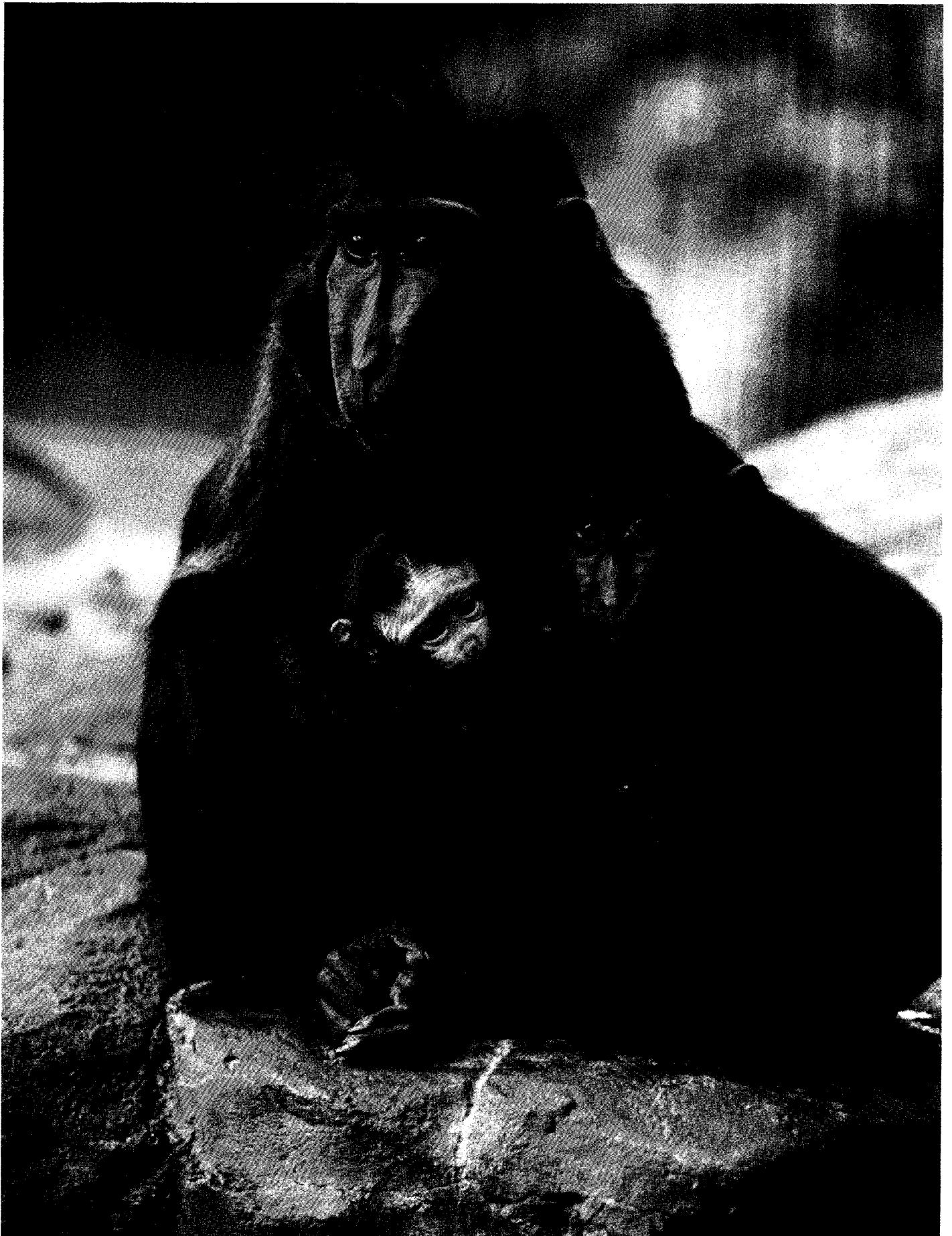
Cover photo: The Chinese golden monkey or Sichuan golden snub-nosed monkey (*Rhinopithecus roxellana*) (photo by Richard Tenaza).

IUCN/SSC PRIMATE SPECIALIST GROUP ACTION PLAN FOR ASIAN PRIMATE CONSERVATION: 1987-91

Compiled by
A.A. Eudey
University of California, Riverside
and
Regional Coordinator for Asia
IUCN/SSC Primate Specialist Group

February 1987





The Celebes black macaque (*Macaca nigra*). The species occurs in Dumoga-Bone National Park, the most important reserve in Sulawesi, Indonesia (photo by Tom Cajacob, Minnesota Zoo).

Foreword

In 1977, Sir Peter Scott, then Chairman of the IUCN Species Survival Commission, asked all Specialist Group Chairmen to prepare Global Conservation Strategies for the animal groups for which they were responsible. In response to this, the Primate Specialist Group prepared a 325 page document that included 69 projects costing a total of \$3,104,250. Though never published or widely circulated, this document represented the first attempt to approach primate conservation problems on a global rather than merely local basis, and also the first attempt to establish international priorities for primate conservation.

This Global Strategy was sent to a number of conservation organizations and attracted the attention of two in particular, World Wildlife Fund and the New York Zoological Society, which immediately began funding projects identified in this plan. Less than two years later, World Wildlife Fund also established its own Primate Program to deal with international conservation problems. This program has been able to find support for and implement some 125 projects, large and small, in over 30 countries. In addition to many other primate conservation activities, it produces *Primate Conservation*, the Journal and Newsletter of the IUCN/SSC Primate Specialist Group, which is the major means of communication among the world's primate conservationists.

The New York Zoological Society has also continued a major involvement in primate conservation, and further support has come from such organizations as Wildlife Preservation Trust International, the Brookfield Zoo, the National Geographic Society, the Fauna and Flora Preservation Society and the Frankfurt Zoo. It is not unfair to say that a good portion of this interest in primate conservation can be attributed to the work of the Primate Specialist Group and the concern generated by the original Global Strategy for Primate Conservation.

Unfortunately, the original Global Strategy is now 10 years old and quite out-of-date. A new global review is in order, so that we can continue to follow sound scientific guidelines in determining our interna-

tional primate conservation priorities during the remainder of this decade.

Since our data base on primates and their conservation has grown tremendously over the past few years, it is no longer practical to prepare a single global plan. Instead, we are preparing *regional* action plans for Africa, Madagascar, Asia and the Neotropical region. The African Action Plan, compiled by John F. Oates, appeared in 1986 and has been very well received. This Asian Action Plan, compiled by Dr. Ardith A. Eudey, in collaboration with the Asian Section of the Primate Specialist Group, is the second in the series, and plans for Madagascar and the Neotropical Region will appear later in 1987 or in early 1988.

This Asian Action Plan summarizes both the primate *and* tropical forest conservation needs of Asia in a clear and succinct manner, and we hope that it will help to stimulate the kind of action required to make sure that *all* Asian primate species survive in their natural habitats. All that is needed is a little more than \$4,000,000 over the next five years, a very small sum in global terms, especially when we consider what is at stake and what we stand to lose if we are unable to undertake the projects identified.

It should also be noted that this plan would never have been possible without the time and energy that Dr. Eudey has dedicated to it and the expertise that she has accumulated in two decades of work on Asian primates. On behalf of the whole Species Survival Commission, I would like to take this opportunity to thank Dr. Eudey and the other members of the Asian Section of the Primate Specialist Group for their outstanding contributions to this important document. Thanks also to World Wildlife Fund and to UNEP for making the publication of this plan possible.

Russell A. Mittermeier
Chairman, IUCN/SSC Primate
Specialist Group

Compiler's note and acknowledgments

This plan is the second in a series of regional action plans for primate conservation being prepared under the auspices of the IUCN Species Survival Commission. It has evolved from the first Global Strategy for Primate Conservation, which was prepared by R.A. Mittermeier in January 1978, and its format conforms to that established by J.F. Oates in September 1985 for the Action Plan for African Primate Conservation: 1986-90. Earlier, notable efforts to establish priorities for the conservation of Asian primates include those of D.J. Chivers, on behalf of the Conservation Working Party of the Primate Society of Great Britain, and C.W. Marsh.

In February 1983, in order to initiate work on the present plan, a request for conservation projects was sent out to members of the Asian Section of the IUCN/SSC Primate Specialist Group and other concerned primatologists and conservationists working in Asia. The information received was compiled into a list of projects circulated for comment in June 1983. A revised list subsequently was circulated in January 1984. In October 1985, a draft of this plan was distributed for review. Comments on that draft were incorporated into a final draft that received limited distribution in November 1986. Comments on the second draft, and new information received up to February 1987, have been incorporated into this version.

For the information, advice, and encouragement that they have provided during this long process, I wish to express my gratitude to the following: G. Agoramoorthy, M.F. Ahsan, R. Ali, J.B. Alvarez, Jr.,

P. Andau, S. Azuma, A. Baker, E.L. Bennett, L. Berenstain, N. Bishop, D. Brandon-Jones, W.Y. Brockelman, E. Brotoisworo, J.O. Caldecott, D.J. Chivers, C. Edwin, J. Erwin, J. Fooden, B.M.F. Galdikas, S.P. Gittins, C.P. Groves, E.H. Haimoff, M.A. Huffman, Ji Weizhi, J.M. Johnson, M. Kavanagh, M.A.R. Khan, A. Kumar, D.G. Lindburg, J.R. MacKinnon, K.S. MacKinnon, B.O. Manullang, C.W. Marsh, J.T. Marshall, A. Mitchell, R.A. Mittermeier, S.M. Mohnot, J. Moore, R.P. Mukherjee, J.F. Oates, J. Payne, M.C. Pearl, F. E. Poirier, C.H. Southwick, C. Stanford, J. Sugardjito, R.R. Tenaza, R. Wirth, and V. Weitzel. Special thanks are due M.D.F. Udvardy for having made available unpublished maps of the revised Indomalayan biogeographical provinces. M. Panelli and, especially, A.K. Phillips assisted in the initial efforts to gather information for the plan. Editing and design of this publication were carried out by R.A. Mittermeier and S.D. Nash. S.D. Nash drew the final maps.

All efforts have been made to ensure that the finished plan reflects the best expert advice available. Disagreement among the experts over details was reviewed at length. Any biases, errors, or omissions that are still present are the responsibility of the compiler.

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Riverside, February 1987

INTRODUCTION

A number of factors set Asian primates apart from the primate faunas found elsewhere in the world. To a degree that is not exhibited by other primates, Asian species play significant roles not only in rain forest ecosystems but also in a variety of arid and especially temperate ecosystems. In contrast to the basically continental distribution of African and Neotropical primates, Asian primates are found in significant numbers and kinds in both continental and island areas, although their colonization of islands sometimes has given rise to endemism with low diversity. Although the major events of human evolution appear to have been enacted in Africa rather than Asia, Asia is unique in having two ape families, the endemic Hylobatidae as well as the Pongidae, and reassessment of the evolutionary significance of the *Ramapithecus* (*Sivapithecus*) fossils has renewed interest in the history of the Asian orang-utan.

The history of Asian primates has been intertwined with that of the human population for millennia. There is no other region in the world where commensalism between other primates and humans is so well established, which is, in part, a consequence of the toleration and respect (or at least avoidance) that has been afforded primates and sometimes all animals by several of Asia's major religions. This toleration may be breaking down as secularism becomes more widespread, however.



A hermit plays his pipe while feeding Hanuman langurs (*Semnopithecus entellus*) at Mt. Abu, India. The commensalism between humans and other primates in many regions of Asia has deep roots in religion (photo by Jim Moore/Anthro-Photo).

A set of factors also combine to present unique problems for conserving primates and maintaining their diversity in Asia. Asian primates have suffered heavily from trapping for export (e.g., Asia has been the overall major supplier of primates for biomedical research during the 20th cen-

tury), guerrilla warfare and saturation bombing, and excessive habitat destruction (e.g., Asian forests are the major source of hardwoods used for plywood and veneers). Conservation problems are acute, not only because of these factors, but also because of the general high levels of human population pressure throughout Asia, which have existed in many regions for centuries.

This is the Action Plan for the period 1987-91 developed by the Asian Section of the Primate Specialist Group of the IUCN/SSC to protect Asia's threatened primate fauna. It is the second in a series of action plans for the world's major primate faunas being prepared by the Primate Specialist Group. The African Action Plan was compiled initially by J.F. Oates (1985), and that action plan is serving as a model for subsequent compilations, including the present one.

The Primate Specialist Group is one of several groups of experts providing technical assistance to the Species Survival Commission of the International Union for Conservation of Nature and Natural Resources (IUCN), which is headquartered in Gland, Switzerland. The Primate Specialist Group, under the chairmanship of R.A. Mittermeier, has set itself the major goal of maintaining 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.

Human population increase and the associated exploitation of natural resources make it inevitable that a large part of the world's primate populations and their (forest) habitats will be lost. The Primate Specialist Group feels that, with respect to action directed specifically at primate populations and their habitats, these losses can be mitigated best by:

(1) setting aside protected areas for endangered and vulnerable species;

(2) creating large national parks and reserves in areas of high primate diversity and/or abundance;

(3) maintaining or increasing the effectiveness of parks and reserves that already exist; and

(4) creating or increasing public awareness of the need for primate conservation and the importance of primates both as part of the natural heritage of the countries in which they occur, and as important components in environmental systems whose proper functioning is vital for human well-being.

The principles underlying these goals are that effective habitat conservation is essential for the survival of wild populations, and that conservation will not work if people living in areas where primates occur do not benefit from and fully support conservation efforts.

As a scientific advisory group, we feel that the most appropriate action the Primate Specialist Group can take to help in achieving these goals is to determine the current patterns of diversity and distribution of the Asian primate fauna, to assess the threats it faces, and to suggest priorities among specific projects aimed at the establishment and management of protected areas. Surveys may be an integral part of these projects where the distribution and status of primate populations are judged to be poorly known. Human expansion makes it increasingly more difficult to establish large, strictly-protected reserves in representative biogeographical provinces and subprovinces and districts. As a consequence, the Primate Specialist Group may be involved in determining what forms of multi-use management do the least damage to primate populations and encouraging the implementation of this management, much in agreement with the biosphere reserve concept. The effectiveness of any conservation plan is contingent upon the extent to which it takes into account local and political realities, and this underscores the need for primate conservation efforts to become essential components of national heritage and resource conservation or development programs.

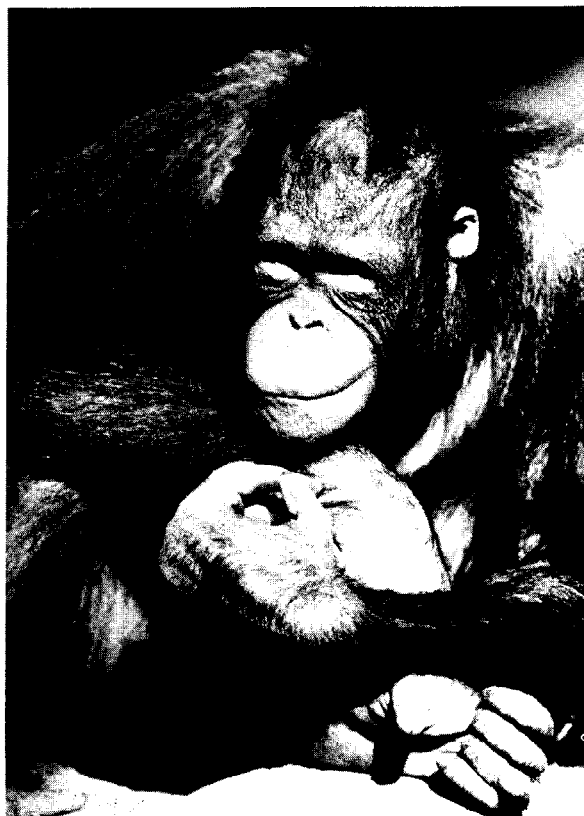
The emphasis of this Action Plan on establishing priorities for surveys and reserve management programs should not be construed to mean that other activities such as captive breeding to recover critically endangered species, ending all illegal and otherwise destructive traffic in primates, or promoting educational programs are not considered important by the

Primate Specialist Group. On the contrary, there is a very real need throughout much of Asia to educate the public about the need for and the value of all aspects of conservation. Likewise, scientists and managers in habitat countries should be provided with every opportunity to participate in conservation training programs at home and abroad.

To achieve the goal of maintaining primate diversity, the current pattern of diversity first must be established. This has required drawing up a catalogue of distinct forms and mapping their patterns of geographical distribution, paying attention to areas such as those occupied by a large number of different forms but also those occupied by marginal or peripheral populations. Having established these existing patterns of diversity and distribution, it has been necessary to assess the relative degree of threat faced by individual forms and by local groups of forms (or communities) in order to determine priorities for conservation action. This Action Plan, therefore:

- (1) presents a species list of Asian primates;
- (2) assesses the degree of threat to each of these species, as well as noting distinctive subspecies and marginal populations that may be under threat;
- (3) reviews the distribution of Asian primate communities in respect to biogeographical provinces, noting communities with high levels of species diversity or species endemism;
- (4) lists projects needed to better conserve threatened primate species and communities, with an estimate of cost; and
- (5) establishes priorities among these projects, based on the number of primate species involved, their taxonomic uniqueness, and the degree to which they are endangered.

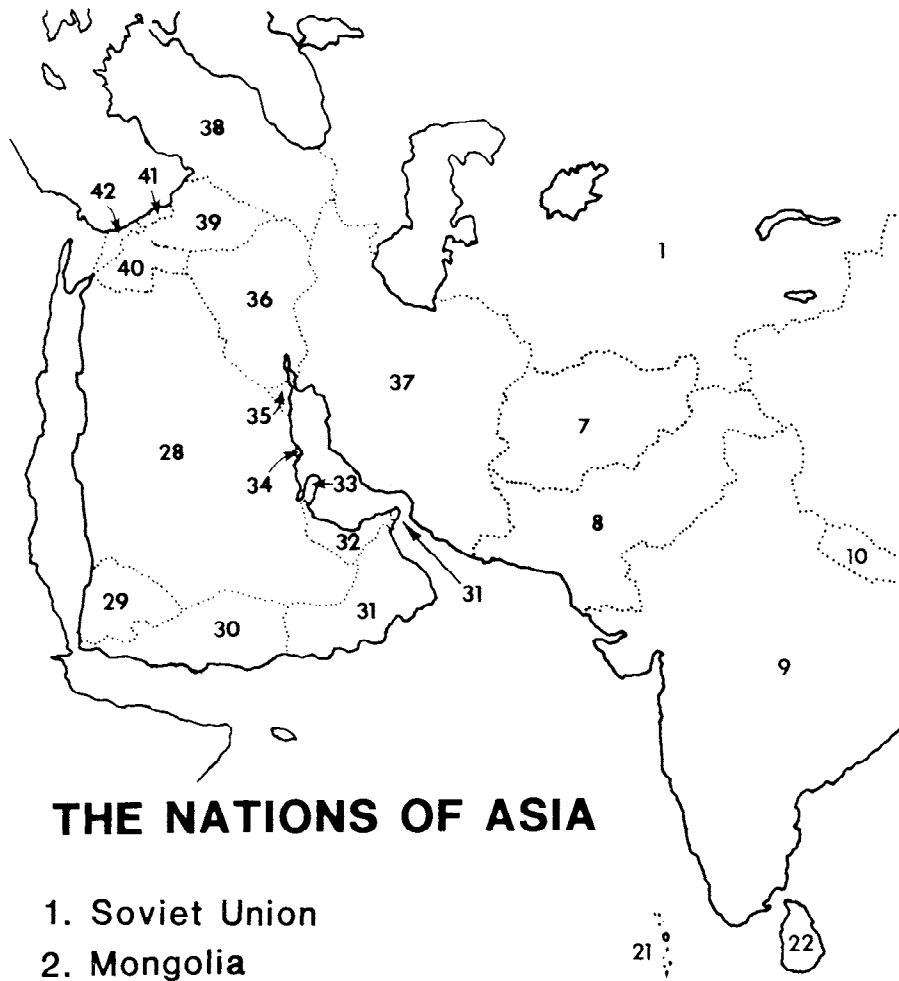
It is hoped that this Action Plan will further the development and implementation of national conservation programs for primates in Asia as well as indicate regions in which international programs may contribute most effectively to primate conservation.



The orang-utan (*Pongo pygmaeus*), whose distribution includes Borneo and northernmost Sumatra, is the only great ape in Asia (photo by Andrew Young).



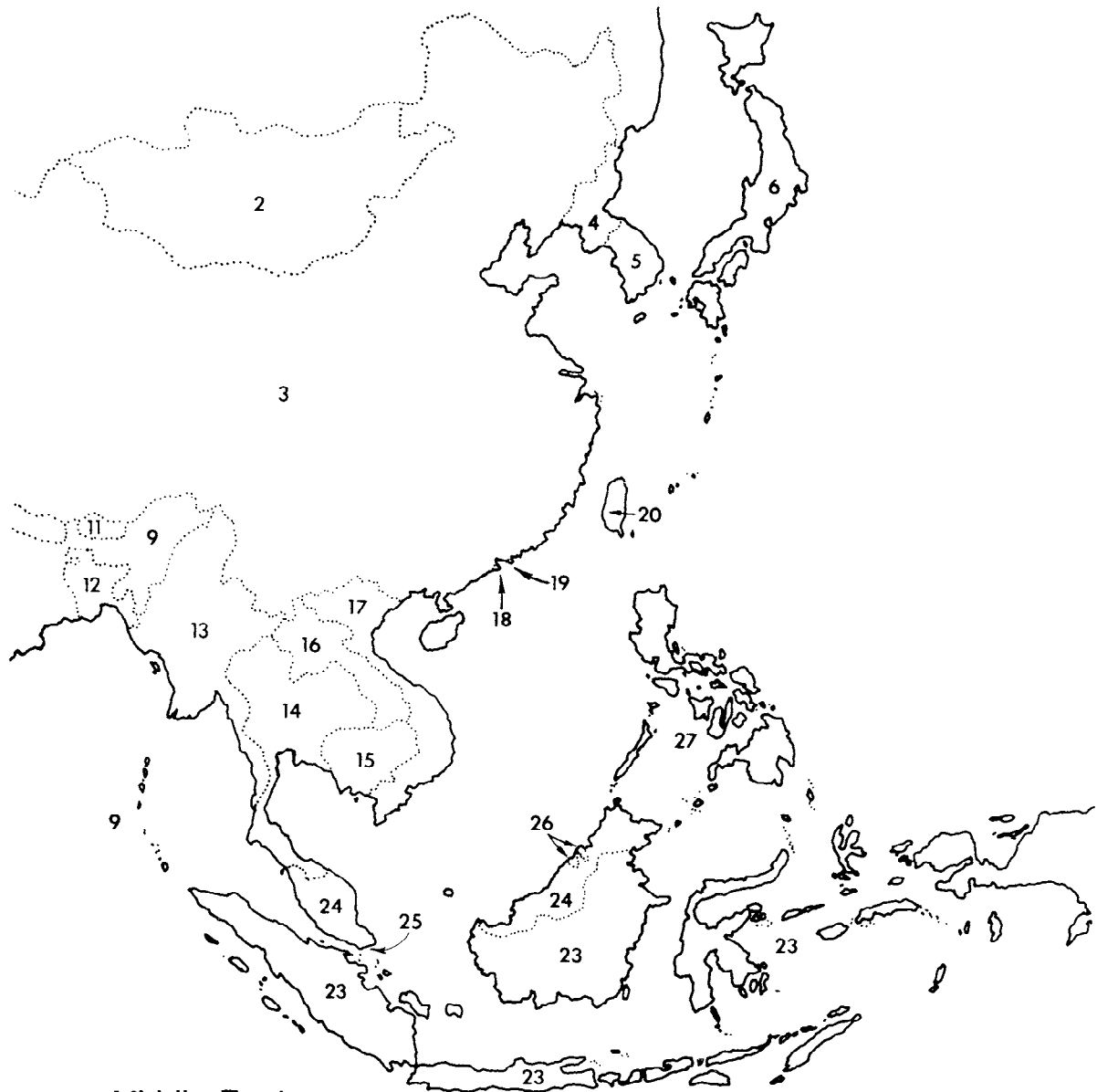
Rhesus macaques (*Macaca mulatta*) along a roadside in north India. Roadside populations have long been censused in India. From the 1930's to 1978, India was the major exporter of rhesus macaques. An Indian ban on the export of all primates became effective in April 1978, by which time the total population of rhesus macaques may have dropped to no more than 200,000. Local recoveries have been recorded subsequent to the ban (photo by Charles H. Southwick).



THE NATIONS OF ASIA

- | | |
|-----------------|-----------------------|
| 1. Soviet Union | |
| 2. Mongolia | |
| 3. China | |
| 4. North Korea | 16. Laos |
| 5. South Korea | 17. Vietnam |
| 6. Japan | 18. Macau (Portugal) |
| 7. Afghanistan | 19. Hong Kong |
| 8. Pakistan | 20. Taiwan |
| 9. India | 21. Maldives |
| 10. Nepal | 22. Sri Lanka |
| 11. Bhutan | 23. Indonesia |
| 12. Bangladesh | 24. Malaysia |
| 13. Burma | 25. Singapore |
| 14. Thailand | 26. Brunei Darussalam |
| 15. Kampuchea | 27. Philippines |

Map 1. The nations of Asia. Primate species lists for the countries with primates are contained in Appendix I (map by Stephen Nash).



Middle East:

- | | |
|--|-------------|
| 28. Saudi Arabia | 35. Kuwait |
| 29. Yemen Arab Republic | 36. Iraq |
| 30. People's Democratic Republic
of Yemen | 37. Iran |
| 31. Oman | 38. Turkey |
| 32. United Arab Emirates | 39. Syria |
| 33. Bahrain | 40. Jordan |
| 34. Qatar | 41. Lebanon |
| | 42. Israel |

Classification

Asian primates are represented by five families: LORISIDAE (lorises); TARSIIDAE (tarsiers); CERCOPITHECIDAE (Old World monkeys); HYLOBATIDAE (lesser apes or gibbons); and PONGIDAE (great apes, of which the orang-utan is found in Borneo and Sumatra). Extant species of the families Tarsiidae and Hylobatidae are found only in Asia.

To ensure that no taxonomically distinct populations are overlooked for conservation action, a conservative classification has been adopted in the Action Plan. Most populations or sets of populations that are recognized in the relatively recent literature as genera or species are accorded that rank. This procedure agrees with that used in the *Action Plan for African Primate Conservation* (Oates, 1985), following the practice of the compilers of the IUCN *Red Data Books*. For some Asian primate populations additional field work appears essential to resolve questions of taxonomic distinctness, especially at the species level.

The Lorisidae are represented in Asia only by the subfamily Lorisinae. Two genera customarily are recognized. Following Groves (1971b), *Nycticebus* is regarded as consisting of two species, *N. coucang*, with four subspecies, and the more primitive *N. pygmaeus*. A single species of *Loris*, with six subspecies, is recognized throughout south India and Sri Lanka (Hill, 1953), although all populations may not be conspecific (see Groves, 1971b).



The pygmy loris (*Nycticebus pygmaeus*) is known only from Laos and Vietnam. This rare prosimian is reported to be exploited for medicinal purposes in Vietnam (photo by Rolf Petterson, courtesy of Jonas Wahlström, Skansen-Akvariet).

The Tarsiidae contain only the genus *Tarsius*. Three species commonly were recognized throughout the island distribution of the genus in Southeast Asia (Hill, 1955). The lesser spectral tarsier, found in the highlands of central Sulawesi, recently was demonstrated to be a true species (*T. pumilus*), distinct from the larger and more widespread spectral tarsier (*T. spectrum*) [Niemitz, 1984; Dagosto and Musser, 1986; Musser and Dagosto, 1987]. MacKinnon and MacKinnon (1980), on the basis of vocalizations, suggest that there may be several distinct species on Sulawesi, corresponding to the diversity of macaques recorded on the island. Greater species diversity may be present elsewhere, although Niemitz (1984), on the basis of morphological characters, recognizes only two subspecies for the western tarsier (*T. bancanus*) and no subspecies for the Philippine tarsier (*T. syrichta*).



A group of stump-tail macaques (*Macaca arctoides*). The large male (right) examines the infant with its pale natal coat (photo by Ramon J. Rhine).

The classification of the Cercopithecoidea presents the greatest problem. With the exception of populations of hamadryas baboons (*Papio hamadryas*) in the southwest of the Arabian peninsula, the subfamily Cercopithecoinae is represented in Asia exclusively by the genus *Macaca*, of which the only non-Asian population is the North African Barbary macaque (*M. sylvanus*). The number of macaque species remains problematic. Current classifications include at least 13 but no more than 19 species. Disagreement about the number of species primarily revolves around specific identification of macaques on Sulawesi (Hill, 1974; Fooden, 1969, 1975; Thorington and Groves, 1970; Groves, 1980; Napier, 1981), although Hill's (1974) assignment of these macaques to two different genera, *Macaca* and *Cynopithecus*, has not been supported. Following Fooden (1969), seven species of Sulawesi macaques provisionally are recognized here: *M. maura*, *M. nigra*, *M. nigrescens*, *M. ochreata*, *M. brunescens*, *M. tonkeana*, and *M. hecki*. In addition, the Mentawai Islands macaque, which is classified as a subspecies of *M. nemestrina* by Fooden (1975), is recognized here as a distinct species, *M. pagensis* (see Tenaza, 1975, in press; Crockett Wilson and Wilson, 1977; Whitten and Whitten, 1982).

Within the genus *Macaca*, debate over the affinities of populations is expressed by species group allocations, which are important in assessing the degree of taxonomic uniqueness of populations. Fooden (1976b) considers *M. arctoides* to be the sole representative of the *arctoides* group, which is accepted here, although Delson (1980) assigns the species to the *sinica* group, along with *M. assamensis*, *M. radiata*, *M. sinica*, and *M. thibetana*. *M. thibetana* commonly was regarded as a subspecies of *M. arctoides* until Fooden (1976b, 1983) and Fooden *et al.* (1985) described a number of anatomical features which indicate that they are distinct species.

The Asian Colobinae, as is also true for the African assemblage of the subfamily (see Oates, 1985), has no generally accepted classification, but all recent classifications do make a distinction between a group of "odd-nosed" and other colobine monkeys. Among the former, the extent of distinctness on both the generic and specific levels is problematic. Groves (1970) and Thorington and Groves (1970), for example, proposed that *Rhinopithecus* be grouped with *Pygathrix* and that *Simias* be grouped with *Nasalis*, but recently Groves (in litt. 1984) has accepted the generic distinctness of *Rhinopithecus*, and, on the basis of morphological differences (and distribution), he recognizes the three populations of Chinese snub-nosed monkeys as distinct species, the position likewise assumed by Chinese taxonomists (Li and Lin, 1983). In recent classifications of the Colobinae, both Brandon-Jones (1984) and Napier (1985) continue to treat *Rhinopithecus* as a subgenus. Brandon-Jones' treatment of the two subspecies of the Douc monkey as distinct species, *P. nemaus* and *P. nigripes*, is accepted here, however, on analogy with *Rhinopithecus*. Brandon-Jones also unites *Simias* with *Nasalis*,



The stump-tail macaque (*Macaca arctoides*) may be persecuted as a crop raider as its forest habitat throughout southern Asia is converted for agriculture. This male had been shot and impaled as a scarecrow to discourage further ravages of a corn field planted by Hmong hill folk in mountainous western Thailand (photo by Ardith A. Eudey).

but Napier treats the two taxa as distinct genera. The most conservative classification for the "odd-nosed" colobines is adopted here (see Ellerman and Morrison-Scott, 1966; Chasen, 1940; Napier and Napier, 1967).

The other Asian colobines have been regarded as congeneric and assigned to *Presbytis*, for which four species groups tentatively were recognized (see Groves, 1970; Thorington and Groves, 1970; Napier and Napier, 1967). Recent identifications have led to the following designations for the species groups: *melalophos* (ex-*aygula-melalophos*) group; *cristata* group; *entellus* group; *vetulus* (ex-*senex*) group (Napier, 1985). This assemblage of populations still appears to be most seriously in need of taxonomic and nomenclatural revision.

There is increasingly compelling evidence, including the results of a morphological and dietary analysis of Southeast Asian colobines by Weitzel (1983), to make a bipartite or tripartite split on the genus level among the species presently assigned to *Presbytis*. Brandon-Jones (1984, in litt. 1986) treats *Presbytis* and *Semnopithecus* as separate genera, with *Trachypithecus* as a subgenus of *Semnopithecus*. His practice of calling the former "sureli," and the latter "langur" and "leaf monkey" respectively, while potentially useful, is not entirely satisfactory due to the restricted use of this native term. Groves (in litt. 1985; Weitzel *et al.* in press), in contrast, supports a multigeneric model of *Presbytis*, in which both *Semnopithecus* and *Trachypithecus* are resurrected as distinct genera. Both Brandon-Jones and Groves consider that the distinction between *Trachypithecus* and *Kasi* is untenable. The tripartite classification proposed by Groves tentatively is accepted here. For purposes of consistency, the taxonomic and nomenclatural revisions proposed by Weitzel (1983), Groves (in litt. 1984, in litt. 1985), Weitzel and Groves (1985), and Weitzel *et al.* (in press) likewise are accepted:

(1) *Presbytis comata* is accepted as the correct name for the grizzled leaf monkey in west Java formerly designated *Presbytis aygula* (Weitzel and Groves, 1985).

(2) *Trachypithecus auratus* is accepted as the correct name for the Javan colobine formerly designated "*Presbytis cristata pyrrhus*" (Weitzel and Groves, 1985), with the Bali leaf monkey becoming *T. auratus kohlbruggei* (Groves, in litt. 1985). Brandon-Jones (1984) includes a population in northwestern Vietnam usually classified as Francois' leaf monkey in this species, which is not followed here.

(3) *Presbytis femoralis*, also found in Sumatra and Borneo, provisionally is accepted as the correct name for the Malayan peninsula banded leaf monkey generally known as *Presbytis melalophos* (Miller, 1934; Weitzel, 1983). The latter species is considered to be restricted in distribution to Sumatra (Weitzel, 1983; Brandon-Jones, 1984). *P. femoralis* is the least clear grouping of *Presbytis* and may consist of several species rather than one.

In addition, following the change in the scientific name of the species from *senex* to *vetulus*, as proposed by Brandon-Jones (see Napier, 1985), *Trachypithecus vetulus* is accepted here as the correct name for the purple-faced leaf monkey of Sri Lanka.



The grizzled leaf monkey (*Presbytis comata*, formerly named *P. aygula*) is restricted to a number of forest patches in west and central Java (photo by Russell A. Mittermeier).

During the next five years significant taxonomic and nomenclatural revisions will continue to occur for the Asian Colobinae. Brandon-Jones (1984) already has assigned the numerous southwest Indian langur subspecies to the species *Semnopithecus hypoleucos*, distinct from the more widespread *S. entellus*. Brandon-Jones (1984, in litt. 1986) also has proposed the relegation of "*Presbytis phayrei*" to subspecific status and the resurrection of "*Semnopithecus (Trachypithecus) barbei*," although Napier (1985) considers that the status of *barbei* is still in doubt. Likewise, the standing of the six (or even seven) taxa comprising the *Trachypithecus francoisi* group remains uncertain. In 1957 Tan (1985) proposed the white-headed leaf monkey of southwestern Guangxi, China, as a distinct species, "*P. leucocephalus*," but Li and Ma (1980) consider it to be a subspecies of "*P. francoisi*," having found intermediate types between the two. The taxa of the *francoisi* group are treated here as subspecies, but there is increasing evidence to assign them all species standing (Brandon-Jones, 1984, in litt. 1986; Groves, in litt. 1985).

The classification of the Hylobatidae is that used by Haimoff *et al.* (1982, 1984) and Marshall and Sugardjito (1986), in which *Symphalangus* is synonymized with *Hylobates*, and nine lesser ape species are recognized. Four subgenera are recognized, of which three are monotypic. Some debate remains about the number of species comprising the genus and their distribution. Dao (1983) suggests, for example, that the all-black and light-cheeked groups of subspecies of *H. concolor* are distinct

species, *H. concolor* and *H. leucogenys*, respectively. This distinction is supported by Chinese biologists (see Ma and Wang, 1986). Recent field work in Yunnan, China suggests that *H. concolor concolor* may differ from other gibbons in habitat preference and family group structure (Haimoff *et al.*, in press). However, significant differences in the vocalizations of the two subspecies groups have not been detected to date (J.T. Marshall, pers. comm. 1987). Disagreement about specific status, however, primarily has involved the "lar group," which comprises five forms of gibbons distributed allopatrically over much of mainland southeast Asia and the major islands of the Sunda Shelf (for recent discussion of the problem see Creel and Preuschoft, 1984; Haimoff *et al.*, 1984; Groves, 1984; and Marshall and Sugardjito, 1986). The five species accepted here for the "lar group" generally have been recognized in the field (Marshall and Marshall, 1976; Marshall *et al.*, 1984; Marshall and Sugardjito, 1986; Chivers, 1977; Brockelman and Gittins, 1984).

The classification of the Pongidae is that in most widespread use and is followed by Honacki *et al.* (1982) and by Wolfheim (1983). Bornean (*Pongo pygmaeus pygmaeus*) and Sumatran (*P. pygmaeus abelii*) subspecies of the orang-utan commonly are recognized (Groves, 1971a, 1986; J.R. MacKinnon, 1974; Rijksen, 1978).

For reasons of clarity, old nomenclature is included with new nomenclature in the lists of primates for individual Asian countries in Appendix 1.

Table 1
List of Asian Primate Species

Arranged by Family, Subfamily and Species Group or Subgenus

Species	Common Name
Family Lorisidae	
Subfamily Lorisinae	
<i>Loris tardigradus</i>	Slender loris
<i>Nycticebus coucang</i>	Slow loris
<i>Nycticebus pygmaeus</i>	Pygmy loris
Family Tarsiidae	
<i>Tarsius bancanus</i>	Western or Horsfield's tarsier
<i>Tarsius pumilus</i>	Lesser spectral tarsier
<i>Tarsius spectrum</i>	Spectral or Sulawesi tarsier
<i>Tarsius syrichta</i>	Philippine tarsier
Family Cercopithecidae	
Subfamily Cercopithecinae	
<i>Papio hamadryas</i>	Hamadryas baboon
silenus-sylvanus group	
<i>Macaca silenus</i>	Lion-tailed macaque
<i>Macaca nemestrina</i>	Pigtail macaque
<i>Macaca maura</i>	Moor macaque
<i>Macaca nigra</i>	Celebes black macaque
<i>Macaca nigrescens</i>	Gorontalo macaque
<i>Macaca ochreatra</i>	Booted macaque
<i>Macaca brunnescens</i>	Muna-Butung macaque
<i>Macaca tonkeana</i>	Tonkean macaque
<i>Macaca hecki</i>	Heck's macaque
<i>Macaca pagensis</i>	Mentawai macaque
sinica group	
<i>Macaca sinica</i>	Toque macaque
<i>Macaca radiata</i>	Bonnet macaque
<i>Macaca assamensis</i>	Assamese macaque
<i>Macaca thibetana</i>	Tibetan macaque
fascicularis group	
<i>Macaca fascicularis</i>	Long-tailed or crab-eating macaque
<i>Macaca mulatta</i>	Rhesus macaque

<i>Macaca cyclopis</i>	Formosan rock or Taiwan macaque
<i>Macaca fuscata</i>	Japanese macaque
arctoides group	
<i>Macaca arctoides</i>	Stumptail or bear macaque
Subfamily Colobinae	
<i>Semnopithecus entellus</i>	Common, Hanuman or Himalayan langur
<i>Presbytis comata</i>	Grizzled leaf monkey
<i>Presbytis femoralis</i>	Banded leaf monkey
<i>Presbytis frontata</i>	White-fronted leaf monkey
<i>Presbytis hosei</i>	Hose's leaf monkey
<i>Presbytis melalophos</i>	Mitred leaf monkey
<i>Presbytis potenziani</i>	Mentawai leaf monkey
<i>Presbytis rubicunda</i>	Maroon leaf monkey
<i>Presbytis thomasi</i>	Thomas' leaf monkey
(Kasi)	
<i>Trachypithecus vetulus</i>	Purple-faced leaf monkey
<i>Trachypithecus johnii</i>	Nilgiri or John's leaf monkey
(<i>Trachypithecus</i>)	
<i>Trachypithecus auratus</i>	Ebony leaf monkey
<i>Trachypithecus cristatus</i>	Silvered leaf monkey
<i>Trachypithecus francoisi</i>	Francois' or Tonkin leaf monkey
<i>Trachypithecus geei</i>	Golden leaf monkey
<i>Trachypithecus obscurus</i>	Dusky or spectacled leaf monkey
<i>Trachypithecus phayrei</i>	Phayre's leaf monkey
<i>Trachypithecus pileatus</i>	Capped leaf monkey
"Odd-nosed" colobines	
<i>Nasalis larvatus</i>	Proboscis monkey
<i>Simias concolor</i>	Pig-tailed snub-nosed monkey
<i>Pygathrix nemaus</i>	Red-shanked Douc monkey
<i>Pygathrix nigripes</i>	Black-shanked or black-footed Douc monkey
<i>Rhinopithecus avunculus</i>	Tonkin snub-nosed monkey
<i>Rhinopithecus roxellana</i> ¹	Sichuan golden snub-nosed monkey
<i>Rhinopithecus bieti</i>	Black or Yunnan snub-nosed monkey
<i>Rhinopithecus brelichi</i>	Gray or Guizhou snub-nosed monkey
Family Hylobatidae	
(<i>Nomascus</i>)	
<i>Hylobates concolor</i>	Black, crested or light-cheeked gibbon
(<i>Symphalangus</i>)	
<i>Hylobates syndactylus</i>	Siamang
(<i>Bunopithecus</i>)	
<i>Hylobates hoolock</i>	Hoolock or white-browed gibbon
(<i>Hylobates</i>)	
<i>Hylobates klossii</i>	Kloss's gibbon
<i>Hylobates moloch</i>	Silvery or moloch gibbon
<i>Hylobates pileatus</i>	Pileated or capped gibbon
<i>Hylobates agilis</i>	Agile gibbon
<i>Hylobates lar</i>	Lar gibbon
<i>Hylobates muelleri</i>	Müller's, Bornean, or grey gibbon
Family Pongidae	
<i>Pongo pygmaeus</i>	Orang-utan

¹The addition of the "e" to the species-group name "*Roxellana*" is an unjustified emendation not present in the original spelling (D. Brandon-Jones, in litt. 1986).

Priority Ratings of Species For Conservation Action

In Table 2 Asian primate species are rated for conservation action. Following Oates (1985), three parameters have been used to achieve this rating: (1) Degree of threat to population, (2) Taxonomic uniqueness of species, and (3) Association of species with other threatened forms. Ratings are on a 1-6 scale for degree of threat. Two different statuses, "rare" and "at risk," are subsumed under numeral 2, and populations with the latter status appear to be more threatened than the former. Future revisions of the Primate Action Plans probably will recognize these as distinct categories. Ratings are on a 1-3 scale for taxonomic uniqueness, and a 1 or 2 rating is used for association with other threatened primates.

According to this system, the highest possible overall rating of 11 would characterize a highly endangered species that is the only member of its genus and which occurs in an area where several other threatened primates are found. In contrast, a species under no special threat which has several close relatives and is not part of a highly threatened community would receive an overall rating of 3.

The different numerical scales for the three parameters act as weighting factors to indicate the relative importance of these variables. The degree

of threat, which directly addresses the problems of habitat conversion and hunting, is considered to be the most important variable for establishing priorities for conservation action, but the taxonomic uniqueness of the population and its association with other threatened species, which is an indirect reference to the complexity of the ecosystem, also must be taken into consideration. Ideally primate species also should be rated in terms of their association (or lack of association) with other threatened wildlife, but the data necessary to undertake such a rating have not been compiled systematically.

The attempt of this rating system is to establish relatively objective general guidelines for conservation. However, it should be appreciated that the ratings are inevitably somewhat arbitrary. They are based on the existing evidence, which is often scanty, available to the compiler.

Ratings have been assigned according to the following criteria:

a. Degree of Threat

1. Not known to be especially rare or threatened.
2. Rare or at risk. Populations exist at a low density and/or in a limited geographical area, and individuals may not be located readily in a short-term search even by professionals; or, a widely distributed species occupying diverse habitats, in which some populations, including peripheral ones, are subject to extreme selection pressures due to habitat alteration and hunting and/or trapping. The latter populations are at risk to become more fragmented and reduced in numbers by the year 2000 if no new conservation action is taken.



Concolor gibbons (*Hylobates concolor*) exhibit sexual differences in hair color: adult males and juveniles of both sexes are black while females turn fair, the coat color of both sexes during the first year of life. *H. c. leucogenys*, pictured here, recently has been proposed as a distinct species, *H. leucogenys* (photo by Tom Cajacob, Minnesota Zoological Garden photo).



The slender loris (*Loris tardigradus*) occurs in south India and Sri Lanka. Contrary to earlier assumptions, this nocturnal prosimian is capable of active locomotion, including bridging behavior (photo by Ute Nieschalk).

Table 2

CONSERVATION PRIORITY RATINGS FOR ASIAN PRIMATE SPECIES

Species	Degree of Threat	Taxonomic Uniqueness	Assoc. with Other Threatened Forms	Total Rating
<i>Loris tardigradus</i>	3	3	1	7
<i>Nycticebus coucang</i>	1	3	1	5
<i>Nycticebus pygmaeus</i>	4	3	2	9
<i>Tarsius bancanus</i>	1	3	1	5
<i>Tarsius pumilus</i>	3	3	2	8
<i>Tarsius spectrum</i>	3	3	2	8
<i>Tarsius syrichta</i>	4	3	1	8
<i>Papio hamadryas</i>	2	1	1	4
<i>Macaca silenus</i>	6	1	2	9
<i>Macaca nemestrina</i>	3	1	1	5
<i>Macaca maura</i>	5	1	2	8
<i>Macaca nigra</i>	4	1	2	7
<i>Macaca nigrescens</i>	4	1	2	7
<i>Macaca ochreata</i>	5	1	2	8
<i>Macaca brunnescens</i>	5	1	2	8
<i>Macaca tonkeana</i>	5	1	2	8
<i>Macaca hecki</i>	5	1	2	8
<i>Macaca pagensis</i>	6	1	2	9
<i>Macaca sinica</i>	3	1	1	5
<i>Macaca radiata</i>	2	1	1	4
<i>Macaca assamensis</i>	3	1	1	5
<i>Macaca thibetana</i>	5	1	2	8
<i>Macaca fascicularis</i>	2	1	1	4
<i>Macaca mulatta</i>	2	1	1	4
<i>Macaca cyclopis</i>	5	1	1	7
<i>Macaca fuscata</i>	5	1	1	7
<i>Macaca arctoides</i>	4	2	1	7
<i>Semnopithecus entellus</i>	2	2	1	5
<i>Presbytis comata</i>	6	1	2	9
<i>Presbytis femoralis</i>	2	1	1	4
<i>Presbytis frontata</i>	2 ^a	1	1	4
<i>Presbytis hosei</i>	2	1	1	4
<i>Presbytis melalophos</i>	2	1	1	4
<i>Presbytis potenziani</i>	5	1	2	8
<i>Presbytis rubicunda</i>	2	1	1	4
<i>Presbytis thomasi</i>	3	1	2	6
<i>Trachypithecus vetulus</i>	4	2	1	7
<i>Trachypithecus johnii</i>	4	2	2	8
<i>Trachypithecus auratus</i>	3	1	1	5
<i>Trachypithecus cristatus</i>	3	1	1	5
<i>Trachypithecus francoisi</i>	5	2	2	9
<i>Trachypithecus geei</i>	3	1	1	5
<i>Trachypithecus obscurus</i>	2	1	1	4
<i>Trachypithecus phayrei</i>	3	1	1	5
<i>Trachypithecus pileatus</i>	3	1	1	5
<i>Nasalis larvatus</i>	4	3	2	9
<i>Simias concolor</i>	6	3	2	11
<i>Pygathrix nemaus</i>	5	3	2	10
<i>Pygathrix nigripes</i>	5	3	2	10
<i>Rhinopithecus avunculus</i>	6	3	2	11
<i>Rhinopithecus roxellana</i>	5	3	1	9
<i>Rhinopithecus bieti</i>	6	3	2	11
<i>Rhinopithecus brelichi</i>	6	3	2	11
<i>Hylobates concolor</i>	5	2	2	9
<i>Hylobates syndactylus</i>	3	2	1	6
<i>Hylobates hoolock</i>	5	2	1	8
<i>Hylobates klossii</i>	5	2	2	9
<i>Hylobates moloch</i>	6	2	2	10
<i>Hylobates pileatus</i>	5	2	1	8
<i>Hylobates agilis</i>	4	1	1	6
<i>Hylobates lar</i>	3	1	1	5
<i>Hylobates muelleri</i>	3	1	1	5
<i>Pongo pygmaeus</i>	4	3	2	9

^a Little is known about the status of *Presbytis frontata* throughout Borneo. It is given a rating of "2" for degree of threat on the basis of information from Sarawak.

3. Vulnerable. Populations have limited distribution and/or ecological tolerance, and current rates of habitat alteration and/or hunting pressure likely to intensify; or, current rates of habitat alteration and/or hunting are slowly but significantly reducing most populations. High probability of moving to category 4 by the year 2000 if no new conservation action is taken.
4. Highly vulnerable. Surviving populations small or fragmented, and threatened by habitat destruction and/or hunting. Likely to move to category 5 by the year 2000 if no new conservation action is taken.
5. Endangered. Population restricted to a very limited area, or with a very fragmented distribution; less than 25,000 individuals probably remain, and these are threatened by major habitat alteration and/or severe hunting; likely to move to category 6 by the end of the century if current destructive forces continue to operate.
6. Highly endangered. Less than 10,000 individuals remain, and no large section of the population is really secure.

b. Taxonomic Uniqueness

1. A member of a large species group (i.e., one of several closely related species), or species status sometimes questioned, but at least a distinct subspecies.
2. A very distinct species, or one of a small number of closely related forms which together are clearly distinct from other species.
3. Only member of a monotypic genus (or family), or a member of a genus with four or less species.

c. Association with Other Threatened Primates

1. A wide-ranging species, and/or most of range does not overlap with any highly threatened form.
2. A major part of the species' range overlaps with one or more highly threatened forms, or several that are under moderate threat.

Summary of High Conservation Priority Ratings for Asian Primate Species

In terms of the criteria used in Table 2 for rating species for conservation action, (11) is the highest possible priority rating. The following species exhibit this rating:

Simias concolor
Rhinopithecus avunculus
Rhinopithecus bieti
Rhinopithecus brelichi

The following species (10 rating) also are considered to merit the highest conservation priority rating:

Pygathrix nemaeus
Pygathrix nigripes
Hylobates moloch

These species have a very high conservation rating (9):

Nycticebus pygmaeus
Macaca silenus
Macaca pagensis
Presbytis comata
Trachypithecus francoisi
Nasalis larvatus
Rhinopithecus roxellana
Hylobates concolor
Hylobates klossii
Pongo pygmaeus

These species have a high priority rating (8):

Tarsius pumilus

Tarsius spectrum
Tarsius syrichta
Macaca maura
Macaca ochreata
Macaca brunnescens
Macaca tonkeana
Macaca hecki
Macaca thibetana
Presbytis potenziani
Trachypithecus johnii
Hylobates hoolock
Hylobates pileatus

And the following species have a priority rating (7) but are not very distinctive taxonomically, with the exception of *Loris tardigradus*, and may not live in close association with other threatened forms:

Loris tardigradus
Macaca nigra
Macaca nigrescens
Macaca cyclopis
Macaca fuscata
Macaca arctoides
Trachypithecus vetulus

All these 37 species (59% of Asian primate species) are judged to need some conservation action, but special attention should be given to the species with the highest ratings, (11), (10), and (9). An additional 15 species are regarded as vulnerable, with threat rating "3" or greater.



Hunters in S.E. Siberut (Katurai Peninsula) with a Kloss's gibbon (photo by Richard Tenaza).



Juvenile male Kloss's gibbon (*Hylobates klossii*), one of the four endemic primates of the Mentawai Islands, Indonesia (photo by Richard Tenaza).



The silvery or moloch gibbon (*Hylobates moloch*) is the rarest and most endangered gibbon species. It is confined to forest patches in west Java and may have lost as much as 98% of its habitat (photo by Russell A. Mittermeier).

Threatened Subspecies or Biological Entities

With the exception of *Tarsius bancanus borneus*, no Asian primate subspecies has been listed to date in the *Mammal Red Data Book*. This reflects the fact that the taxonomy of Asian primates, especially the subfamily Colobinae, needs considerable revision and that surveys (along with analyses of vocalizations) are needed to help clarify taxonomic problems and to assess the status of local populations. The *1986 IUCN Red List of Threatened Animals*, prepared by the IUCN Monitoring Centre, includes 16 Asian primate species, which are listed in Appendix 2.

Asia, unlike Africa and the Neotropics, is characterized by a multitude of real islands, as contrasted with forest islands, and endemism, on both specific and subspecific levels, comparable to that of the other tropical regions is found primarily on the many islands ringing continental Asia. Much of the island dispersal of Asian primates is associated with eustatic fluctuations of sea level during the Quaternary, and the diversity of primates remains to be established in many areas, especially in Sundaland or the Sunda shelf. When Sundaland was exposed, the most recent episode ending about 10,000 years ago, it was possible for species to disperse widely and, as a consequence, species (and subspecies) boundaries are not necessarily coincident with island boundaries. However, deep and wide valleys ran between the major present-day islands and may have contributed to the isolation of populations (see Verstappen, 1975).

Quaternary glacial phenomena also appear to have caused considerable climatic and environmental change in continental southeast Asia and probably south Asia. In the former region, the emergence of the Sunda and Sahul shelves due to eustatic lowering of sea level contributed to a continental climate with lower precipitation and a longer dry season and



Adult male pig-tailed snub-nosed monkey (*Simias concolor concolor*) in South Pagai, Mentawai Islands, Indonesia. The monkey is under severe threat in the Pagai Islands due to hunting as a preferred food species (photo by Richard Tenaza).

a corresponding reduction of rain forest. Cores or refuges of rain forest probably alternated with, or were substantially replaced by, monsoon or deciduous forest and tree savanna, thereby creating habitat discontinuities that may have contributed to population differentiation (see Verstappen, 1975).

The following subspecies have been identified as requiring special conservation attention. The list is not exhaustive and will require continuous revision. Many, although not all, of the taxa listed here have been proposed elsewhere as distinct species: all qualify as biological or evolutionary entities.

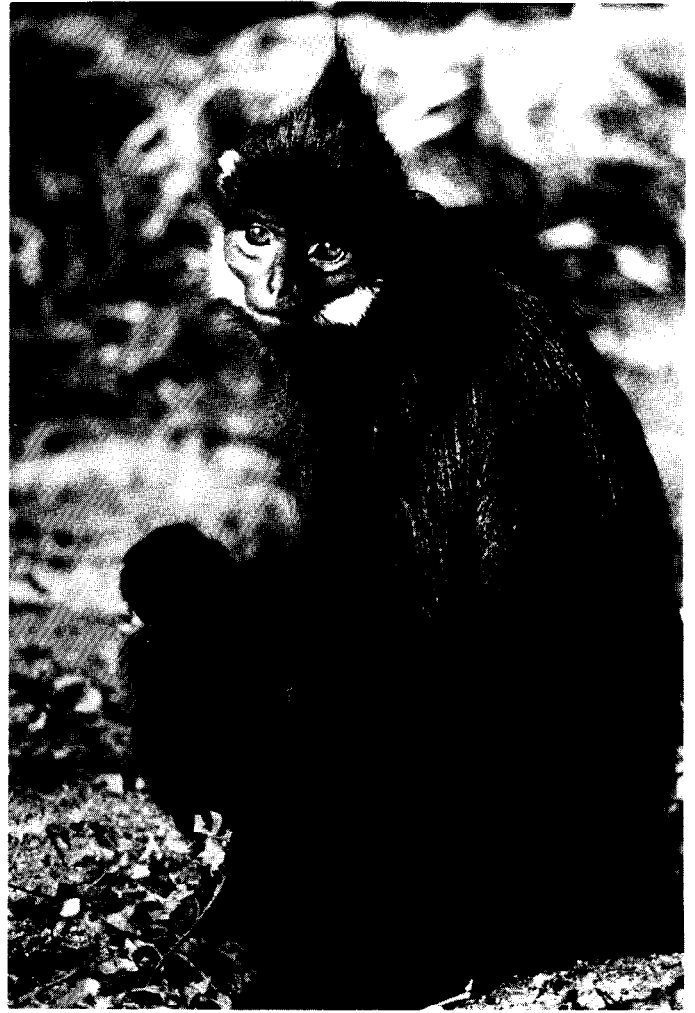
<i>Macaca pagensis</i> subsp.	Sipora and Pagai Islands and off-shore islands, Mentawais, Indonesia
<i>Macaca sinica aurifrons</i>	lowland and midland moist evergreen forest, Sri Lanka
<i>Macaca sinica opisthomelas</i>	montane moist evergreen forest, Sri Lanka
<i>Macaca radiata diluta</i>	south Kerala, India
<i>Macaca fascicularis fuscus</i>	Simeulue Island, Indonesia
<i>Macaca fascicularis mordax</i>	Bali, Indonesia
<i>Macaca fascicularis pumila</i>	Natuna Islands, Indonesia
<i>Macaca fascicularis philippinensis</i>	Philippines
<i>Macaca fascicularis umbrosa</i>	Nicobar Islands, India
<i>Macaca mulatta mcmahoni</i>	northern Pakistan
<i>Macaca mulatta villosa</i>	northern Pakistan
<i>Macaca fuscata yakui</i>	Yakushima, Japan
<i>Semnopithecus entellus aeneus</i>	western slopes, Western Ghats, India



A sub-adult *Simias concolor* (photo by Richard Tenaza).



The long-tailed or crab-eating macaque (*Macaca fascicularis mordax*) in Bali, Indonesia (photo by Russell A. Mittermeier).



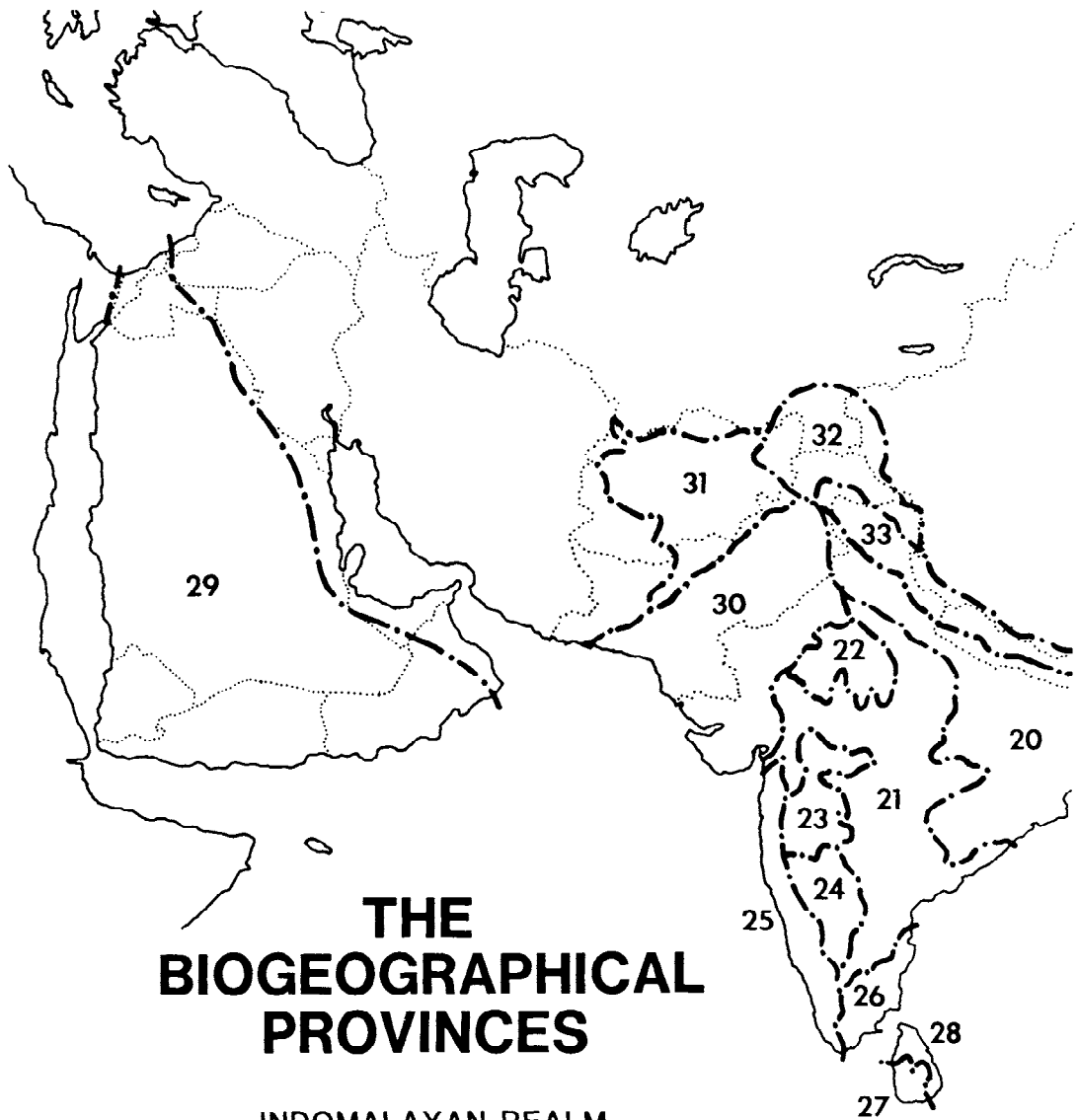
Trachypithecus francoisi francoisi, with a range extending from southwest China into northeast Vietnam, is the only widespread subspecies of Francois' leaf monkey. The six (or even seven) taxa comprising the *francoisi* group all may be distinct species (photo by Ron Garrison, Zoological Society of San Diego).

<i>Semnopithecus entellus iulus</i>	Western Ghats, India
<i>Presbytis comata comata</i>	west Java, Indonesia
<i>Presbytis comata fredericae</i>	central Java, Indonesia
<i>Presbytis femoralis batuana</i>	Batu Islands, Indonesia
<i>Presbytis femoralis chrysomelas</i>	west coastal Borneo
<i>Presbytis femoralis cruciger</i>	west coastal Borneo
<i>Presbytis femoralis natunae</i>	Natuna Islands, Indonesia
<i>Presbytis hosei canicrus</i>	East Kalimantan, Indonesia
<i>Presbytis potenziani potenziani</i>	Sipora and Pagai Islands and off-shore islands, Mentawais, Indonesia
<i>Presbytis rubicunda carinatae</i>	Karimata Island, Indonesia
<i>Trachypithecus vetulus monticola</i>	montane moist evergreen forest, Sri Lanka
<i>Trachypithecus auratus kohlbruggei</i>	Bali, Indonesia
<i>Trachypithecus cristatus vigilans</i>	Natuna Islands, Indonesia
<i>Trachypithecus francoisi francoisi</i>	northeast Tonkin, Vietnam; Guangxi and Guizhou, China
<i>Trachypithecus francoisi leucocephalus</i>	southwest Guangxi, China
<i>Trachypithecus francoisi poliocephalus</i>	Catba Island, Tonkin, Vietnam
<i>Trachypithecus francoisi delacouri</i>	north Annam, Vietnam
<i>Trachypithecus francoisi laotum</i>	west-central Laos
<i>Trachypithecus francoisi hatinhensis</i>	north coastal Annam, Vietnam

<i>Trachypithecus pileatus durga</i>	Bangladesh
<i>Simias concolor concolor</i>	Sipora and Pagai Islands and off-shore islands, Mentawais, Indonesia
<i>Hylobates concolor concolor</i>	central and south Yunnan, China and northern Vietnam
<i>Hylobates concolor hainanus</i>	Hainan Island, China
<i>Hylobates concolor jindongensis</i> ¹	central Yunnan, China
<i>Hylobates concolor fuvogaster</i> ^{1 2}	southwestern Yunnan, China
<i>Hylobates concolor leucogenys</i>	south Yunnan, China, northern Laos, and northern Vietnam
<i>Hylobates concolor lu</i>	northwestern Laos
<i>Hylobates concolor siki</i>	central Vietnam and central Laos
<i>Hylobates concolor gabriellae</i>	southern Vietnam, southern Laos, and Kampuchea
<i>Hylobates lar carpenteri</i>	northern Thailand
<i>Hylobates lar entelloides</i>	central Thailand and eastern Burma
<i>Hylobates lar vestitus</i>	northern Sumatra, Indonesia
<i>Hylobates lar yunnanensis</i> ¹	west Yunnan, China
<i>Pongo pygmaeus abelii</i>	northern Sumatra, Indonesia

¹ Subspecies recently described by Ma and Wang (1986).

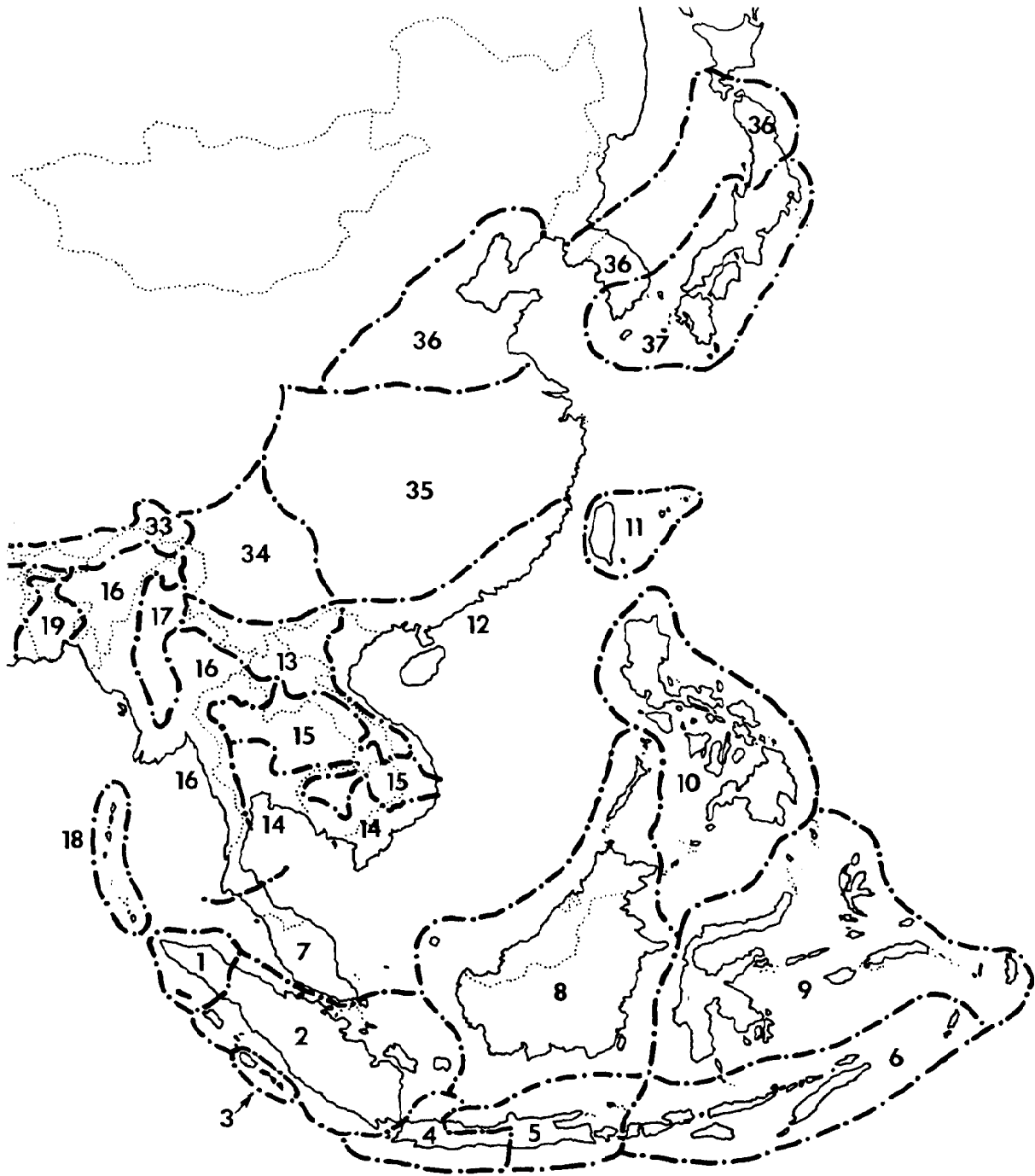
² The name customarily is spelled "fuvogaster."



THE BIOGEOGRAPHICAL PROVINCES

INDOMALAYAN REALM

- | | |
|---------------------------------|---------------------------------|
| 1. North Sumatra | 15. Thai-Indochinese Dry Forest |
| 2. South Sumatra | 16. Assam-Kra Rainforest |
| 3. Mentawai Islands | 17. Burma Dry Forest |
| 4. Javan Rainforest | 18. Andaman & Nicobar |
| 5. Javan Monsoon Forest | 19. Bengal Rainforest |
| 6. Lesser Sunda Islands | 20. Sal |
| 7. Malaysian Rainforest | 21. Teak |
| 8. Borneo & Palawan | 22. Anogeissus |
| 9. East Malayan Islands | 23. Deccan Semiarid |
| 10. Philippine Islands | 24. Karnataka |
| 11. Taiwan | 25. Malabar Rainforest |
| 12. Tonkin-Chinese Rainforest | 26. Coromandel |
| 13. Transhimalayan Mountains | 27. Ceylonese Rainforest |
| 14. Thai-Indochinese Rainforest | 28. Ceylonese Monsoon Forest |



PALAEARCTIC REALM

- | | |
|-------------------------------|-------------------------------|
| 29. Arabian Desert | 34. Sichuan Highlands |
| 30. Thar Desert | 35. Chinese Subtropical |
| 31. Hindu Kush Highlands | 36. Oriental Deciduous Forest |
| 32. Pamir-Karakorum Highlands | 37. Japanese Evergreen Forest |
| 33. Himalayas | |

Distinct Communities and Ecosystems

In the *Action Plan for African Primate Conservation* (Oates, 1985), two types of ecosystem are identified as being of particular importance for conservation action and maintaining diversity: (1) those containing many species, and (2) those with high levels of species endemism. In the present Action Plan an additional type of ecosystem is proposed: (3) those containing marginal populations, sometimes of widely distributed species, under extreme selection pressures. This addition recognizes the importance that has been attached to peripheral isolates in the process of speciation by both "gradualist" and "punctuated" schools of thought, and the precedent for its use in rating ecosystems for primate conservation was established by its application to the North African Barbary macaque (*Macaca sylvanus*) [Fa, 1984].

Primates are widely distributed in south Asia, from the Indian subcontinent and the island of Sri Lanka throughout southeast Asia as far east as the Philippines and the Indonesian islands of Sulawesi and Timor. In central and north Asia, their distribution extends from Afghanistan through southern China, including the island of Hainan, and Taiwan to Japan. Farther east, the long-tailed macaque (*Macaca fascicularis*) has been introduced into Angaur, Palau Islands, where its status is precarious due to hunting as an agricultural pest (Poirier and Smith, 1974; Poirier and Farslow, 1984). With the exception of the hamadryas baboon (*Papio hamadryas*) in the southwestern Arabian peninsula, the westernmost occurrence of Asian primates is in northwestern Afghanistan, where a population of only a few thousand rhesus macaques (*Macaca mulatta*) is reported to remain in oak and cedar forest (Puget, 1971). Only Sundaland (or the Sunda shelf area) and the island of Sulawesi actually are bisected by the equator, and there is limited extension of land within the Torrid Zone south of the equator, not reaching the Tropic of Capricorn.

Equatorial Sundaland consists of more than 13,000 islands and the Malay Peninsula and contains the most extensive moist evergreen forest in Asia. At least 26 primate species occur within this region, including the only Asian member of the family Pongidae (the orang-utan, *Pongo pygmaeus*) and six of the nine lesser apes. This diversity may be attributed to both the extent of equatorial forest and the fluctuations in exposed land surfaces and climate caused by periodic glacial advances and retreats during the Quaternary. At the same time, Marsh (1987) considers that ecological similarity throughout much of Sundaland is demonstrated by the fact that a typical primate community in the Malay Peninsula, Sumatra, Borneo, or Java contains at least the following primates: one prosimian (*Nycticebus coucang*); two macaques (*Macaca fascicularis* and *M. nemestrina*), except in Java; two leaf monkeys (usually one *Trachypithecus* sp. and one *Presbytis* sp., except in Borneo and much of Sumatra); and from one to three apes (*Hylobates* spp. and *Pongo pygmaeus*).

On the continent a series of mountain ranges extending southward from the Yunnan Plateau in southern China may have served as refuges for primates (and other mammals and birds) during Quaternary episodes of climatic deterioration: these ranges include the Annamitic Cordillera, Dawna Range, and the series of mountains south of the Brahmaputra River and extending eastward, including the Khasi, Lushai, and Chin Hills. The restricted distribution of the "odd-nosed" colobine genera *Rhinopithecus* and *Pygathrix* as well as some leaf monkey and gibbon subspp. may be associated with early retreats. During episodes of climatic recovery, other primates, including *Macaca* spp. and some *Trachypithecus* spp., may have dispersed widely by following the major rivers originating in this mountain complex, such as the Yangtze, Red, Mekong, Salween, Irrawaddy, Chindwin, and Brahmaputra.

The distribution of primates in Asia extends northward beyond the Tropic of Cancer to the southern islands of Japan, where the endemic species *Macaca fuscata* occurs. On the continent, *M. mulatta* has achieved the northernmost expansion. The species' limit is about 32° N latitude in southwest China, but small relict populations in northern Hebei province at 41° N latitude and in Shanxi and Henan provinces represent the northernmost distribution of the species (Tan, 1985). The historical literature suggests that *M. mulatta* formerly had a wide distribution in northern China (see Tan, 1985). Primates likewise have reached elevations in excess of 3000-3500 meters in upper montane forest in the Himalaya, where both macaques (*M. mulatta*, *M. assamensis*) and leaf monkeys (*Semnopithecus entellus*, *Trachypithecus geei*) have been recorded.

Semnopithecus entellus and some macaques are found in grassland and semidesert in western India (*Macaca mulatta*), southern India (*M. radiata*), and Sri Lanka (*M. sinica*). Some Asian primates also are able to exploit a variety of habitats including agricultural and urban areas, including *M. mulatta* and *S. entellus* on the Indian subcontinent and *M. fascicularis* in much of southeast Asia. All species basically are forest dwelling, however, and occur in habitats ranging from moist evergreen and moist deciduous to temperate forest, depending on both latitudinal and altitudinal zonation.

The task of identifying major biogeographical regions for the conservation of Asian primates is in a preliminary stage. For the Action Plan, the classification of biogeographical realms and provinces (ecosystematic or biotic subdivisions of the former) developed on the basis of vegetational types by Udvardy (1975, 1985) primarily has been used. Supplementary information on vegetational regions of China was obtained from Hou (1983) and Zhang *et al.* (1981). Some additional modifications of the Udvardy classification were derived from a biogeographical scheme developed by Marsh (1987), in which the boundaries of Asian provinces are demarcated according to the ranges of "commonly recognized" primate species rather than different vegetational or habitat types.

Most Asian primate species occur within the Indomalayan Realm, one of eight differentiated by Udvardy, in moist evergreen and moist deciduous forest south of the Himalaya chain and continuing Sichuan mountains. The current revision of the Indomalayan Realm (Udvardy, 1985) recognizes 29 provinces, and primates are found in all but three



The silvered leaf monkey (*Trachypithecus cristatus*) is threatened by loss of mangrove and riverine habitats in Sarawak, Malaysia (photo by Russell A. Mittermeier).

small island provinces (see Map 2). In the Action Plan, the province identified as the Sumatran Rainforest has been divided into the three provinces of North Sumatra, South Sumatra, and Mentawai Islands, following Marsh (1987). The ranges of some Asian primate species extend into the Palearctic Realm, while some other species are found exclusively in provinces in this realm in east Asia (see Map 2). Significant Asian primate communities are reviewed by provinces below. The numbers by which biogeographical provinces are designated in the text correspond to those used to locate them on Map 2.



Juvenile orang-utan (*Pongo pygmaeus*). The demand from zoos and research institutions in Europe and North America for both live and dead orang-utans assumed its greatest proportions in the 1930's and 1960's. In Indonesia the ape was subjected to continuous illegal hunting pressures until a rehabilitation program for confiscated orang-utans was established in 1971 at Ketambe in then Gunung Leuser Reserve. Illegal traffic in infant and juvenile orang-utans also was suppressed through the eventual refusal of foreign zoos and transshipment countries such as Singapore and Hong Kong to accept them. In 1977 the orang-utan was listed on Appendix I of the Convention on International Trade in Endangered Species (photo by R.A. Mittermeier).

INDOMALAYAN REALM

(1) North Sumatra Biogeographical Province

The North Sumatra province is demarcated from the South Sumatra province by a faunal boundary at the Simpangkiri and Wampu rivers north of Lake Toba. Within this province lie most of the approximately 9460 km² of Gunung Leuser National Park, a very steep area intersected by rivers which contains a wide variety of habitat types ranging from coastal mangrove and lowland moist evergreen forest to sub-alpine elfin woodland and grasses and sedges with dwarf shrubs. Over half of all Sumatran vertebrate species have been found within the Park. The Park is the last stronghold for the endemic Sumatran orang-utan (*Pongo pygmaeus abelii*), and seven other primate species also are known within

its boundaries: *Hylobates syndactylus*, *Hylobates lar vestitus*, *Presbytis thomasi*, *Trachypithecus cristatus*, *Macaca nemestrina*, *Macaca fascicularis*, and *Nycticebus coucang*. The lar gibbon subspecies and Thomas' leaf monkey are endemic to the province, although Brandon-Jones (1984) has attributed the latter to *Presbytis comata*, which is generally accepted as endemic to Java, and recognizes it as *P. comata thomasi*. Timber concessions and agricultural developments pose a threat to lowland forest, including that in reserved areas. Increasing forest clearance and human settlement in the Alas Valley, which bisects the reserve, threatens the integrity of Gunung Leuser National Park.

Simeulue (also known as Simalur), the northernmost island in the archipelago along the west coast of Sumatra, contains a distinct macaque *Macaca fascicularis fuscus*, which may have split from the mainland stock at a very early date. Coastal forest especially is being converted to agriculture on the island.

For further information on the North Sumatra province and its primates, see Crockett and Wilson, 1980; Crockett Wilson and Wilson, 1977; Ghiglieri, 1986; Gurmaya, 1986; Mitchell, 1983; van Noordwijk and van Schaik, 1985; Rijksen, 1978, 1986; and Whitten *et al.*, 1984.



Adult male Mentawai macaque (*Macaca pagensis*) on South Pagai, Mentawai Islands, Indonesia. The macaques are being poisoned for crop raiding as forest is being converted to coconut plantations on South Pagai (photo by Richard Tenaza).

(2) South Sumatra Biogeographical Province

This province is differentiated from the northern province by the composition of the ape and leaf monkey populations and the presence of *Tarsius*. The apes are represented only by *Hylobates agilis* and *Hylobates syndactylus*, the latter species also being present in the north. The taxonomy and distribution of *Presbytis* spp. requires clarification (see Crockett Wilson and Wilson, 1977; Weitzel, 1983). *Presbytis melalophos* inhabits primary forest at higher elevations south of Lake Toba, although in this inland area it is essentially parapatric with *Presbytis femoralis*,

which prefers lowland habitats including scrub forest. *P. melalophos* is found at lower elevations in southern Sumatra, where *P. femoralis* does not seem to occur. *P. femoralis*, the least clear grouping of *Presbytis*, may consist of more than one species. Brandon-Jones (1984), for example, differentiates this group into *P. femoralis* and *P. siamensis*, which are possibly sympatric in central Sumatra. *Tarsius bancanus bancanus* is confined to the lowlands of the southeast and the island of Bangka and is sympatric with *Nycticebus coucang coucang* on the mainland, while the Bornean *Nycticebus coucang menagensis* is found on Bangka. The remaining primates are *Trachypithecus cristatus*, *Macaca nemestrina*, and *Macaca fascicularis*. Currently, Indonesia is the major supplier of *M. nemestrina* in world trade (Kavanagh, 1984; Mack and Eudey, 1984), and Sumatra is the principal source of these monkeys as well as *M. fascicularis*, which is traded by Indonesia in much larger numbers (World Wildlife Fund Indonesia, 1980).

Declaration of the Kerinci-Seblat Reserve as a National Park should strengthen protection for primates in west-central Sumatra. Throughout Sumatra, slash and burn agriculture, timber extraction, and transmigration of the human population are causing destruction of forest habitat. Further information on this region and its primates may be found in Groves, 1971b; Hill, 1953, 1955; Whitten *et al.*, 1984.



Traditional hunters in swamp forest in southeastern Siberut, Mentawai Islands, Indonesia. All four species of Mentawai primates inhabit this forest (photo by Richard Tenaza).

(3) Mentawai Islands Biogeographical Province

The Mentawai Islands off the west coast of Sumatra constitute a separate province. The four small islands comprising the Mentawais (Siberut, Sipora, North Pagai, and South Pagai) have a total land area of 7,000 km² and have been separated from Sumatra by a deep marine trough for at least 500,000 years. The islands are characterized by many endemic plants and animals, including four primates: *Hylobates klossii*, *Presbytis potenziani*, *Macaca pagensis*, and *Simias concolor* (a monotypic genus whose closest living relative appears to be *Nasalis larvatus* in Borneo). The Mentawais have the highest number of endemic primates per unit area of all islands in the world.

Sixty-three percent of Siberut, the largest of the islands at 4,480 km², remains undisturbed forest. Four logging companies currently are operating in Siberut: the extent of their operations is unknown (R. Tenaza, pers. comm. 1986). Large-scale harvest of rattan for export to Sumatra may be detrimental to primates (Tenaza and Mitchell, 1985). The present availability of air rifles in trading settlements likewise may disrupt traditional, sustainable hunting of primates (Tenaza, in press). Teitei Batti Game Sanctuary, in which either strict protection of habitat and wildlife and/or traditional uses and commercial uses may be allowed, has been expanded from its original 65 km² to 565 km², and the entire island of Siberut was declared a UNESCO Biosphere Reserve in 1981.

Selective commercial logging is severely modifying forest habitat in the southern Mentawais, although a recent survey recorded about 40% undisturbed forest on South Pagai and good populations of all primates,

with the exception of *Simias concolor* (Tenaza, in press). Primates are not protected in the Pagais. *S. concolor concolor* is threatened with local extinction by hunting because its flesh is favored over that of other wild and domestic animals, and a distinct subspecies of *Macaca pagensis* has become vulnerable through poisoning as an agricultural pest as forest is brought under coconut cultivation (Tenaza, in press).

Additional information on the Mentawai primates and the region may be found in Tenaza, 1975; Tenaza and Tilson, 1985; Tilson, 1977; Tilson and Tenaza, 1982; Watanabe, 1981; Whitten, 1982a, 1982b; Whitten and Whitten, 1982; and Whitten *et al.*, 1979.



Adult male Mentawai leaf monkey (*Presbytis potenziani*) in forest on North Pagai, Mentawai Islands, Indonesia (photo by Richard Tenaza).

(4) Javan Rainforest Biogeographical Province and (5) Javan Monsoon Forest Biogeographical Province

The island of Java is divided into two provinces. The Javan Rainforest province encompasses the western moist evergreen forest, which is reduced to fragmented pockets, and the Javan Monsoon Forest province includes eastern Java and the island of Bali. A zone of increasingly dry and seasonal climate appears to have extended from lower Burma to eastern Java when Sundaland was exposed due to eustatic lowering of sea level (see Verstappen, 1975). During the Pleistocene, the fauna of Sundaland was more evenly distributed over Java, Borneo, and Sumatra than at present, and Java experienced the greatest reduction in "well-known" mammals, including the local extinction of both *Hylobates syndactylus* and *Pongo pygmaeus* (Hooijer, 1975). Two endemic primates are restricted to a number of forest patches in the western province: *Hylobates moloch* and *Presbytis comata*. *P. comata fredericae*, which has been proposed by Brandon-Jones (in litt. 1986) as a distinct species, *Presbytis fredericae*, is known with certainty only from Gunung Slamet

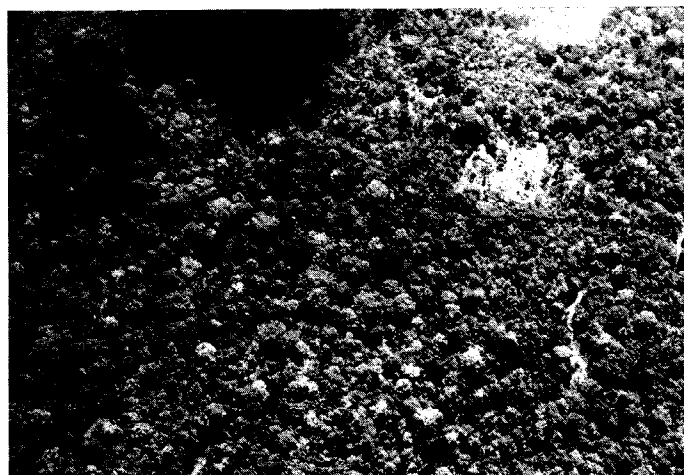
in central Java.¹ *Trachypithecus auratus* occurs in both provinces, with different subspecies recognized for west Java (*T. auratus sondaicus*), east Java (*T. auratus auratus*), and Bali (*T. auratus kohlbbruggei*). The distinct subspecies *Nycticebus coucang javanicus* is found on the island. *Macaca fascicularis mordax* may be nearly extirpated on Java (see K.S. MacKinnon, 1986) but survives on Bali and extends into the Lesser Sunda Islands. Java's human population of about 90 million has caused serious encroachment on forest habitat. There is a system of small national parks and reserves scattered throughout the island, including Ujung Kulon/Gunung Honje (768 km²) and Gunung Halimun (400 km²), which probably has the largest populations of the Javan Rainforest province endemics. Further information on this region and its primates may be found in Angst, 1975; Brotoisworo, 1978; Kappeler, 1984; MacKinnon and Suwelo, 1984; and K.S. MacKinnon, 1986a, 1986b, in press.

(6) Lesser Sunda Islands Biogeographical Province

To the east of Bali the Lesser Sunda Islands make up another province. The province is characterized by moist deciduous forest although the climate is generally drier than in the Greater Sundas. *Macaca fascicularis mordax* is the only primate species found in the Lesser Sundas, with the exception of *Trachypithecus auratus kohlbbruggei* on Lombok, and they both appear to be recent arrivals.

(7) Malaysian Rainforest Biogeographical Province

The Malaysian Rainforest province, which includes peninsular Thailand up to approximately 8° N latitude, is rich in moist evergreen forest. A series of rivers limits the distribution of three lesser ape species: *Hylobates syndactylus*, *Hylobates lar*, and *Hylobates agilis*. *Presbytis femoralis* and *Trachypithecus obscurus* occur throughout inland forest, and *Trachypithecus cristatus* is confined to mangrove forest along part of the west coast (Marsh and Wilson, 1981). The boundary between the subspecies *Macaca nemestrina leonina* (to the north) and *M. nemestrina nemestrina* (to the south) roughly corresponds to the boundary of the



Aerial view of Krau Game Reserve in the vicinity of Kuala Lompat, Peninsular Malaysia. The Krau has been the site of long-term research on Malaysia's forest primates (photo by David J. Chivers).

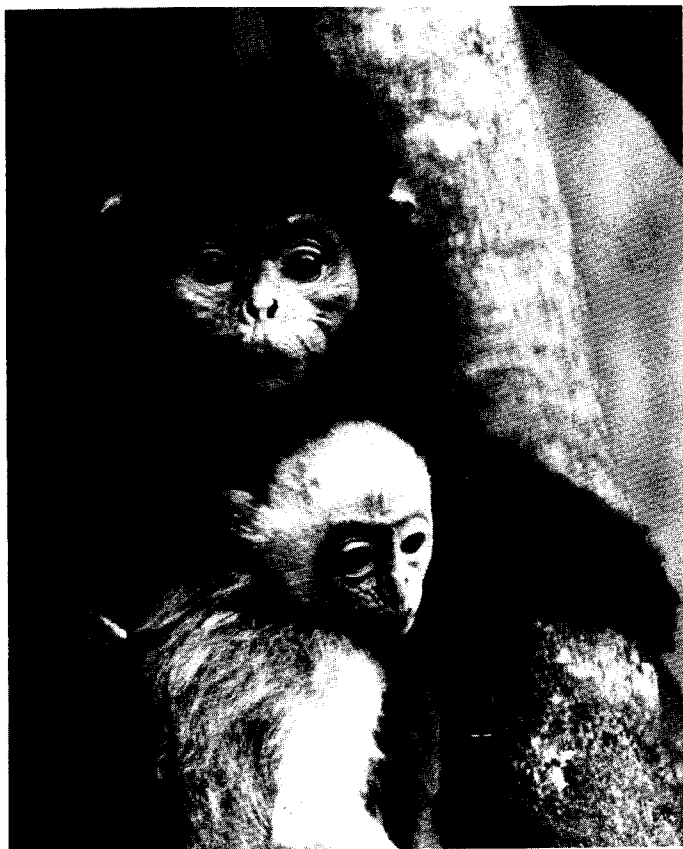
province (Fooden, 1975), and *Macaca arctoides* reaches the southern limit of its range at the Thai/Malayan border. The other primates are *Macaca fascicularis* and *Nycticebus coucang*. Much of the area of Peninsular Malaysia has been converted for agriculture and other uses, although about 49% of the land remains forested (Khan *et al.*, 1984).

Taman Negara National Park and Krau Game Reserve are important areas for the conservation of primates in Peninsular Malaysia, and the Tone Nga Chang/Khao Banthat/Khao Poo/Taleban complex of reserved areas is important in southernmost Thailand. For more detailed information on the Malaysian Rainforest province and its primates, see Caldecott, 1986; Chivers, 1973, 1974, 1980; Chivers and Davies, 1979; S.H. Curtin, 1977; Curtin and Chivers, 1978; Fooden, 1976a; Gittins, 1982; Marshall, 1981; Medway, 1978; and Raemaekers, 1979.

(8) Borneo and Palawan Biogeographical Province

Borneo and the Philippine island of Palawan constitute one province. The Sunda shelf extends northeastward from Borneo through Palawan, and *Macaca fascicularis* probably dispersed into the Philippine Islands biogeographical province by this route.

Borneo has four political divisions: Brunei Darussalam; the Malaysian states of Sabah and Sarawak; and Indonesian Kalimantan, which consists of four provinces - West (Kalimantan Barat), East (Kalimantan Timur), South (Kalimantan Selatan), and Central (Kalimantan Tengah). Kalimantan contains some of the best evergreen forest in Borneo and Sundaland, especially in the lowlands, although forests are threatened by slash and burn agriculture, conversion to plantations, transmigration schemes, and logging. The endemic *Nasalis larvatus* is found in mangrove, peat swamp, and riverine forest, as much as 350 km inland. It is declining especially where there is heavy exploitation of mangrove forest, and most known populations are under threat: Sarawak's total population may be as low as 1,000 (World Wildlife Fund Malaysia, pers. comm. 1985). Three other endemic colobine species are *Presbytis hosei*, which Brandon-Jones (1984) has assigned to the Javan species, *Presbytis comata*, and recognizes as *P. comata hosei*; the widely distributed *Presbytis rubicunda*; and the rare *Presbytis frontata*, which may be restricted to primary forest. The distribution of *P. frontata* remains to be established in interior Borneo, but a viable population is protected in Sarawak's Lanjak Entimau Wildlife Sanctuary. Two endemic *Presbytis femoralis* subspp. are restricted to northwestern coastal Borneo: in Sarawak, *P. femoralis chrysomelas* is protected in a few small reserves, but *P. femoralis cruciger* is totally unprotected (Bennett *et al.*, 1986).



The ebony leaf monkey (*Trachypithecus auratus*, formerly classified as a subspecies of *T. cristatus*) occurs in Java and Bali (photo by Russell A. Mittermeier).

¹ R. Wirth (in litt. 1986) reports a skin of *Presbytis comata fredericae* in the Leiden Museum from Gunung Lawu (formerly Lawoe) in central Java at about 7°40' S latitude, 111°10' E longitude, which would extend the distribution of the population into the Javan Monsoon Forest province.

The Kapuas and Barito rivers separate the endemic *Hylobates muelleri* from *Hylobates agilis albibarbis*, although the two populations appear to exhibit limited sympatry (and hybridization) in Central Kalimantan (see Marshall *et al.*, 1984; Marshall and Sugardjito, 1986).

The orang-utan (*Pongo pygmaeus pygmaeus*) is found in all political divisions of Borneo, except Brunei Darussalam. The largest populations of orang-utans almost certainly occur in Kalimantan, where extensive areas of forest still exist, especially along the east coast, although drought and forest fires recently damaged about 30,000 km² of evergreen forest in East Kalimantan (Berenstain *et al.*, 1986). Recent helicopter surveys for nests (Junaidi Payne, 1986) suggest that 3,500-4,000 (Davies and Payne, 1982; Davies, 1986) may be underestimates of actual orang-utan numbers in Sabah. Total numbers are unknown for Sarawak, but the population that is centered on the Lanjak-Entimau Wildlife Sanctuary and the proposed Batang Ai National Park, covering at least 1600 km², is thought to contain a viable number of at least 500 (World Wildlife Fund Malaysia, pers. comm. 1985). Other Bornean primates are *Trachypithecus cristatus*, which is threatened by loss of mangrove and riverine habitats; *Macaca nemestrina*; *Macaca fascicularis*; *Tarsius bancanus bancanus*, which appears to be widespread; and *Nycticebus coucang*.

Important reserved areas in Borneo include the Danum Valley Conservation Area in Sabah; Lanjak-Entimau Wildlife Sanctuary, Gunung Mulu National Park, Bako National Park, and Samunsam Wildlife Sanctuary in Sarawak; and Kutai National Park in East Kalimantan and Tanjung Puting National Park in Central Kalimantan. Brunei Darussalam recently proposed setting aside almost 8250 km² as Conservation and Protection Forests (Anon., 1985). Further information on the Bornean region and its primates may be found in Aken and Kavanagh, 1984; Crompton and Andau, 1986; Fittinghoff and Lindburg, 1980; Galdikas, 1979, 1985a, 1985b; Jeffrey, 1982; Kavanagh, 1985; J.R. MacKinnon, 1974; K.S. MacKinnon, 1986a, 1986b, in press; Mittermeier, 1981; Payne *et al.*, 1986; Rijksen, 1986; Rodman, 1973, 1977, 1978; Salter *et al.*, 1985; Supriatna *et al.*, 1986; and Wheatley, 1980.



Conversion of forest to coconut palm plantations is reducing the habitat of the Celebes black macaque (*Macaca nigra*) in northern peninsular Sulawesi, Indonesia (photo by Russell A. Mittermeier).

(9) East Malayan Islands Biogeographical Province

Primates are found within this province on Sulawesi and the small islands of Muna and Buton at the end of its southeastern peninsula. The historical geology of Sulawesi and its connection with Sudaland to the west are controversial. The western half of Sulawesi may have been a part of Sundaland and largely above sea level during most of the Quaternary. The island consists of a central land mass and four peninsulas. Moist deciduous forest characterizes the southern half of the southern peninsula and parts of the southeastern peninsula, and semi-evergreen forest occurs elsewhere. The family Dipterocarpaceae occurs most commonly on the north coast of the northern peninsula (see Groves, 1980).

The primates consist of a unique radiation of perhaps as many as seven endemic macaque species (Fooden, 1969): *Macaca nigra*, in the extreme northern peninsula; *Macaca nigrescens*, in the central northern peninsula; *Macaca hecki*, in the southern half of the northern peninsula; *Macaca tonkeana*, in the central land mass and the eastern peninsula; *Macaca maura*, in the southern peninsula; *Macaca ochreata*, in the southeastern peninsula; and *Macaca brunnescens*, on the islands of Muna and Buton. A radiation of tarsiers corresponding to that of the macaques also may exist. All populations were assigned to the endemic species *Tarsius spectrum*, but the small montane population found in the highlands of central Sulawesi recently was recognized as a distinct species, *Tarsius pumilus* (Niemitz, 1984; Dagosto and Musser, 1986; Musser and Dagosto, 1987). *Tarsius* may be more widely distributed than previously believed: there are no trapping localities, for example, south of Lake Towuti on the southeastern peninsula (Niemitz, 1984). Some populations may turn out to be very restricted in range and possibly endangered (MacKinnon and MacKinnon, 1980). *M. maura* is probably the most threatened of the macaques, but protection for *M. tonkeana*, *M. hecki*, *M. ochreata*, and *M. brunnescens* also does not appear to be adequate (K.S. MacKinnon, 1986). With the exception of the southeastern region, a system of reserves has been established in Sulawesi, including Lore Kalamanta and Dumoga-Bone National Park.



Female Tonkean macaque (*Macaca tonkeana*) with hybrid *M. tonkeana* x *M. ochreata* infant. The Tonkean macaque and the booted macaque (*M. ochreata*) are two of the seven macaque species endemic to Sulawesi, Indonesia (photo by Ron Garrison, Zoological Society of San Diego).

(10) Philippine Islands Biogeographical Province

The Philippine Islands, an archipelago of some 7,000 islands, is recognized, with the exception of Palawan, as a separate province. Most land mass is on Luzon, Mindanao, and the intervening Visayan Islands. By the end of the century, all forests may be eliminated if the current rate of conversion to logging and cultivation continues.



The Philippine tarsier (*Tarsius syrichta*) appears to be the most endangered of the tarsiers due to extensive loss of forest habitat in the Philippines (photo by David Haring).

Tarsiers are reported for the southeastern islands of Samar, Leyte, Dinagat, Siargao, Bohol, and northern, central, and southwestern Mindanao, although the details of distribution are unknown. All have been assigned to the endemic species *Tarsius syrichta*, for which Niemitz (1984) recognizes no valid subspecies. The presence of tarsier (*Tarsius spectrum*) on the Sangihe Islands is due probably to dispersal northward from Sulawesi (C. Groves, in litt. 1985). The Bornean slow loris (*Nycticebus coucang menagensis*) is recorded on Mindanao at Catagen, where it may be introduced, and on Bongao in the Tawitawi Islands, southeast of Mindanao (Groves, 1971b). *Macaca fascicularis* occurs in both coastal and interior upland areas. In addition to habitat loss and persecution as an agricultural pest, this macaque has been subjected to heavy trapping for export (see Kavanagh, 1984; Mack and Eudey, 1984) and its status is unknown. Some additional information on the Philippine region is contained in Rabor, 1955, 1968.

(11) Taiwan Biogeographical Province

The island province of Taiwan in the South China Sea is characterized by several altitudinally graded vegetation zones. The lowlands are covered by humid subtropical forest, and subtropical warm temperate and temperate ecosystems occur at higher elevations. Palynological research has established fluctuating glacial conditions on Taiwan from before 60,000 to 10,000 years ago, during which time the island was part of the Asian mainland (Tsukada, 1967) and appears to have been on the route of vertebrate migrations from eastern Asia to the Philippines and Sulawesi (Sartono, 1973). The endemic *Macaca cyclops* is

the only primate species on Taiwan and has been recorded in subtropical hardwood forest and bamboo forest and, at higher elevations, in conifer forest, mixed conifer-hardwood forest, and especially temperate hardwood forest. Major threats to the species are habitat destruction for logging and trapping for commercial purposes, including for human consumption and formerly for export (Poirier, 1984b). The concentration of the monkeys in southeast Taiwan has been attributed to the effects of forest destruction and development elsewhere rather than to hunting (Masui *et al.*, 1986).

A Nature Conservation Strategy was approved by the Taiwan Government in 1984, and four national parks totaling 2,264 km² have been declared since 1982. Kenting National Park (326 km²) in the sub-tropical climatic zone in southernmost coastal Taiwan contains *M. cyclops*. Some additional information on the Taiwan macaque may be found in Dien, 1958; Peng *et al.*, 1973; and Poirier and Davidson, 1979.



A group of Taiwan macaques (*Macaca cyclops*) at Kenting National Park, southern Taiwan (photo by Ecology Laboratory, Department of Zoology, National Taiwan University, Taipei, courtesy of Hai-Yin Wu).

(12) Tonkin-Chinese Rainforest Biogeographical Province

The Tonkin-Chinese Rainforest province encompasses southeasternmost China and the island of Hainan and the coastal strip of northern Vietnam east of the Annamitic Cordillera almost as far south as 13° N latitude. In China well-sheltered valleys have thick moist evergreen forest, while limestone hills and drier areas support semi-evergreen forest (or moist deciduous forest). *Hylobates concolor* is found in the province. Only a small relict population of about 30-40 *H. concolor hainanus* commonly is thought to remain on two isolated mountain peaks on Hainan Island, China (Tan, 1985; Yang *et al.*, in press). The discontinuous range of *Hylobates concolor leucogenys* also may extend into the province, at about 19° N. latitude in Vietnam (C.P. Groves, in litt. 1987).

Rhinopithecus avunculus is endemic to northern Vietnam and is known primarily from specimens collected earlier this century in Tonkin north of the Red River at about 22° N latitude on or near the eastern boundary of the Transhimalayan Mountains biogeographical province (Delacour, 1940). It is one of the Asian species with the highest conservation rating. The species may number only in the hundreds (Dao Van Tien, in litt. 1984). Some of its habitat (forests on limestone hills) may be protected in Ba Bé National Park (MacKinnon and MacKinnon, in press).

Pygathrix nemaus is found in central Vietnam. The population on Mt. Sontra studied in 1974 by Lippold (1977) is now extinct (MacKinnon and MacKinnon, in press). Of *Trachypithecus francoisi* subsp., only *T. francoisi francoisi* is widespread, with a substantial range in Guangxi and Guizhou in southwest China (Tan, 1985), extending into northeastern Vietnam. *T. francoisi leucocephalus* appears to number only 400-600 in southwestern Guangxi (Tan, 1985). *T. francoisi poliocephalus* is known only for northeastern Tonkin and may be restricted to Catba Island: D. Brandon-Jones (in litt. 1986) considers this population to be

a subspecies of *Trachypithecus* ["*Semnopithecus*"] *johnii*. *T. francoisi hatinhensis* is recorded for northern coastal Annam. *T. francoisi delacouri* is known for north-central Annam and may be the most endangered Asian monkey population (R. Wirth, in litt. 1986). The close geographic proximity of all the *T. francoisi* subspecies suggests that their actual range is not much greater than their known geographic range (D. Brandon-Jones, in litt. 1986).

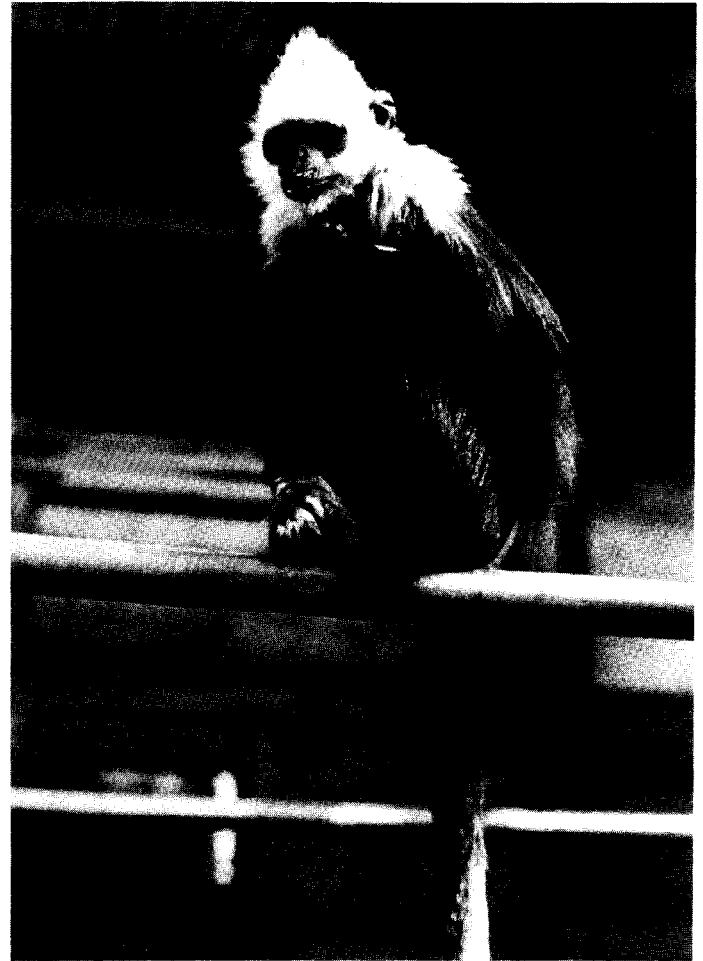


The Tonkin snub-nosed monkey (*Rhinopithecus avunculus*), endemic to northern Vietnam, has the highest possible priority rating for conservation action in Asia. The species is known primarily from collected specimens, such as this mounted specimen in Paris identified as *Pygathrix avunculus* (photo by Roland Wirth).

Macaca mulatta is the most widely distributed macaque in the province, and its range includes Hainan. *Macaca arctoides* and *Macaca assamensis* are reported for the province, and the range of *Macaca fascicularis* extends northward into the province to the area of Hué north of 16° N latitude. *Trachypithecus phayrei* may extend eastward into the province at about 19° N latitude (see Fooden, 1976a), and *Macaca nemestrina* may extend eastward into the province in the vicinity of Hué (see Fooden, 1975). *Nycticebus coucang* occurs in the province, and *Nycticebus pygmaeus* was collected near Hué.

South China has had a shorter period of continuous human development than either north or central China, but loss of habitat through intensive farming, the recent expansion of the rubber industry, and deforestation and hunting pose threats to primates (Zhang *et al.*, 1981; Tan, 1985; Yang *et al.*, in press). Sporadic skirmishes and shellings continue to occur on the China—Vietnam border. Although well-preserved forests are reported to exist on the Chinese side of the border, this warfare may have destroyed forest habitat on the Vietnamese side. The Red River Delta and the narrow coastal plain extending to the Mekong Delta in the south have been cultivated intensively for centuries, resulting in the disappearance of most larger vertebrates (Constable, 1982). Natural forest cover has been reduced to about 21% in Vietnam, and 20,000 km² of forest were devastated during the 30-year Vietnam

war (Anon., 1986). In China reserves include the Nanwan Nature Reserve in southeast Hainan and Pearl River Mouth Macaque Nature Reserve. Vietnam has a National Conservation Strategy and management plans for some reserves, but all primates are inadequately protected. Some additional information on Vietnam is contained in Westing and Westing, 1981.



Trachypithecus francoisi leucocephalus, which is found in the limestone hills of southwestern Guangxi, China, may number only 400-600. It is one of the six (or seven) taxa comprising the *T. francoisi* group, all of which may be distinct species (photo by Colin P. Groves).

(13) Transhimalayan Mountains Biogeographical Province

The Transhimalayan Mountains province extends from east of the Irrawaddy river in the north of the Burmese Shan State and from western and southern Yunnan southeastward through Laos and northwestern Vietnam and along the Annamitic Cordillera, including Plateau des Bolovens, to just south of 14° N latitude at 108° E longitude in Vietnam. The province is characterized by complex mountain vegetation, including tropical moist evergreen forest, subtropical moist evergreen and hill forest, and hill savanna. *Hylobates hoolock* in the west is replaced by *Hylobates lar* east of the Salween river. *Hylobates concolor* occurs both east and west of the Mekong river (Li and Lin, 1983). Black gibbon subspp. occur to the east of the Mekong in central and southern Yunnan and extend south of the Red river along the eastern boundary of the province in northern Vietnam (*H. concolor concolor*); immediately to the west of the former in central Yunnan (*H. concolor jingdongensis*); and between the Mekong and Salween rivers in western Yunnan (*H. concolor fuvogaster*) [see Li and Lin, 1983; Yang *et al.*, in press; Groves, 1984, in litt. 1987; Ma and Wang, 1986]. The light-cheeked gibbon subspp. are found in the far south of Yunnan and adjacent area of Laos and discontinuously in Laos at about 19° N latitude and in Vietnam at about 22° and 20° N latitude (*H. concolor leucogenys*) and in central Vietnam and

central Laos (*H. concolor siki*) [see Yang *et al.*, in press; Groves, 1984, in litt. 1987]. Sympatry between *H. concolor leucogenys* and *H. concolor concolor* has been recorded in both Vietnam and China, strengthening the contention that the concolor gibbons represent two distinct species (see Dao, 1983, 1985; Ma and Wang, 1986).



Conversion of forest to agriculture in southeast Ha Son Binh province, about 150 km south of Hanoi, Vietnam (photo by Russell L. Ciochon).

Pygathrix nemaus is reported for east-central Laos. *Trachypithecus francoisi laotum* is recorded for west-central Laos. The eastern range of *Trachypithecus phayrei* extends throughout most of the province, although *Trachypithecus cristatus* is recorded for Plateau des Bolovens (see Fooden, 1976a.) *Macaca mulatta*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca arctoides* and apparently both *Nycticebus pygmaeus* and *Nycticebus coucang* are found in the province. Destruction of forest in the steep mountains, especially as a consequence of hill tribes' slash and burn agriculture, has altered the habitat throughout much of this province. In China, the small populations of all gibbons are considered to be faced with extinction (Tan, 1985), although *H. concolor concolor*, while highly endangered, may be more secure (Haimoff *et al.*, in press). Laos has proposed a network of reserves (MacKinnon and MacKinnon, in press), but little is known about the status of primates in the country. Prolonged warfare and mass migrations of the human population in Indochina may have resulted in extensive habitat destruction and primate loss, but Laos is the least disturbed of the Indochinese countries (MacKinnon and MacKinnon, in press). For more information on the primates of the Transhimalayan Mountains province, see Fooden, 1975, 1982; Fooden *et al.*, 1985; and Groves, 1971b.



Juvenile pileated gibbon (*Hylobates pileatus*) feeding on figs in Khao Soi Dao Wildlife Sanctuary, southeastern Thailand. Young pileated gibbons are colored like adult females while adult males are black with some white markings. The status of the species is precarious in Thailand and unknown in Kampuchea (photo by Warren Y. Brockelman).

(14) Thai-Indochinese Rainforest Biogeographical Province

This province extends from the Central Highlands of Vietnam southward and westward through central and southern Kampuchea to the central plain of Thailand, extending eastward along the Thai border with northern Kampuchea. Dry evergreen forest covered the central plain of Thailand until about 200 years ago (Pongpangan and Poobrasert, n.d.), although most remnants are deciduous. More dense evergreen forest occurs in the Petchabon Range in central Thailand, and moist evergreen forest occurs in the southeastern province of Chantaburi. The entire biogeographical province is characterized by an extensive coastline and includes the Mekong Delta. The light-cheeked *Hylobates concolor gabriellae* occurs east of the Mekong river in Kampuchea and southern Vietnam, and the range of *Hylobates pileatus* generally is considered to be restricted to west of the river. *Hylobates lar* occurs north and west of the Takhong, a tributary of the Mun river, and there is a zone of overlap with *H. pileatus* in the Petchabon Range (see Brockelman and Gittins, 1984). *Pygathrix nigripes* is recorded for southern Vietnam, southern Laos, and eastern Kampuchea (Brandon-Jones, 1984). *Trachypithecus cristatus* is the most widespread colobine monkey, and the species may be parapatric with *Trachypithecus phayrei* at the western boundary of the province and with *Trachypithecus obscurus* and *Presbytis femoralis* in the extreme northeast of peninsular Thailand (Fooden, 1971, 1976a; Eudey, 1979). *Macaca nemestrina* is widespread, although the presence of the species is only inferred for Kampuchea (see Fooden, 1975). *Macaca fascicularis* occurs in coastal and riverine areas and may be common in the Mekong Delta. The ranges of *Macaca assamensis* and *Macaca mulatta* extend within the western boundary of the province, and *Macaca arctoides* occurs here and in some mountainous areas on the Gulf of Siam (Fooden, 1971, 1982; Eudey, 1981). *Nycticebus pygmaeus* is recorded for Cochin China, and *Nycticebus coucang* also is found in the province (see Groves, 1971b).



Moist evergreen forest of Khao Soi Dao Wildlife Sanctuary, southeastern Thailand. The sanctuary has been the site of an important study on the pileated gibbon (*Hylobates pileatus*) (photo by Warren Y. Brockelman).

The central plain of Thailand and the narrow coastal plain of Vietnam extending to the Mekong Delta are areas of intensive cultivation. At the conclusion of the war in Vietnam in 1975, considerable tracts of both upland forest and mangrove forest had experienced some damage, and mangrove forests may have been reduced by as much as 40% (Westing and Westing, 1981). Kampuchea has proposed a network of reserves (MacKinnon and MacKinnon, in press), but the effects of prolonged warfare and mass human migrations on the forests and primate species in the country remain to be established. Hunting for food by the Montagnard people may be a threat to primates in the Central Highlands of Vietnam. Important reserved areas in Thailand include Khao Soi Dao Wildlife Sanctuary in Chantaburi province, Khao Yai National Park in the Petchabon Range, and Huai Kha Khaeng Wildlife Sanctuary

on the western periphery of the province. Additional information on the region and its primates in Thailand may be found in Brockelman, 1978, 1983; Eudey, 1980; Jintanugool *et al.*, 1984; and Srikosamatara, 1984.



Abandoned fields invaded by unwanted grasses in the central plain of Thailand. Slash and burn agriculture, which is practiced by lowland ethnic Thais as well as hill tribes, has resulted in significant loss of forest cover (photo by Ardith A. Eudey).

(15) Thai-Indochinese Dry Forest Biogeographical Province

The large Thai-Indochinese Dry Forest province extends southeastward from northwest Thailand through southwest and central Laos and much of Kampuchea to the region north of the Central Highlands in Vietnam. The province effectively separates regions of moister vegetation from one another and appears to have disrupted the dispersal of primate species in Southeast Asia. Northeastern Thailand is characterized by dry dipterocarp forest, which does not support primates, with patches of mixed deciduous and dry evergreen forest. *Hylobates lar* may occur in suitable forest habitat in more continuous mountain areas, but the species was not contacted recently in the Phu Phan Mountains in northeastern Thailand (Srikosamatara and Doungkhae, 1982). Colobine monkeys and macaques basically are absent from the province, although *Trachypithecus phayrei* and *Macaca nemestrina* may occur in mountains in north-central Thailand (Fooden, 1975, 1976a). The range of *Macaca mulatta* may extend into the northernmost region of the province to about 17° N latitude (Fooden, 1971).

(16) Assam-Kra Rainforest Biogeographical Province

The Assam-Kra Rainforest province extends from the Isthmus of Kra northward, through Tenasserim, the Mergui Archipelago, and the Shan State in Burma and adjacent areas of western and northwestern Thailand and Laos, and westward, through the Mouths of the Irrawaddy and the Arakan region in Burma into northeastern India and the western hills of Burma and the Chittagong region in Bangladesh. Moist evergreen forest characterizes the Isthmus of Kra and regions on the Andaman Sea and Bay of Bengal, while tidal, dune, and swamp forest are found at the mouths of the Irrawaddy. In the east, moist deciduous and dry evergreen forest or subtropical moist hill forest and hill savanna are replaced by moist evergreen forest at higher elevations. In the northwest, moist semi-evergreen and evergreen forest are replaced by subtropical hill and temperate evergreen forest successively at higher elevations.

Hylobates lar occurs to the east of the Salween river, and *Hylobates hoolock* occurs south of the Brahmaputra river. *Hylobates concolor lu* is recorded from northwest Laos, immediately east and north of the Mekong River (C.P. Groves, in litt. 1987). *Presbytis femoralis* is found in the Isthmus of Kra, as is *Trachypithecus obscurus*. *Trachypithecus cristatus* extends westward from the Thai-Indochinese Rainforest province into lower Tenasserim and the Mergui Archipelago and in the Dawna Range at about 15° N latitude may be parapatric, if not sympatric, with *Trachypithecus phayrei*, the most widespread colobine monkey in the province (Fooden, 1976a; Eudey, 1979). *Trachypithecus*

pileatus occurs in northeastern India and the adjacent hills of Burma and is sympatric with *T. phayrei* in Tripura, India (Mukherjee, 1982, 1983) and in Sylhet and the east-central Chittagong region in Bangladesh (Khan and Ahsan, 1986).

Macaca fascicularis ranges over peninsular Thailand and its offshore islands; the Mergui Archipelago, Tenasserim, and the interior of the Dawna Range to about 16° N latitude; and lower Burma. Recently the species was recorded in coastal vegetation in the extreme southeast of the Teknaaf peninsula (Cox's Bazar) in Bangladesh (Khan and Ahsan, 1981, 1986). *Macaca nemestrina* occurs in the south of the Isthmus of Kra and some islands of the Mergui Archipelago; Tenasserim and the Dawna Range; eastern Burma; and foothills in the north and west of Burma, extending into northeastern India and Sylhet and the Teknaaf peninsula in Bangladesh. The Assamese macaque (*Macaca assamensis assamensis*) is found in northeastern Assam and adjacent hills in northern Burma, Sylhet and the eastern Chittagong region in Bangladesh, and northwestern Thailand: the species reaches the southernmost limit of its range in the Dawna Range in western Thailand at about 15° N latitude (Fooden, 1982). *Macaca mulatta* is broadly sympatric with *M. assamensis* throughout much of the province, although its range includes eastern Burma and extends into the Teknaaf peninsula in Bangladesh. *Macaca arctoides* is found in the Isthmus of Kra, Dawna Range, and northeastern India and adjacent hills in Burma. *Nycticebus coucang bengalensis* occurs throughout much of the province.



Adult female hoolock gibbon (*Hylobates hoolock*). The hoolock gibbon is the largest of the gibbons excepting the siamang and is sexually different in coloration. The adult female is pale brown with a white brow and facial outline, while the adult male is black with white eyebrows (photo by Alan Mootnick, taken at the Gibbon and Gallinaceous Bird Center).



Monsoon deciduous forest in Huai Kha Khaeng Wildlife Sanctuary, western Thailand. The sanctuary straddles the boundary between two biogeographical provinces and contains nine primate species, including five macaques (photo by Ardith A. Eudey).

Most of the lowland forest in peninsular Thailand has been cleared for agriculture. In this region macaques were subject to heavy trapping until a complete ban on primate exports from Thailand went into effect in 1976 (Eudey, 1978). The highlands of northwest Thailand are experiencing a dramatic increase in human population, and some military skirmishes involving insurgents continue on the Burma–Thailand border. Within the province are found hill tribes who practice slash and burn agriculture and may hunt primates for food or as agricultural pests (see Eudey, 1986). Logging activities, both legal and illegal, and hydroelectric projects also contribute to the loss of forest habitat. Extensive loss of forest cover likewise has occurred in Burma, and poaching of wildlife is widespread (Blower, 1984, 1985). Important reserved areas include Thung Yai Wildlife Sanctuary and contiguous Huai Kha Khaeng Wildlife Sanctuary in Thailand, which have been proposed as a World Heritage Site. No national parks or nature reserves have been declared yet in Burma, and habitat is not protected within the existing small wildlife sanctuaries (Blower, 1985). Reserves important for the protection of primates would include Tamanthi Wildlife Sanctuary on the east bank of the Chindwin river in the northwest; Alaungdaw Kathapa in the west-central region, which has been approved as a national park; and Kyaukpandaung and Natma Taung (Mt. Victoria) in the southern Chin Hills (Blower, 1985). Additional protected areas are needed in Tenasserim, where the forest is being exploited increasingly by local people and highly organized Thai timber thieves (Blower, 1985).



An accumulation of hardwood logs near Mae Sod, western Thailand. Timbering, both legal and illegal, is a major factor contributing to forest loss in Thailand (photo by Ardith A. Eudey).

(17) Burma Dry Forest Biogeographical Province

The Burma Dry Forest province encompasses the Irrawaddy river basin, into which the Chindwin river flows from the northwest, and separates the forested mountains in the west from those in the east of Burma. The central zone of the province consists of open scrubland with acacia, from which radiate out zones of dry upper mixed deciduous forest and moist mixed deciduous forest respectively. Small, scattered populations of *Trachypithecus phayrei*, *Macaca mulatta*, and perhaps *Macaca nemestrina* occur in suitable forest habitat in the province (see Fooden, 1976a, 1982; Southwick and Southwick, 1985). The fertile basin of the Irrawaddy-Chindwin river system supports a large human population.

(18) Andaman and Nicobar Biogeographical Province

The Andaman and Nicobar province in the Bay of Bengal is classified as a complex island system. The endemic subspecies *Macaca fascicularis umbrosa* occurs on only three of the Nicobar Islands, which extend northward from Sumatra: Great Nicobar, Little Nicobar, and Katchall. The population has been recorded on the coast and up to an elevation of 1000 meters in bamboo and evergreen forest. Conversion of habitat for agriculture, with attendant persecution of the monkeys as crop-raiders, is a major threat to the macaque (Devaraj, 1983).



Trachypithecus pileatus durga, a capped leaf monkey with striking red coloration, is found in Madhupur National Park, Bangladesh (photo by Craig Stanford).

(19) Bengal Rainforest Biogeographical Province

The Bengal Rainforest province encompasses Bangladesh, (with the exception of Sylhet, the Chittagong region and small areas in the northwest) and immediately adjacent areas in the Indian states of West Bengal, Tripura, Meghalaya, and Assam. The vast alluvial plain formed by the Padma (Ganges), Jamuna (Brahmaputra), and Meghna rivers dominates the province and may never have been completely forested (Green, 1977).

1978; Khan and Assan, 1986). The Madhupur Tract (and north Mymensingh) in north-central Bangladesh is an area of highlands, supporting the single largest moist deciduous or *sal* forest in Bangladesh, and slopes up to the Garo Hills in Meghalaya. The Sunderbans, the largest tropical humid or mangrove swamp forest in the world, lies at the southwest of the province.

Macaca mulatta is the most widely distributed primate species in the province, although, with the exception of a few pockets, it is absent from the alluvial plain in Bangladesh (Khan and Ahsan, 1981). The largest and healthiest population of rhesus macaques, which is estimated at 88,000 (Khan and Ahsan, 1986) to 126,000 (Gittins, 1981) is found in the Bangladesh Sunderbans. No human settlement occurs in this area, and the forest has maintained a mature structure although almost the entire area has been selectively logged. *Hylobates hoolock*, *Trachypithecus pileatus*, and *Nycticebus coucang* (as well as *M. mulatta*) have been recorded in the Madhupur/northern Mymensingh region. The widespread Hanuman langur subspecies *Semnopithecus entellus entellus* occurs in Bengal and recently was recorded in adjacent Jessore and Kushtia in Bangladesh, where it is rare (Gittins, 1981; Khan and Ahsan, 1986).



Rice cultivation contributes to the patchiness of the moist deciduous or *sal* forest in Madhupur National Park, Bangladesh (photo by Craig Stanford).

Bangladesh's forests continually are being degraded by illegal logging and over-exploitation for firewood and bamboo. Increasing efforts to convert marginal land to agriculture and the practice of clear-cutting mean that only a bare minimum of land can be set aside for wildlife protection. The Madhupur Tract, including Madhupur National Park, is inhabited by Garo tribal people and cattle and local farmers, and 30% of the area is reported to be already under the possession of squatters (Khan and Ahsan, 1986). In Bengal the dense human population has resulted in loss of habitat for *M. mulatta*, and the rhesus macaque may have disappeared due to trapping for export or removal (Southwick *et al.*, 1964). In Bangladesh no viable rhesus populations may exist outside of forest areas due to competition with the human population (see Oppenheimer *et al.*, 1983). Additional information on the Bengal rain-forest province and its primates is contained in Gittins and Akonda, 1982; Gittins and Tilson, 1984; Khan, 1984; Roonwal and Mohnot, 1977; and Tilson, 1979.

(20) Sal Biogeographical Province

The Sal province, an extensive area of moist deciduous or *sal* forest (which is dominated by *Shorea robusta*), extends along the foothills of the Himalaya in northern Pakistan and India and Nepal and stretches southeastward into the Indian states of Bihar, Bengal, Orissa, and the extreme northwest of Assam. A band of subtropical pine forest occurs in the northern highlands. *Macaca mulatta* and *Semnopithecus entellus* are found in the province. *S. entellus Hector* is found north of the Ganges river in lowland Terai jungle and subtropical pine forest; *S. entellus entellus* is widespread south of the river and is replaced by *S. entellus anchises* in the southeast (Roonwal, 1981; Napier, 1985).



Sal forest, which is dominated by *Shorea robusta*, in the Siwalik Hills, north India (photo by Donald G. Lindburg).

With the exception of hilly and mountainous areas and a few protected lowland areas, most of the natural forest has been lost in India and the process is accelerating in Nepal (Bishop *et al.*, 1981). The densest human populations in India are found in Bihar and Bengal. *Macaca mulatta* continues to exhibit commensalism with human populations in farms, villages, and cities, but the species experienced serious decline in the late 1950's and early 1960's when trapping for export reached its maximum. The present population of rhesus macaques throughout all India may be no more than 200,000 (Southwick and Lindburg, 1986; Tiwari, 1983). Further information on the Sal province and its primates may be found in Dolhinow and Lindburg, 1983; Jay, 1965; Lindburg, 1971, 1977; Neville, 1968; Seth and Seth, 1983; Southwick *et al.*, 1965; and Teas *et al.*, 1980.



Bonnet macaques (*Macaca radiata diluta*) at a temple near Mundanthurai Wildlife Sanctuary, Western Ghats, peninsular India (photo by Jim Moore/Anthro-Photo).

(21) Teak Biogeographical Province

The Teak province extends to the west and south of the Sal province and includes much of the Indian states of Uttar Pradesh, Madhya Pradesh, Maharashtra, and Andhra Pradesh. The province is characterized by

tropical dry deciduous forest, although tropical thorn forest extends into the southern region. The bonnet macaque (*Macaca radiata radiata*) occurs in the province, although *Macaca mulatta* penetrates south of the Godavari and Krishna rivers to the Velikonda Range in the Eastern Ghats (Fooden *et al.*, 1981). *Semnopithecus entellus entellus* occurs in the northern sector of the province, while *S. entellus anchises* extends into the eastern part of the province in Andhra Pradesh (Roonwal, 1981). *Loris tardigradus lydekkerianus* is reported for the Eastern Ghats (Hill, 1953). Additional information on the Teak province and its primates may be found in Fooden, 1981; Roonwal and Mohnot, 1977; and Seth and Seth, 1983.

(22) Anogeissus Biogeographical Province

The Anogeissus province is identified as a region of tropical dry deciduous forest in east Rajasthan and the adjacent area of Uttar Pradesh. *Macaca mulatta* and *Semnopithecus entellus entellus* are found in the province. At present the province is largely an agricultural region with scattered fragments of forest, and local populations of rhesus macaques are doing very well and are increasing (Malik *et al.*, 1984; Seth and Seth, 1983).

(23) Deccan Semiarid Biogeographical Province

The Deccan Semiarid province encompasses central Maharashtra and northeastern Karnataka. The province is characterized by tropical thorn forest or a tropical grassland and savanna biome. *Semnopithecus entellus achates* is reported to be abundant in the region, while both *Macaca mulatta* and *Macaca radiata* are absent (Fooden *et al.*, 1981). Information on the province and the Hanuman langur is contained in Roonwal, 1981; and Roonwal and Mohnot, 1977.

(24) Karnataka Biogeographical Province

The Karnataka province encompasses moist deciduous forest along its western boundary, a more extensive zone of dry deciduous forest to the east, and tropical thorn forest in the northeast. *Semnopithecus entellus achates* is found in the north of the province (Roonwal, 1981); *Macaca radiata radiata* occurs primarily in the northwest and the south (Fooden, 1981); and *Loris tardigradus lydekkerianus* is reported for the south in the Mysore plain and adjacent hills (Hill, 1955). Further information on this region and its primates may be found in Rahaman and Parthasarathy, 1967, 1969; Roonwal and Mohnot, 1977; Simonds, 1965; Sugiyama, 1965a, 1965b, 1967, 1971; and Sugiyama and Parthasarathy, 1979.

(25) Malabar Rainforest Biogeographical Province

The Malabar Rainforest province encompasses the Western Ghats in peninsular India, extending through the states of Tamil Nadu, Kerala, Karnataka, Goa, and Maharashtra. Tropical semi-evergreen and moist evergreen forests are replaced at lower elevations by moist deciduous forest. The moist evergreen forests or *sholas* generally are found at elevations between 500 and 1500 meters.

The endangered *Macaca silenus*, whose total numbers in the wild formerly were estimated from 670-915 to no more than 2,000 (see Ali, 1982, 1985), is found in fragmented patches of *shola*, or moist and luxuriant growth, in the south in Kerala and Tamil Nadu and in the north in Karnataka, where as many as 3,000 may occur (Karanth, 1985). *Trachypithecus johnii* is sympatric with the lion-tailed macaque in southern hill ranges (Oates, 1979) and has become extremely rare in Karnataka (and Kerala) due to heavy poaching (Karanth, 1985). *Macaca radiata radiata* is common north of approximately 10° N latitude in deciduous forest and scrub jungle at lower elevations and may make seasonal incursions into higher areas, while the entire range of *M. radiata diluta* may be confined to the far south of the province. *Semnopithecus entellus* also is found primarily in deciduous forest, and populations may be persistently hunted in Kerala and the adjacent region of Karnataka (Karanth, 1985). Roonwal (1981) recognizes seven subspecies of *S. entellus* for the province. Small populations of *S. entellus iulus*, *S. entellus aeneas*, and *S. entellus elissa* on the eastern boundary of the province in northern Kerala and southern Karnataka may be very vulnerable. A

small population of *S. entellus dussumieri* is recorded for coastal Kerala and *S. entellus priamellus*, *S. entellus hypoleucos*, and *S. entellus ther-sites* are found in the far south of the province. Brandon-Jones (1984) recognizes a distinct Malabar langur (*Semnopithecus hypoleucos*) for southwest India, ranging between the Western Ghats and the coast to 14°25' N latitude. The endemic subspecies *Loris tardigradus malabaricus* is another deciduous forest species (Hill, 1955).

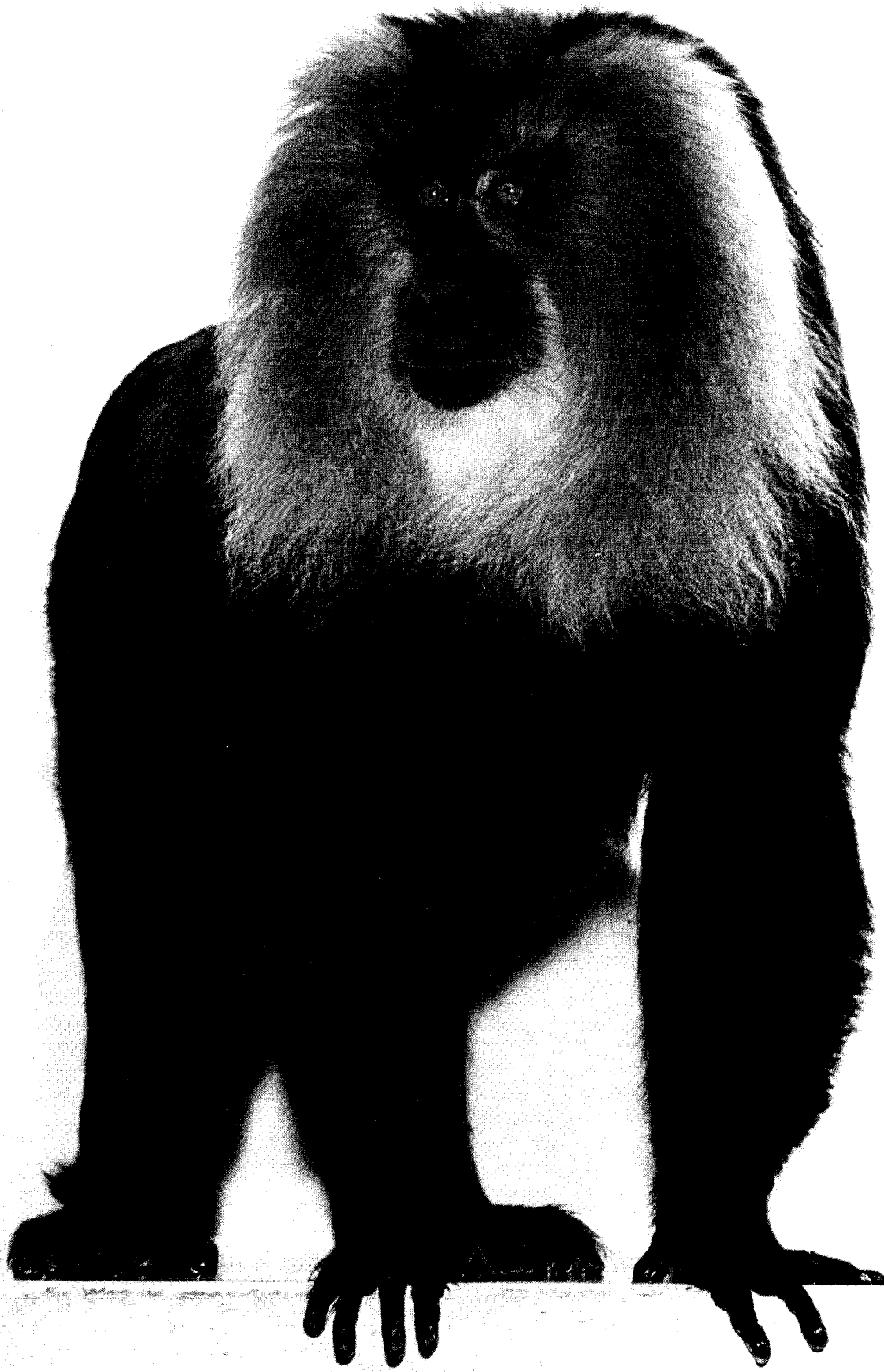
The most serious threat to primate populations, especially *Macaca silenus*, is continued loss of habitat through conversion to plantation agriculture, the development of hydroelectric and irrigation projects, road construction, and mining (see Ali, 1985). In Karnataka logging for plywood and matchwood continues to fragment primate habitat (Karanth, 1985). In Tamil Nadu and Kerala lion-tailed macaques are found in Agastiyamalai, the southernmost region of the Western Ghats; the western slopes of the Nilgiri Hills; the Anamalai Hills; and the Periyar area. The 5700 km² Nilgiri Biosphere Reserve includes the entire Nilgiri Hills and slopes of the Wynad Hills, and 730 km² of evergreen forest includes the New Amarambalam Reserve Forest and Silent Valley National Park. Another 3100 km² biosphere reserve has been proposed for the entire Agastiyamalai areas on the state boundary between Tamil Nadu and Kerala, which would contain the Mundanthurai, Kalakad, and Neyyar Wildlife Sanctuaries (see Ali, 1985). Additional information on the Malabar province and its primates may be found in Ali, 1986; Green and Minkowski, 1977; Johnson, 1985; Joseph, 1985; and Poirier, 1970.



The purple-faced leaf monkey (*Trachypithecus vetulus*) endemic to Sri Lanka is related to the Nilgiri leaf monkey of the Western Ghats in India (photo by Russell A. Mittermeier).

(26) Coromandel Biogeographical Province

The Coromandel province includes the tropical dry forest of southeastern Tamil Nadu. Dry evergreen forest is found on the coast, and dry deciduous forest characterizes the hills extending south from



The arboreal lion-tailed macaque (*Macaca silenus*), found in fragmented patches of moist evergreen forest in the Western Ghats of peninsular India, appears to have its greatest population numbers in the northern part of its range in Karnataka. Although the macaque is not poached in Karnataka as it is elsewhere, developmental projects and exploitation of forest products are reducing its habitat in the state (photo by Zoological Society of San Diego).

the Palni Hills to Cape Comorin. *Macaca radiata radiata* is recorded for the Palni Hills (see Fooden, 1981), and *Semnopithecus entellus hypoleucos* ranges as far south as Cape Comorin. *Loris tardigradus lydekkerianus* also occurs in the province (Hill, 1955). More information on the province and its primates may be found in Roonwal and Mohnot, 1977.

Trachypithecus vetulus philbricki occurs in the low country dry zone to the northwest. *Loris tardigradus nordicus* is found in the dry and arid zones in the north, but no lorises are known for most of southeastern Sri Lanka (Hill, 1955). *Semnopithecus entellus thersites* also is found in the dry zone.

Loss of habitat constitutes the greatest threat to primates in Sri Lanka. Forests are being exploited for agriculture, plantations, and timber. The human population is concentrated in the wet zone, and lowland and midland forests are in the greatest danger of destruction (see Dittus, 1977b). A series of at least five dams on the Mahaweli river, and the resulting irrigation and cultivation, may disrupt the distribution of primate

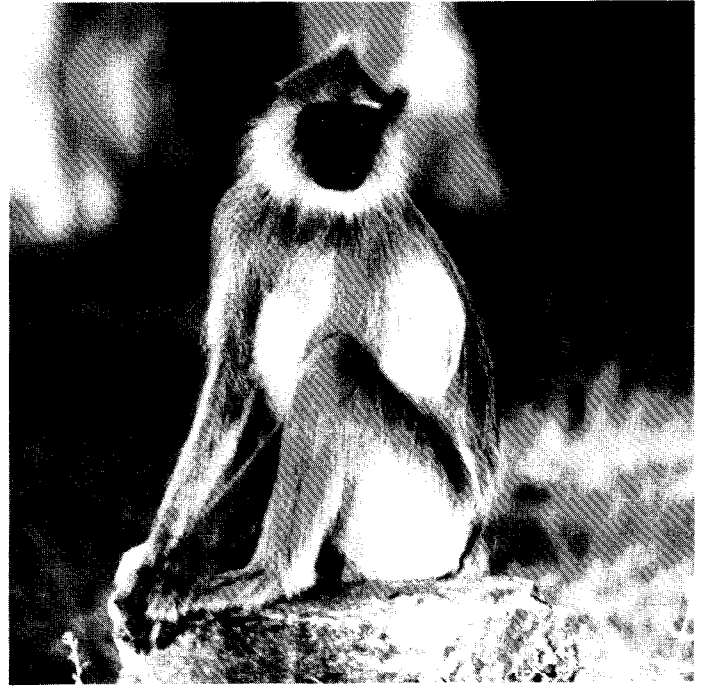


The endemic toque macaque (*Macaca sinica*) at Polonnaruwa in the eastern dry zone, Sri Lanka (photo by Russell A. Mittermeier).

(27) Ceylonese Rainforest Biogeographical Province and (28) Ceylonese Monsoon Forest Biogeographical Province

The Ceylonese Rainforest province encompasses primarily lowland moist evergreen forest, although hilly midland and montane moist evergreen forests occur in its east-central sector. A region intermediate between this wet zone and the dry zone of the remainder of the island is included within this province (see Dittus, 1977b). *Macaca sinica aurifrons* is found in the lowland and midland forest. *Trachypithecus vetulus vetulus* occurs in the wettest regions of the lowlands in the west and southwest, and *T. vetulus nestor* is found in the western wetlands. The lowland *Loris tardigradus tardigradus* is replaced in the hilly region by *L. tardigradus grandis*. *M. sinica opisthomelas*, *T. vetulus monticola*, and *L. tardigradus nycticeboides* are found in montane forest. *M. sinica sinica* and *L. tardigradus grandis* occur in the intermediate zone, although lorises are not recorded in the west or east (Hill, 1955).

The remainder of the island falls within the Ceylonese Monsoon Forest province. The dry zone, with semi-evergreen forest and patches of savanna forest, extends over most of the lowland plains in the north and east and grades into arid zones in the northwest and southeast (see Dittus, 1977b). *Macaca sinica sinica* is widespread in the province.



Semnopithecus entellus thersites, from Sri Lanka (photo by Russell A. Mittermeier).



The Horton Plains Reserve contains moist evergreen forest, including cloud forest, essential for the conservation of endemic animal species in Sri Lanka (photo by Anne Baker).

species and force them into small habitat patches: *Trachypithecus vetulus* and *Loris tardigradus* probably will be most affected (A. Baker, in litt. 1986). Important, but small, reserved areas are the Sinharaje Forest Reserve, the last lowland moist evergreen forest, and Horton Plains Reserve, which contains montane moist evergreen forest vital for the conservation of endemic animal species. The major national parks are all within the dry or arid zones and cannot be viewed as refuges for any primate populations. Further information on Sri Lanka and its primates may be found in Crusz, 1973; Dittus, 1975, 1977a; Hladik, 1977; Petter and Hladik, 1970; Ripley, 1967, 1970; and Rudran, 1973a, 1973b.

PALAEARCTIC REALM

(29) Arabian Desert Biogeographical Province

In the warm desert biome of the Arabian desert province, populations of *Papio hamadryas* are found in Saudi Arabia and North and South Yemen (Harrison, 1964, 1968). The species is known primarily from northeast Africa in the Afrotropical Realm (see Tappen, 1960). For more information, see Kummer *et al.*, 1981.

(30) Thar Desert Biogeographical Province

The Thar Desert province includes much of Gujarat and western Rajasthan in India and Pakistan drained by the Indus river. *Semnopithecus entellus entellus* is found in the tropical thorn forest of *Acacia* and *Euphorbia* at the eastern edge of the province and is reported to be abundant in the Gir Forest in Gujarat. *Macaca mulatta* is recorded for the eastern edge of the Thar Desert. For more information on the region's primates, see Hrđy, 1977; Mohnot, 1971; Mohnot *et al.*, 1981; Moore, 1985; Roonwal and Mohnot, 1977; Seth and Seth, 1983; Vogel, 1977; and Winkler *et al.*, 1984.

(30) Hindu Kush Highlands Biogeographical Province

The Hindu Kush Highlands province may contain the westernmost population of rhesus macaques (*Macaca mulatta mcmahoni*) in oak and cedar forest in Paktia, eastern Afghanistan (Puget, 1971). Habitat destruction, including that caused by livestock grazing, would appear to threaten the survival of the population, and conservation of dwindling habitats may be impossible at this time for political reasons.

(31) Pamir-Karakorum Highlands Biogeographical Province

The Pamir-Karakorum Highlands province, which encompasses a complex mountain system biome, includes northwestern Pakistan and the



Jodhpur, Rajasthan, India. A professional feeder distributes food to Hanuman langurs (*Semnopithecus entellus*) (photo by Jim Moore/Anthro-Photo).

adjacent area of Afghanistan and most of Azad Kashmir. *Macaca mulatta mcmahoni* occurs in Chitral and Dir and on the Afghan border. The range of *M. mulatta villosa* extends into the Chitral Valley and Azad Kashmir from eastward in the Himalayas province (see Napier, 1981). A small population of *Semnopithecus entellus ajax* also may occur in Pakistan (see Roonwal, 1981).

Habitat destruction is the greatest threat to rhesus macaques in Pakistan. Forests are being destroyed rapidly as the human population expands and increases its demand for lumber, fuel and fodder, arable land, and grazing space for livestock. Livestock, especially goats, are very destructive of forest habitat, and the livestock population has increased as animals have been brought into Pakistan by Afghan refugees (M. Pearl, in litt. 1983). For more information on the region and its primates, see Goldstein, 1984; Pearl, 1982; and Roberts, 1977.

(33) Himalayas Biogeographical Province

The Himalayas province encompasses northeastern Pakistan, including the Jhelum river valley; northernmost India; northern Nepal; Sikkim; Bhutan and the adjacent areas of Bengal and Assam; and southeastern Tibet. The province is characterized by subtropical evergreen forest with temperate conifers.

Trachypithecus geei has been found in a limited area in south-central Bhutan, extending southward to the Bhutan-Assam border (Gee, 1955, 1961; Khajuria, 1956, 1962). The possibility of its occurrence in other areas of Assam and in Nepal remains to be investigated. Only a small population exists in northwestern Assam, but the species appears to be common in the Bhutan part of its range. *Semnopithecus entellus ajax* occurs in the western sector of the province, and *S. entellus schistacea* is found in Nepal and Sikkim (see Napier, 1985; Roonwal, 1981). *S. entellus lania* may be the population recorded in southeast Tibet and also may occur in Tibet along the borders of Bhutan and Nepal (Tan, 1985). Reports of *S. entellus* in Bhutan have been attributed to misidentified records of *T. geei*, and recent reports of the species in Assam also need verifying (Brandon-Jones, in litt. 1986; see Napier, 1985). Reports of *Rhinopithecus* in Assam (Roonwal and Mohnot, 1977) and Sikkim (Wolfheim, 1983) remain unsubstantiated; *Rhinopithecus bieti* is recorded for southeastern Tibet (see Tan, 1985).

The range of *Macaca mulatta villosa* includes the western sector of the province. In Bhutan rhesus macaques may prefer tropical moist deciduous *sal* forest (see Fooden, 1982), but in northwest Nepal the species has been recorded in pine-oak-spruce forest at over 3000 meters (Teas *et al.*, 1980). In southeastern Tibet the range of the species may overlap with that of *Macaca thibetana* (Tan, 1985). *Macaca assamensis pelops* is recorded for Nepal, Sikkim, and Bhutan: the subspecies also was collected earlier in the Sunderbans along the Bay of Bengal (see Fooden, 1982). The Brahmaputra river appears to separate the subspecies from *M. assamensis assamensis* to the east. In some regions of the province, habitat destruction and a less tolerant attitude toward crop-raiding may pose a threat to primates, especially macaques.

Additional information on the primates of the Himalayas province is contained in Bishop, 1979; Boggess, 1979, 1980, 1982; R.A. Curtin, 1982; Mukherjee, 1978; Mukherjee and Saha, 1974; Roonwal and Mohnot, 1977; and Sugiyama, 1976.

(34) Sichuan Highlands Biogeographical Province

The Sichuan Highlands province encompasses the complex of mountains and valleys running from north to south in western Sichuan and Yunnan. The province has a humid climate with a distinct dry season and exhibits subtropical mountain vegetation with temperate conifers. Evergreen oak forest is found on sunny slopes, and succulent thorn scrub (*Opuntia* and *Euphorbia*) occurs in deep, dry valleys (see Hou, 1983).

Macaca mulatta has been recorded throughout the province at elevations from 1700 to 3400 meters: the northern limit of its distribution is about 32° N latitude (see Tan, 1985). The known limit of the distribution of *Macaca thibetana* also is inferred to be about 32-35° N latitude (Fooden *et al.*, 1985; Fooden, 1983). The species is reported to be widespread in western Sichuan (Tan, 1985), although the limits of its

natural distribution extend farther east (Fooden *et al.*, 1985; Fooden, 1986).

The endangered *Rhinopithecus bieti*, whose total numbers currently are estimated at 600-800 (Ji Weizhi, pers. comm. 1986), is found in the narrow strip of mountainous land between the Jinshajiang (upper Yangtze) river on the east and the Lancangjiang (Mekong) river on the west in northwestern Yunnan and extending into southeastern Tibet.¹ The species has been recorded at 3600 meters in forest dominated by conifers. The range of the more numerous *Rhinopithecus roxellana* extends from Sichuan to southern Gansu. The species is found in conifer and conifer-mixed deciduous/evergreen forest at elevations ranging from 1500 to 3400 meters, and seasonal migration appears to be a response to the seasonal presence of humans at all but the very highest elevations (D.G. Lindburg, in litt. 1987). Its range conforms to that of the giant panda [*Ailurapoda melanoleuca*] (Li and Lin, 1983; Li *et al.*, 1981; Poirier, 1984a; Tan, 1985).

Destruction of forest in the steep mountains, especially as a consequence of slash and burn agriculture, has altered the habitat of primates throughout southwest China. Some species, such as *Rhinopithecus bieti*, have been hunted for medicinal purposes, although, in general, primates are reported to face less trapping pressures in this province than in any other in China (Zhang *et al.*, 1981). Important reserved areas are Wolong Nature Reserve, Baihe Nature Reserve, and Bai-shui-jiang Nature Reserve.



The Tibetan macaque (*Macaca thibetana*) is endemic to China. Failure to differentiate the Tibetan macaque from the stump-tail macaque (*M. arctoides*) impeded earlier efforts to work out its distribution in China (photo by G. Fournier, courtesy of Jack Fooden).

(35) Chinese Subtropical Biogeographical Province

The Chinese Subtropical province encompasses the western mountain region and eastern hilly-plain region of central China (see Zhang *et al.*, 1981). Subtropical evergreen broadleaf forests and conifer forests are associated with a moist, warm climate without a distinct dry season. Vegetation is altitudinally zoned, from lowland evergreen forest through mixed deciduous-evergreen forest, which also is characteristic of limestone formations, to scrub at elevations over 3000 meters (Hou, 1983).



Wolong Nature Reserve, Sichuan, China. Efforts to conserve the giant panda (*Ailurapoda melanoleuca*) in the reserve also may benefit the Sichuan golden snub-nosed monkey (*Rhinopithecus roxellana*) (photo by Colin P. Groves).

In the western region, *Macaca mulatta* is reported for the mountains to the north and south of the Red Basin, along the southern margin of which the Yangtze river flows (see Tan, 1985). South of the Red Basin, the range of *Macaca thibetana* overlaps that of the rhesus macaque. The Tibetan macaque is found at elevations from about 400 to 2200 meters in mixed deciduous-evergreen and mixed conifer-evergreen forests (see Fooden *et al.*, 1985; Fooden, 1986). *Rhinopithecus brelichi* occurs only in mountainous northeastern Guizhou and may be reduced to a population numbering no more than about 200-300 to 500-670 on Mt. Fanjingshan (Ji Weizhi, pers. comm. 1986; Wang and Quan, 1986). A relatively warm climate supports broadleaf vegetation, and the species has been found at elevations ranging from 500 meters (evergreen forest) to 2570 meters (mixed-deciduous-evergreen forest). There are two disjunct populations of *Rhinopithecus roxellana* in the province, to the north and east respectively of the Red Basin. In the Qinling Mountains to the north, the species has been found in mixed deciduous-evergreen forest at 1200 meters up to subalpine conifer forest at 3000 meters (Tan, 1985; Poirier, 1984; Poirier and Hu, 1983). *Trachypithecus francoisi francoisi* occurs south of the Red Basin in areas of precipitous limestone hills with thick jungle vegetation in northern and western Guizhou and central Guangxi (Tan, 1985).

In the eastern hill region, the reduction of considerable areas of natural forest has resulted in the discontinuous distribution, and apparent genetic isolation, of populations of *Macaca mulatta*. Rhesus macaques are reported to have disappeared long ago from areas along the middle and lower reaches of the Yangtze river and its tributaries, the Han, Gan, and Yuan rivers (Zhang *et al.*, 1981; see also Poirier, 1985). *Macaca arctoides* and *Macaca assamensis* apparently are restricted to Guangxi and appear to be relatively rare in this province, as they are also in

¹ Wang and Quan (1986) estimate the population at 5,000.



The gray or Guizhou snub-nosed monkey (*Rhinopithecus brelichii*) is found only in northeastern Guizhou, China (photo from *Acta Theriologica Sinica*, 1981, courtesy of Colin P. Groves).



Habitat of the Sichuan golden snub-nosed monkey (*Rhinopithecus roxellana*) in Baihe Nature Reserve, China. The monkeys appear to be surviving human pressures, for the most part, in marginal fringes of vegetation along the high mountain crests (photo by Donald G. Lindburg).

southern and western Yunnan (J. Fooden, in litt. 1986). *Macaca thibetana* appears to be relatively abundant in Ruyuan County, northwest Guangdong, which might be a good area in which to establish a reserve for the species (J. Fooden, in litt. 1986).

Following World War II, the expansion of the human population, industry, development programs (especially hydrology projects), and agriculture has resulted in serious reduction of forest habitat necessary to support primate populations in China. In the expanding agricultural areas, macaques are hunted regularly as crop-raiding pests. Primates also have been subject to heavy trapping pressures (see Tan, 1985). An important reserved area in the western region is the Fanjingshan Nature Reserve.

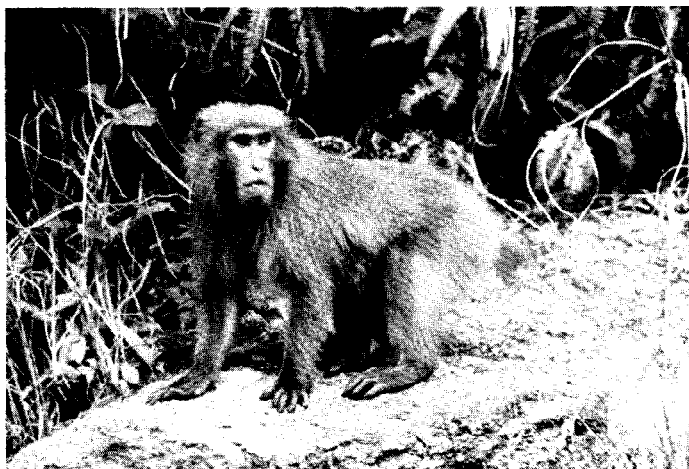


Limestone formations in southwest Guangxi province, southeast China (photo by Russell L. Ciochon).

(36) Oriental Deciduous Forest Biogeographical Province

The Oriental Deciduous Forest province includes the north China plain. Temperate deciduous forest characterized the region, but the land now is almost entirely under cultivation (Hou, 1983). Historically, *Macaca mulatta* was widely distributed north of the Hwang Ho or Yellow river and its range extended northwestward into the semi-humid loess plateau region. Relict populations remain in the Xinlon Mountains of northern Hebei about 100 kilometers northeast of Beijing at 41° N latitude and a few mountain areas in northern Henan and southern Shanxi (Tan, 1985).

The province extends through the Korean peninsula into the northern third of the Japanese island of Honshu and the southern peninsula of Hokkaido. *Macaca fuscata* is endemic to Japan and is found on the islands of Honshu, Shikoku, Kyushu, and several smaller islands.



Macaca fuscata yakui, from Yaku island in Japan (photo by David S. Sprague).



Provisioned Japanese macaques (*Macaca fuscata*) at Arashiyama, Japan. Habitat loss is a serious threat to wild populations, many of which become crop raiders and are trapped for biomedical research (photo by Ardith A. Eudey).

(37) Japanese Evergreen Forest Biogeographical Province

The southern distribution of *Macaca fuscata* falls within the Japanese Evergreen Forest province, which is characterized by warm temperate forests. *Macaca fuscata* occupies a wide range of habitats, from warm temperate lowland forests to alpine vegetation, but appears to prefer evergreen and deciduous forest in submontane and montane areas. All Japanese macaques belong to the subspecies *M. fuscata fuscata*, with the exception of the vulnerable *M. fuscata yakui* on Yaku island in the northern Ryukyu group (Azuma, 1974; Furuichi, 1983; Maruhashi, 1982; Sprague, 1986).

Habitat loss is a serious threat to *Macaca fuscata*. Concentrated human populations and intensive agriculture may be responsible for the absence of the species in lowland areas. Timbering activities and development programs are destroying habitat in mountainous areas. Logging, including large-scale clear cutting and conversion of natural and fire-wood forest into conifer plantations, has resulted in the deterioration of the species' habitat in many parts of its range. The raiding on crops that results means that many troops are persecuted as agricultural pests, and trapped animals mostly are supplied for biomedical research with little consideration even for resource management. A series of national parks contains populations of Japanese macaques, but many of these areas have been developed as tourist attractions. A review of the extensive field work on Japanese macaques, with bibliography, is contained in Baldwin *et al.* (1980). Additional information may be found in Itani, 1975; Sugiyama and Ohsawa, 1982; Wada, 1983; and Wada and Tokidu, 1981.

RECOMMENDED CONSERVATION ACTION

General Recommendations

From our review of the communities of Asian primates, we conclude that if the present patterns of diversity are to be maintained and if opportunities for the adaptive response of primate populations (and the ecosystems of which they are a part) are to be safeguarded, effective conservation measures should be initiated or continued throughout all the biogeographical provinces of Asia. Two different kinds of action are needed if effective conservation in Asia is to be achieved:

(1) SURVEYS are needed in many regions of the provinces described above where the distribution and status of primates are still unclear. These surveys should aim at producing recommendations for further conservation action. The highest priority must be given to surveys of areas containing what are believed to be seriously threatened populations. Surveys are the kind of project for which the technical expertise of IUCN/SSC members is especially well suited.

(2) When the distribution and status of primates are relatively well known and potential conservation sites already have been identified, support and technical advice should be given that will lead to the ESTABLISHMENT and/or EFFECTIVE MANAGEMENT OF RESERVES OR PROTECTED AREAS. Highest priority should be given to large reserves, or potential reserves, containing several threatened primates and a diversity of other species. More than one reserve usually will be needed in a region if sufficiently large populations within an ecological community are to be adequately protected: no one reserve can ever be regarded as totally secure. The development of national conservation strategies and action programs would appear necessary to protect the diversity of ecosystems and their primates within national boundaries, as indicated by the preceding review, and to guarantee sufficient potential for long-term survival and adaptation (see also Marsh and Wilson, 1981; Marsh, 1987).

Specific Projects

This final section of the Action Plan identifies specific projects that should be priorities during the 1987-91 period. With each project an estimate of the funds required during this period is given. In some cases the estimates are preliminary approximations and precise budgets still have to be drawn up. The estimates should give some indication to funding agencies, however, of the kind of commitment that is essential to conserve Asian primates and their habitats and how resources might be allocated most effectively. For instance, survey projects are relatively inexpensive compared to the cost of establishing and managing a large reserve; they are an obvious and cost-effective use of resources in regions where the status of primate populations is unknown and reserve sites have not been identified. The value of a survey is diminished, however, if the management recommendations that result from it are not implemented. Ultimately, the goal of a conservation strategy of this type should be to establish and manage effective reserves, and projects for reserves must take priority in areas where survey work has been done already. An additional set of special projects, such as monitoring the effects of trapping for trade, translocation, and developing alternatives to pest control, are included in the Action Plan.

The following specific projects are listed by country and biogeographical province. Projects for which no funds are required (NFR) are indicated as such.

Indonesia

North Sumatra Biogeographical Province

1. Conservation of Gunung Leuser National Park \$100,000

This area of 9460 km² may be considered as the last stronghold for the Sumatran orang-utan (*Pongo pygmaeus abelii*), and seven other

primates also are known within its boundaries: *Hylobates syndactylus*, *Hylobates lar vestitus*, *Presbytis thomasi*, *Trachypithecus cristatus*, *Macaca nemestrina*, *Macaca fascicularis*, and *Nycticebus coucang*. In addition to these eight primates, two more species may exist within the Sibayak Range south of the Wampu river in the Park: *Hylobates agilis* and *Presbytis melalophos*. Implementation of the management plan and more effective protection is necessary for the Park. Surveys are needed to determine the distribution and abundance of primates in the Park, especially in the Sibayak Range, and the population trends of *Pongo pygmaeus* should be monitored.

In order to determine environmental factors that may be limiting primates, a study is needed that correlates detailed quantitative descriptions of forest structure and floristic composition and forest phenology, especially the degree and nature of seasonality, with the distribution and abundance of primates in the Park. The results of these surveys should be useful for identifying factors that either enhance or endanger primates in natural habitats. Current and future threats to each habitat type and primate species need to be identified for future management considerations.

2. Development of a conservation public awareness program for the Gunung Leuser National Park \$100,000

Severe threats to the Park include shifting agriculture and unregulated hunting in some areas. Assistance to the Park staff is needed to improve relations with people living in the Alas Valley, an area of population pressure caused by urbanization within the Park, and villages surrounding the Park. Revival of a public awareness program, active in the mid-1970's, would involve the development of a mobile unit to visit periodically nearby villages, schools, and clubs. Improvement of the Bohorok Visitor Center also should be undertaken. In addition to promoting good relations between villagers and Park staff vital for Park management, the mobile unit team would be responsible for assessing local attitudes and the extent of land-use threats in each area visited. Assessment of local impact on wildlife, such as hunting and crop-raiding, will be needed to identify the main problem areas.

3. Study of the effects of habitat alteration on primate abundance, distribution, and ecology in northern Sumatra \$90,000

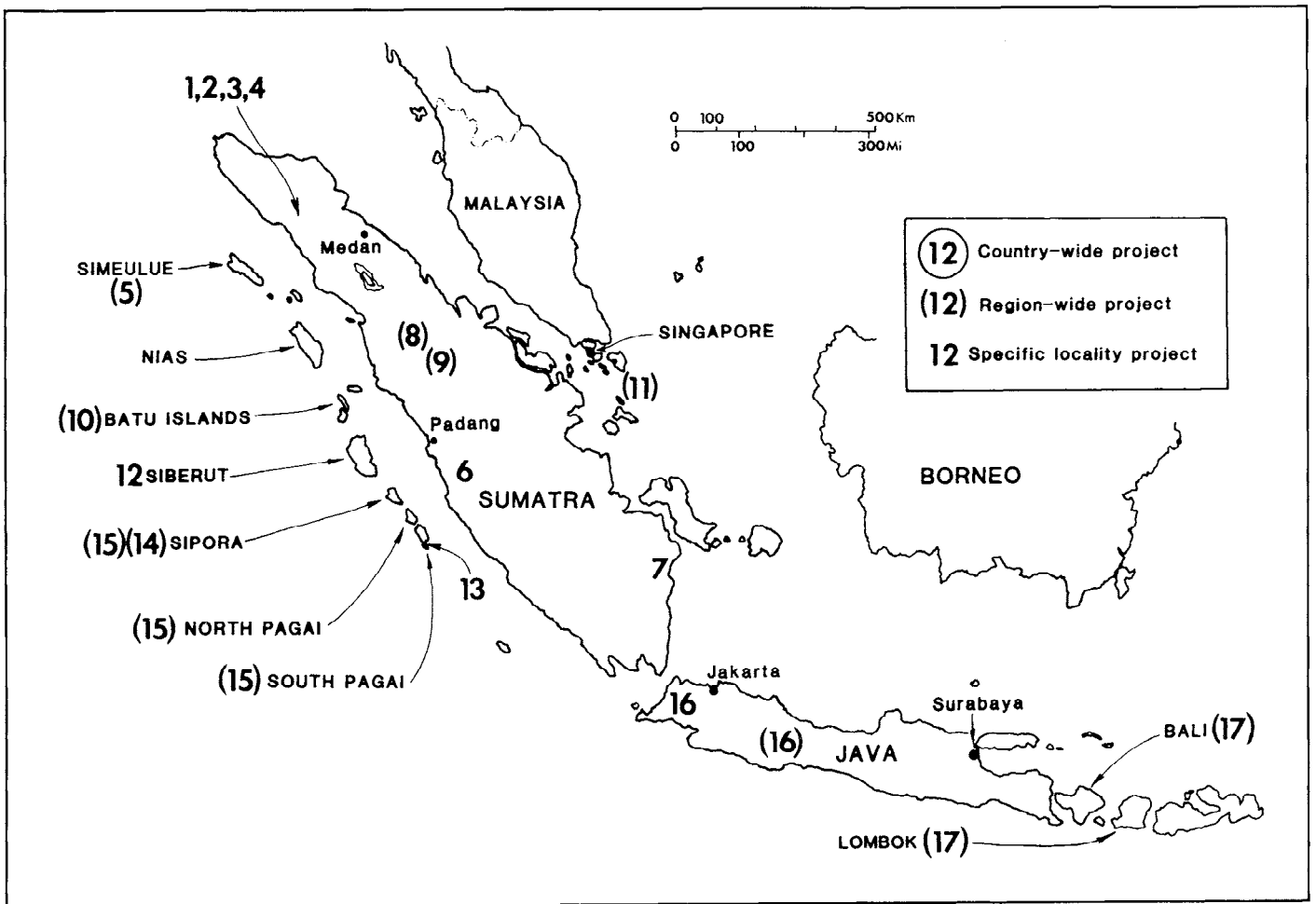
Commercial forests are vital to primate conservation since most of the forests of northern Sumatra are being logged. The area of forest left undisturbed in reserves will be extremely small by comparison. Therefore, how logged forests are managed will have important implications for primate survival. Support is needed to conduct research on how different species respond to alterations of their habitat, especially selective logging. The results of this research will be used to identify factors in selectively logged forests that either enhance or endanger primate populations, thereby making possible recommendations for the management of wildlife in commercial forests.

4. Development of alternative methods for controlling crop-raiding by primates in the Gunung Leuser National Park \$10,000

Loss of forest habitat through logging operations and conversion to agriculture is increasing crop-raiding by primates, especially macaques (*Macaca fascicularis* and *Macaca nemestrina*), and increasing the vulnerability of populations on the forest edge. Support is needed to determine the crop preferences of species and the timing and extent of exploitation in order to test the effectiveness of alternative techniques of control (to killing).

5. Conservation of the Simeulue macaque (*Macaca fascicularis fuscus*) on Simeulue (Simalur) island, off the coast of northwest Sumatra \$50,000

A comprehensive action program is necessary to protect the unique Simeulue macaque as conversion of habitat to clove plantations (especially the coastal forest apparently preferred by the monkeys), accompanied by persecution of the population as an agricultural pest, increases on Simeulue Island. A management plan is required for a proposed 270 km² inland reserve to permit both traditional exploitation of forest prod-



Map 3. Regions included in the North Sumatra, South Sumatra, Mentawai Islands, Javan Rainforest, Javan Monsoon Forest, and Lesser Sunda Islands Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

ucts and protection of unexploited wilderness. The major effort should be devoted to initiating wildlife law enforcement throughout the island, with attention to developing alternatives to pest control.

South Sumatra Biogeographical Province

6. Development of Kerinci-Seblat National Park, south Sumatra \$100,000

Support is necessary for the implementation of the management plan, protection enforcement, and development of a conservation education program for this 14,846 km² Park. Surveys are necessary to establish the distribution and abundance of primate species in this newly declared reserve. The primate fauna includes *Hylobates syndactylus*, *Hylobates agilis*, *Presbytis melalophos*, *Trachypithecus cristatus*, *Macaca nemestrina*, *Macaca fascicularis*, *Tarsius bancanus*, and presumably *Nycticebus coucang*.

7. Conservation of Way Kambas, southeastern Sumatra \$75,000

A conservation education program is needed in and around Way Kambas. The area has been affected by fire and logging but still has good populations of *Hylobates syndactylus*, *Hylobates agilis*, *Presbytis melalophos*, *Trachypithecus cristatus*, *Macaca nemestrina*, *Macaca fascicularis* and presumably *Tarsius bancanus* and *Nycticebus coucang*. Surveys are needed to determine the distribution and abundance of primates in the reserve.

8. Surveys to determine the diversity and distribution of *Presbytis* spp. and subsp. in south Sumatra and to assess their conservation status \$15,000

Surveys are necessary to work out the classification and distribution of the Sumatran leaf monkeys *Presbytis femoralis* and *Presbytis*

melalophos and to make any necessary recommendations for their conservation. The area east of Lake Toba may require special attention. *P. femoralis* is considered to be the population of *Presbytis* least clearly defined taxonomically.

9. Monitoring the effects of trapping for trade on *Macaca fascicularis* and *Macaca nemestrina* \$50,000

The Philippines has proposed restricting the export of *Macaca fascicularis*, which may mean that Indonesia will become the only supplier of wild-caught long-tailed macaques and pigtail macaques in world trade. Sumatra is the major source of both species. Loss of forest habitat through logging, slash and burn agriculture, conversion to plantations, and other activities has made macaque populations more vulnerable to the effects of trapping for trade. Information is needed on how commercial trapping affects population numbers, demography, and dynamics in order to regulate trade.

10. Survey of the Batu Islands \$5,000

The Batu Islands, which are located off the west coast of Sumatra north of the Mentawai Islands, have what may be an endemic leaf monkey, *Presbytis femoralis batuana*, and otherwise are poorly known faunally.

11. Survey of the Riau Islands \$10,000

The Riau Islands are located off the east coast of Sumatra and south of the Malay Peninsula. Batam, Galang, Bintang, and Kundar especially have a variety of primates including *Macaca nemestrina*, *Macaca fascicularis karimoni*, *Presbytis femoralis rhionis*, and *Nycticebus coucang*, some of which are distinctive forms. Surveys are needed to determine the diversity and distribution of the primates and to assess the feasibility of habitat protection.

Mentawai Islands Biogeographical Province

12. Development of the Biosphere Reserve on Siberut Island \$150,000

Support is needed for increased protection and implementation of the management plan by which Teitei Batti Game Sanctuary (65 km²) will be expanded to include a strictly protected core area (500 km²) with additional areas (1000 km²) in which traditional uses would be allowed. This action is necessary to conserve the unique primate fauna of the Mentawai Islands, which is best represented on Siberut: *Hylobates klossii*, *Simias concolor*, *Presbytis potenziani*, and *Macaca pagensis*. The primates, especially *S. concolor*, have been under tremendous pressure from hunting by local people and from commercial exploitation of the forests.

13. Creation of a primate reserve on South Pagai Island and off-shore islands \$100,000

Primates are under severe threat in the Pagai Islands in the southern Mentawais: *Simias concolor concolor* from hunting as a preferred food species, *Macaca pagensis* from poisoning as an agricultural pest, and all species from logging and rapidly accelerating land conversion for agriculture. A reserve to protect these primates should be declared in an undisturbed area of swamp forest and lowland rain forest on two off-shore islands and the adjacent southeastern area of South Pagai Island, outside of timber concessions. An educational program aimed at stopping the hunting of the pig-tailed snub-nosed monkey and persecution of other primates should be integrated with the development of the reserve.

14. Survey of primates on Sipora Island \$7,000

A survey is needed on Sipora Island, to complete the survey of the southern Mentawai Islands, with the intention of setting up reserved areas for *Hylobates klossii*, *Presbytis potenziani potenziani*, *Simias concolor concolor*, and the local subspecies of *Macaca pagensis*. Habitat destruction and hunting have proceeded at such a fast pace on the southern Mentawais that these populations may be considered highly endangered.

15. Captive breeding program to recover the endemic subspecies of Mentawai primates on the southern islands, Sipora and Pagais \$100,000

A conservation-oriented captive breeding program is needed to recover the endemic subspecies *Simias concolor concolor* and *Presbytis potenziani potenziani* and the regional population(s) of *Macaca pagensis*. Habitat loss throughout the islands has reduced much of these populations to small isolates in forest fragments.

Javan Rainforest and Javan Monsoon Forest Biogeographical Provinces

16. Conservation of the endemic *Hylobates moloch* and *Presbytis comata* in west Java \$100,000

Only fragmented pockets of moist evergreen forest remain in west (and central) Java, to which these two rare species are restricted. Human population pressure makes it impossible to declare new reserves. Upgrading of protection at Ujung Kulon/Gunung Honje (768 km²) and Gunung Halimun (400 km²), where the largest populations of these endemics probably occurs, are needed to conserve the two species. Population trends of both *H. moloch* and *P. comata* should be monitored, and the status of *P. comata fredericae* in central Java should be determined. The endemic subspecies *Trachypithecus auratus sondaicus* also would benefit from this action.

17. Survey of Bali \$10,000

Surveys are needed for *Trachypithecus auratus kohlbruggei* and *Macaca fascicularis mordax* to determine the distribution and status of populations and to assess the adequacy of protection for them. The survey for *T. auratus kohlbruggei* should be extended to Lombok, which is beyond the limit of its natural distribution.

Borneo and Palawan Biogeographical Province

18. Conservation of primates, especially *Pongo pygmaeus*, and lowland forest habitats in and around Kutai National Park, Kalimantan \$75,000

Since drought and fire damaged vast portions of the 2000 km² Park and surrounding areas, assessment of the extent of damage to primary moist evergreen forest and primates, particularly *Pongo pygmaeus*, *Hylobates muelleri*, and *Nasalis larvatus*, should be followed by study of the secondary vegetational succession and recovery of primate populations. Population trends of these three species should be monitored. Primate (and other) researchers should be encouraged to continue their studies at Kutai rather than moving elsewhere. The Kutai National Park Management Plan should be implemented, with appropriate amendments in recognition of the new situation, and protection should be increased for the Park. Other primates in the Park are *Presbytis frontata*, *Presbytis rubicunda*, *Trachypithecus cristatus*, *Macaca nemestrina*, *Macaca fascicularis*, *Tarsius bancanus*, and *Nycticebus coucang*.

19. Conservation of primates, especially *Pongo pygmaeus*, and lowland forest habitats in and around Tanjung Puting National Park \$75,000

Tanjung Puting covers 3550 km² and is the largest and most diverse protected area of coastal heath and peat swamp forest, which used to cover much of southwestern and southern Borneo. The Orangutan Research and Conservation Project should be supported in terms of its long-range research on *Pongo pygmaeus*; research on other primates such as *Hylobates agilis*, *Nasalis larvatus*, and *Presbytis rubicunda*; primate rehabilitation; student training; and conservation education of local people. Implementation of the management plan drafted by WWF Indonesia Program for the P.P.A. branch of the Indonesian Forestry Department should be encouraged, accompanied by increased protection for the Park, including boundary patrols. Other primates in the Park are *Macaca fascicularis* and occasionally *Macaca nemestrina*.

20. Conservation of *Nasalis larvatus* and coastal and riverine habitats in Kalimantan \$50,000

A survey is needed to determine the distribution and abundance of *Nasalis larvatus* in mangrove, peat swamp, and riverine forest both within and outside reserved areas in order to identify good populations for which totally effective protection can be established. The species is declining very rapidly throughout Borneo and appears to be restricted largely to small, totally isolated populations. There is no viable population effectively protected throughout the species' entire range. The project should be expanded to include Sabah and Brunei Darussalam. The necessary survey work already has been completed in Sarawak.

21. Surveys for *Presbytis frontata* in Kalimantan \$20,000

A survey is needed to determine the distribution and status of *Presbytis frontata* in interior Kalimantan. Little is known about this species endemic to Borneo, so it is impossible to know if it is adequately protected by the existing reserve system. The survey should be expanded to include Sarawak.

22. Extension of the proposed Cagar Alam Bukit Batikap reserved area in Central Kalimantan \$75,000

The proposed Cagar Alam Bukit Batikap I, II, III, which continue down from the Sarawak border, if extended, would protect *Nasalis larvatus* and the hybrid zone between *Hylobates muelleri* and *Hylobates agilis albibarbis* in the Barito river watershed. *Pongo pygmaeus* also may occur in the region. Development of the extension will be tied in with Project Barito Ulu, which focuses on sustained human use and regeneration of forest in the region.

23. Support for the protection and management of Gunung Betung Dan Kariman Reserve, Kalimantan \$100,000

The reserve is on the border with Sarawak and is contiguous with that

country's Lanjak-Entimau Wildlife Sanctuary. Funds are needed for the development of the reserve, accompanied by surveys for *Pongo pygmaeus* and presumably *Hylobates muelleri*, *Presbytis frontata*, *Presbytis rubicunda*, *Macaca nemestrina*, *Tarsius bancanus*, and *Nycticebus coucang*. The reserve, in combination with Lanjak-Entimau Wildlife Sanctuary, will encompass more than 6000 km² of protected forest and will be of great importance for the conservation of orang-utans and white-fronted leaf monkeys.

24. Support for the protection and management of Bukit Raya Reserve, Central Kalimantan \$75,000

Support is needed for the development of this reserve, along with surveys for *Pongo pygmaeus* and presumably *Hylobates muelleri*, *Presbytis frontata*, *Presbytis hosei*, *Presbytis rubicunda*, *Tarsius bancanus*, and *Nycticebus coucang*.

25. Survey of the Natuna Islands, South China Sea \$15,000

The Natuna Islands consist of several small islands located in the South China Sea close to the international border between Indonesia and Vietnam. The primate fauna includes *Presbytis femoralis natunae*, *Trachypithecus cristatus vigilans*, *Macaca fascicularis pumila*, *Tarsius bancanus*, and *Nycticebus coucang*, some of which may be quite distinctive. Transmigration into the Natuna Islands and development of a military base are a considerable threat to the habitat of the five primates. A survey is needed to determine the distribution and abundance of the primates and to assess the feasibility of habitat protection.

26. Survey of Karimata Island, Kalimantan \$4,000

Support is needed for a survey of Karimata Island, which is situated

some 100 km to the west of Borneo. *Presbytis rubicunda carinatae* is endemic to the island, and its status is unknown.

East Malayan Islands Biogeographical Province

27. Surveys for *Macaca ochreata* and *Macaca brunnescens* in Sulawesi \$20,000

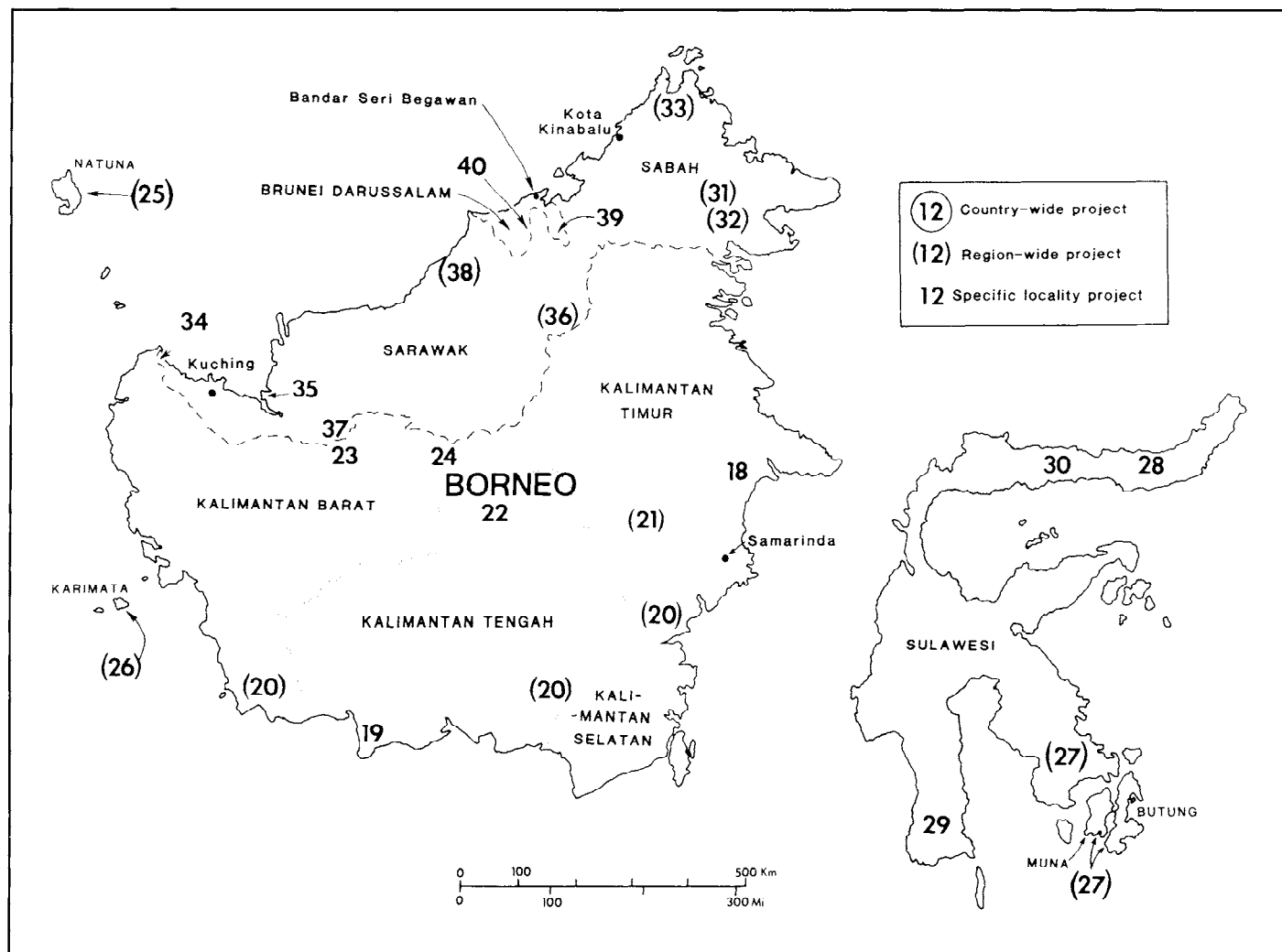
Sulawesi contains a unique radiation of perhaps as many as seven species of macaques, of which two populations are little known. Surveys are needed to determine the distribution and status of *Macaca ochreata* in southeast Sulawesi and *Macaca brunnescens* on Buton and Muna Islands in order to declare reserves for these populations.

28. Conservation of Dumoga-Bone National Park, Sulawesi \$50,000

This 3000 km² Park is the most important in Sulawesi. The primate fauna includes *Macaca nigra*, *Macaca nigrescens*, *Macaca hecki*, and *Tarsius spectrum*. A management plan exists for the Park, and development funding has been obtained from the World Bank. Good research facilities are available, and Project Wallace currently is there. Support is needed for a conservation education program.

29. Conservation of *Macaca maura* in south Sulawesi \$75,000

Macaca maura is probably the most threatened of the Sulawesi macaques. Support is needed for the implementation of the proposals to extend Karaenta Reserve to Bantimurung Reserve to form a national park and to create a new reserve at Gunung Lompobatang. Good habitat for *M. maura* is likely to become increasingly rare elsewhere in south Sulawesi as the human population increases. Population trends of *M. maura* should be monitored in these reserved areas. *Tarsius spectrum* also would benefit from this project.



Map 4. Regions included in the Borneo and Palawan East Malayan Islands Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

30. Conservation of *Macaca hecki* in north Sulawesi \$75,000

The present system of protection for *Macaca hecki* appears to be inadequate. The population occurs only in small reserves such as Panua, Tangale, and Tanjung Panjang and just into the western part of Dumoga-Bone National Park. The rejected proposal for Randangan Reserve should be reviewed, with support being made available for the protection and management of this reserved area. *Tarsius spectrum* also would benefit from this project.

Malaysia

Borneo and Palawan Biogeographical Province

31. Conservation of *Pongo pygmaeus* in Sabah \$50,000

Current estimates of the number of orang-utans in Sabah have ranged from as low as 2,000 to over 4,000. The patterns of forest distribution and the effects of logging, however, rather than present actual numbers of orang-utans, will have the greatest bearing on whether the species survives in Sabah in the long run. Highest population densities of orang-utans consistently occur in primary lowland dipterocarp forests. Yet, by the end of the century, most of this forest will have been replaced by permanent agriculture, which supports no orang-utans. Population densities tend to decrease markedly with increasing altitude, and orang-utans are extremely rare above 1000 meters. Only higher altitude forests are likely to survive in extensive tracts. Kinabalu National Park contains orang-utans, but possibly too few for long-term viability. The vegetation throughout most of the Park cannot support orang-utans. Tawau Hills National Park appears to contain no orang-utans whatsoever.

In order to assess the potential importance of different regions of Sabah's remaining forests for the conservation of orang-utans, funds are required for surveys of existing and proposed reserved areas and of the interior of Sabah, and for an investigation of the effects of logging on orang-utan populations. Areas containing viable orang-utan populations will be identified and specific recommendations for long-term orang-utan conservation will be made.

32. Translocation of *Pongo pygmaeus* displaced by agricultural development to permanent forest reserves or other protected areas in Sabah \$50,000

Many hundreds of orang-utans are losing, or are likely to lose, their habitat as a result of forest clearance for plantations. Forest conversion is so extensive in Sabah that there is no opportunity for the majority of these primates to move to alternative forest areas. The Rehabilitation Center at Sepilok Virgin Jungle Reserve (40 km²) has made a contribution to saving individual orang-utans and to promoting nature education locally, but the reserve is too small and isolated to be an ideal conservation area. In order to ensure that displaced orang-utans contribute to the long-term survival of the species, a project is necessary to develop methods for translocation of orang-utans from forest being clear-felled to permanent forest areas, and to develop guidelines for deciding the circumstances under which orang-utans should be captured and where they should be translocated. Tawau Hills National Park has been proposed as the new location area.

33. Conservation of *Nasalis larvatus* and *Trachypithecus cristatus* in Sabah \$20,000

Surveys are needed to identify viable populations of *Nasalis larvatus* and *Trachypithecus cristatus* for protection in coastal and riverine habitat, in anticipation of selective logging and clear felling in mangrove forest reserves. This project should be coordinated with comparable surveys being conducted elsewhere in Borneo.

34. Conservation of *Nasalis larvatus* in deltaic mangrove forest in Sarawak NFR

Surveys for proboscis monkeys in relatively intact mangrove and peat swamp forest recently have been completed throughout Sarawak, as part of a joint project of the National Parks and Wildlife Office of the Sarawak

Forest Department, World Wildlife Fund Malaysia, and the New York Zoological Society. Studies of the ecology and social organization of the species have been initiated at Samunsam Wildlife Sanctuary (60 km²) as part of the project. Work on a management plan and program of protection for the Sanctuary will be initiated in January 1987. Recommendations include extending the Sanctuary 148 km² to include areas used by groups of *Nasalis larvatus*, as proposed by the National Parks and Wildlife Office. Relief of hunting pressure is an urgent priority. The rare subspecies *Presbytis femoralis chrysomelas*, *Trachypithecus cristatus*, *Macaca nemestrina*, *Macaca fascicularis*, and *Hylobates muelleri* also occur in the Sanctuary.

35. Conservation of lowland swamp forest primate communities in Sarawak NFR

Sarawak has yet to provide permanent protection for any sizeable area of its extensive peat-swamp lowland forest. Approximately 28,900 km² (23%) of the state is less than 30 meters above sea level and is characterized by gley and peat formations, most of which are poorly drained and support various types of swamp forest. This habitat is found in the most accessible and, therefore, the most exploited part of the state. Recent surveys under the joint auspices of the National Parks and Wildlife Office of the Sarawak Forest Department, World Wildlife Fund Malaysia, and the New York Zoological Society identified the Maludam River as an excellent area for the protection of peat swamp forest and *Nasalis larvatus*. *Presbytis femoralis cruciger*, *Trachypithecus cristatus*, and *Macaca fascicularis* also would benefit from protection of the area. Work on a management plan and program of protection for a new sanctuary on the Maludam River will begin in January 1987.

36. Protection of hill and montane forest habitats in the central and northern parts of Sarawak NFR

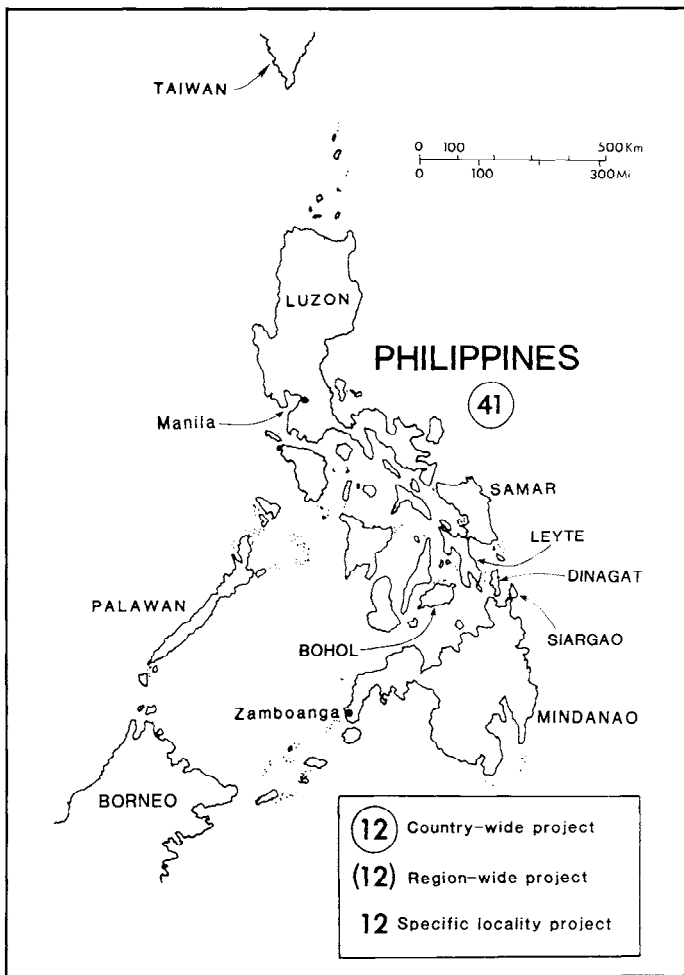
Protection would include the implementation of the Gunung Mulu National Park Management Plan (1977-1982) and the identification, survey, and gazettement of large protected areas where land is still available. Primate species occurring inland include *Pongo pygmaeus*, *Hylobates muelleri*, *Presbytis frontata*, *Presbytis hosei*, *Presbytis rubicunda*, *Tarsius bancanus*, and *Nycticebus coucang*. Reserves are most likely to be possible where protection has value in terms of watershed management, small-scale local forest use, and tourist potential. A number of areas are under consideration by the Sarawak Forest Department.

37. Extension of Lanjak-Entimau Wildlife Sanctuary in Sarawak NFR

Lanjak-Entimau Wildlife Sanctuary (1687 km²) is the largest protected area in East Malaysia and the country's largest wildlife sanctuary. It was gazetted in 1983 primarily to protect *Pongo pygmaeus*. Proposals exist for its extension in several areas by 184 km², and for the creation of Batang Ai National Park (270 km²) contiguous with its southern boundary. *Hylobates muelleri*, *Presbytis frontata*, *Presbytis rubicunda*, *Macaca nemestrina*, *Macaca fascicularis*, *Tarsius bancanus*, and *Nycticebus coucang* also occur within its boundaries. Recruitment of personnel and effective control of hunting will be priority items.

38. Surveys of endangered banded leaf monkeys, *Presbytis femoralis*, in Sarawak \$10,000

In northwestern Borneo, there are two endemic subspecies of *Presbytis femoralis*. Both have limited distributions, but their exact limits are not known. They seem to occur predominantly in the coastal lowlands, areas in which the forests have been logged or cleared on a large scale for shifting cultivation or for large scale agriculture and development schemes. Populations of *P. femoralis* in remaining areas are likely to have been severely affected by hunting. *P. femoralis chrysomelas* occurs in two relatively small totally protected areas, but the distribution of *P. femoralis cruciger* is uncertain, and it is not known definitely to occur in any. As neither subspecies is protected by law, protection in reserves is minimal and hunting heavy. Survey data are needed to formulate a conservation plan for the monkeys.



Map 5. Regions included in the Philippine Islands and Borneo and Palawan Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

Brunei Darussalam

Borneo and Palawan Biogeographical Province

39. Declaration of the Ulu Temburong Conservation Forest

NFR

The Brunei Darussalam Government has agreed in principle to setting aside almost 640 km² of commercially "good" forest as Conservation Forest. The largest single area is in Temburong district (353 km²), and would provide protection for primary mixed dipterocarp forest and nearly all the country's montane forest.

40. Feasibility study for restoring primate fauna in lowland dipterocarp and swamp forest \$10,000

A new forest reserve is planned as a pilot study area for the conservation of humid tropical forest ecosystems. Restoration of the primate and other fauna, including *Pongo pygmaeus*, through reintroduction and subsequent management programs merits consideration.

Philippines

Philippine Islands and Borneo and Palawan Biogeographical Provinces

41. Surveys for *Tarsius syrichta* and *Macaca fascicularis* \$75,000

Surveys are needed to determine the distribution and status of the Philippine tarsier, which is reported for the islands of Samar, Leyte, Dinagat, Siargao, Bohol, and Mindanao; and the Philippine macaque, for which both coastal and upland populations are reported. *Macaca fascicularis* basically is unstudied in the Philippines and its status may be precarious. Less than one-third of the land area of the Philippines

is thought to remain in forest as a consequence of logging and slash and burn agriculture, although the government is attempting to slow the rate of deforestation (and achieve reforestation). The surveys should result in the identification of suitable protected areas for the tarsier and assessment of the adequacy of the present system of reserved areas to provide protection for the macaque. The macaque is harassed as an agricultural pest, hunted for medicine, and has been trapped heavily for export.

Laos

Transhimalayan Mountains, Assam-Kra Rainforest, and Thai-Indochinese Dry Forest Biogeographical Provinces

42. Conservation of primates in Laos \$50,000

The primate fauna of Laos includes *Hylobates concolor* and *Hylobates pileatus* (and perhaps *Hylobates lar* in the area west of the Mekong river), *Pygathrix nemaus* and *Pygathrix nigripes*, *Trachypithecus cristatus*, *Trachypithecus francoisi*, *Trachypithecus phayrei*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca fascicularis*, *Macaca mulatta*, *Macaca arctoides*, and both *Nycticebus coucang* and *Nycticebus pygmaeus*. Many of these species are virtually unknown throughout their ranges. Nothing is known about the status of primates in Laos. Prolonged warfare and mass migrations of the human population in Indochina may have resulted in extensive habitat destruction and loss of primate populations. Surveys are needed to determine the diversity, distribution, habitat requirements, and status of primate species in Laos and to make recommendations for appropriate conservation action, including the development of reserved areas.

Kampuchea

Thai-Indochinese Rainforest and Thai-Indochinese Dry Forest Biogeographical Provinces

43. Conservation of primates in Kampuchea \$30,000

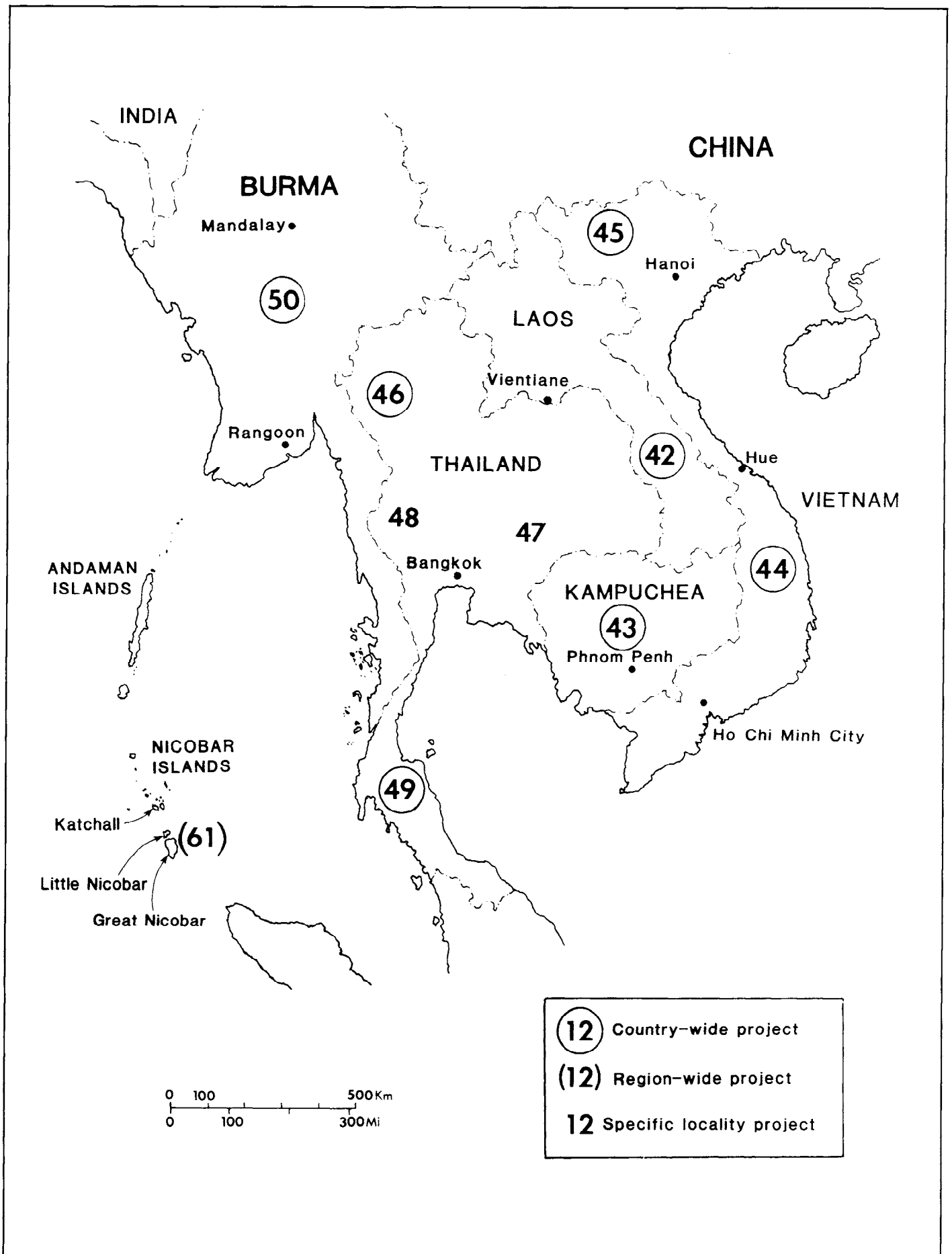
The primate fauna of Kampuchea includes *Hylobates concolor*, *Hylobates pileatus*, *Pygathrix nigripes*, *Trachypithecus cristatus*, *Macaca fascicularis* and *Macaca arctoides* (and perhaps *Macaca nemestrina*), and *Nycticebus coucang*. The largest populations of the endangered pileated gibbon are reported to occur within Kampuchea. Prolonged warfare and mass migrations of the human population in Indochina may have resulted in extensive habitat destruction and loss of primate populations. Surveys are needed to determine the diversity, distribution, habitat requirements, and conservation status of primates in Kampuchea and to make recommendations for appropriate conservation action, including the development of reserved areas.

Vietnam

Tonkin-Chinese Rainforest, Transhimalayan Mountains, Thai-Indochinese Rainforest, and Thai-Indochinese Dry Forest Biogeographical Provinces

44. Survey of primates in Vietnam \$50,000

The primate fauna of Vietnam includes *Hylobates concolor* (and perhaps *Hylobates pileatus*), the highly endangered *Rhinopithecus avunculus*, *Pygathrix nemaus* and *Pygathrix nigripes*, *Trachypithecus cristatus*, *Trachypithecus francoisi*, *Trachypithecus phayrei*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca fascicularis*, *Macaca mulatta*, *Macaca arctoides*, and both *Nycticebus coucang* and *Nycticebus pygmaeus*. Little information is available on the status of primates in Vietnam, although the country has initiated faunal surveys. During the three decades of warfare in Vietnam, mangrove forests in the south were significantly reduced, and sporadic skirmishes on the border with China may be causing the loss of moist evergreen forest in the north. The forest cover of Vietnam is reported to have dropped from 44% in 1943 to 21% at present. The situation has been exacerbated by a rapidly growing human population. Agriculture has not been possible in the very steep interior mountains, and, although the government has proposed controlled cutting of montane forests in the central highlands, some of the area



Map 6. Regions included in the Tonkin-Chinese Rainforest, Transhimalayan Mountains, Thai-Indochinese Rainforest, Thai-Indochinese Dry Forest, Malaysian Rainforest, Assam-Kra Rainforest, Burma Dry Forest, and Andaman and Nicobar Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

has been set aside for wildlife reserves. Support is needed to make it possible for a Vietnamese biologist to concentrate on surveys for primates as part of the general faunal survey of the country. Information is needed on the diversity, distribution, habitat requirements, and status of primate populations.

45. Support for the management and protection of reserves in Vietnam **\$200,000**

Vietnam has a National Conservation Strategy and has declared some reserves, but all primates are considered to be inadequately protected in the country. Support is needed to strengthen the management and protection of existing reserves and/or to declare new ones. The most endangered primates in Vietnam include *Rhinopithecus avunculus*, *Pygathrix nemaeus*, *Hylobates concolor concolor*, and *H. concolor leucogenys* in the northern hill and mountain areas; *Trachypithecus francoisi delacouri*, *T. francoisi poliocephalus*, and *H. concolor siki* in the northern and central coastal areas; and *Pygathrix nigripes* and *H. concolor gabriellae* in the south.

Thailand

Thai-Indochinese Rainforest, Assam-Kra Rainforest, Malaysian Rainforest, and Thai-Indochinese Dry Forest Biogeographical Provinces

46. Survey of primates and habitats in national parks and wildlife sanctuaries in Thailand **\$75,000**

There are about 80 national parks and wildlife sanctuaries in Thailand, as well as other protected areas, which altogether account for about 10% of the country's total land area of 513,500 km². Detailed information about the animals and vegetation in most protected areas has not yet been gathered. In addition, many of the reserved areas, such as Tab Lan National Park in central Thailand, are relatively new and unexplored and require surveys for primates. The Royal Forest Department is in the process of developing management plans for reserved areas. Support is required for biologists from the Royal Forest Department and others to inventory (and survey) primate species and habitats in reserved areas throughout Thailand so that adequate provisions will be made for the protection of primates in management plans. The primate fauna of Thailand includes *Hylobates agilis*, *Hylobates lar*, *Hylobates pileatus*, *Presbytis femoralis*, *Trachypithecus cristatus*, *Trachypithecus obscurus*, *Trachypithecus phayrei*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca fascicularis*, *Macaca mulatta*, *Macaca arctoides*, and *Nycticebus coucang*.

47. Conservation of *Hylobates pileatus* and *Hylobates lar* in Khao Yai National Park **\$30,000**

Further surveys and ecological studies are needed in this zone of contact between the endangered pileated gibbon and lar gibbon in moist evergreen forest in the Petchabon Range in central Thailand. Long-term studies in the Park are providing information on habitat requirements of the two populations, which is necessary for management. Poaching is a continuing problem in the Park and needs to be monitored. Efforts to help Park personnel to reduce poaching need to be made, especially in areas where the declining *H. pileatus* population occurs.

48. Development of Huai Kha Khaeng Wildlife Sanctuary in west-central Thailand **\$150,000**

The sanctuary encompasses over 1650 km² of moist deciduous and dry evergreen forest in lowland and mountainous areas on the eastern flank of the Dawna Range and is contiguous with the larger Thung Yai Wildlife Sanctuary (3180 km²) to the west. The two sanctuaries have been proposed as a World Heritage Site. Both the mammal and bird faunas are rich in diversity, and many bird species locally extirpated in northwestern Thailand survive here. The primates are: *Hylobates lar*, *Trachypithecus cristatus*, *Trachypithecus phayrei*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca fascicularis*, *Macaca mulatta*, *Macaca arctoides*, and *Nycticebus coucang*. Surveys to determine the distribution of macaque species throughout the sanctuary should be continued and

expanded to include the other primate species, and the habitat requirements of all primates should be established. Protection for the sanctuary should be increased, especially patrols against sport and market hunting. Specific projects for the sanctuary include: (1) development and implementation of a management plan, (2) establishment of a training center in wildlife biology, (3) development of a conservation education program for local people, (4) study of the effects of hill tribe peoples on the sanctuary.

49. Expansion of the rural development and national park program **\$100,000**

Thailand now has about 52 national parks. Protection of the larger areas in the parks is not feasible with present or anticipated guard strength, especially since the regulations of many parks are not respected by local people. In order to improve the protection of and benefits from national parks in Thailand, selected and direct economic benefits to poor rural residents in adjacent areas must be promoted. Plans are being formulated for developing selected areas for visitors, both local and international. Such plans seek to maximize benefits to local residents. A pilot trekking and nature study program has been initiated at Khao Yai National Park that employs local residents knowledgeable about the area and wildlife. A management plan is being developed for the selective and gradual expansion of the program under the Royal Forest Department.

Burma

Transhimalayan Mountains, Assam-Kra Rainforest, and Burma Dry Forest Biogeographical Provinces

50. Conservation of primates in Burma **\$50,000**

The primate fauna of Burma includes *Hylobates hoolock*, *Hylobates lar*, *Trachypithecus cristatus*, *Trachypithecus obscurus*, *Trachypithecus phayrei*, *Trachypithecus pileatus*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca fascicularis*, *Macaca mulatta*, *Macaca arctoides*, and *Nycticebus coucang*. There are 14 wildlife sanctuaries in Burma, altogether comprising only 4728 km² or about 0.7% of the total land area of 676,580 km². The fauna in the sanctuaries is protected but the habitat is not, with the result that many areas and species have suffered serious damage. Little information is available on the status of primates. Efforts are underway to upgrade the system of protection and establish a series of national parks. Support is needed for surveys to determine the distribution, habitat requirements, and status of primates in order to assess the adequacy of proposed reserved areas and to make recommendations for conservation action.

Bangladesh

Assam-Kra Rainforest, Bengal Rainforest, and Sal Biogeographical Provinces

51. Conservation of *Macaca nemestrina leonina* in Bangladesh **\$5,000**

Pigtail macaques were contacted only recently in Bangladesh. The species appears to be restricted to deep semi-deciduous-evergreen or evergreen forest in Sylhet and in the Teknaaf peninsula, Cox's Bazar, although it also may be present in the Chittagong Hill Tracts on the border with Assam. In Sylhet, the population appears to be scattered among several small patches of forest, and only the undisturbed area of Rajkandi, a large block of evergreen forest, might function as a viable reserve. The Rajkandi forest should be surveyed with the intention of establishing a suitable area for a wildlife sanctuary and a plan drawn up for its management.

52. Conservation of *Macaca fascicularis* **\$5,000**

The long-tailed macaque only recently was recorded in Bangladesh, in Cox's Bazar Division in the southeast, which represents the westernmost extension of its range. The population appears to be restricted to tidal-mangrove forest along the Naaf river on the Burmese border and to migrate between Bangladesh and Burma. Forest clearing in association with the development of a tidal shrimp industry seriously threatens

the survival of the species in Bangladesh. The Naaf river belt should be surveyed in detail to find a suitable area for a long-tailed macaque reserve, the habitat requirements of the species should be determined, and a management plan should be developed for the sanctuary.

53. Conservation of *Hylobates hoolock* \$10,000

Recent surveys have suggested that the hoolock gibbon's numbers are low throughout Bangladesh. The hoolock gibbon is one of the two gibbon species that has not been the subject of intense ecological study, and, as a consequence, its habitat requirements, especially in seasonal forest, remain unknown. The site of West Bhanugach in Sylhet has been proposed as a sanctuary for the species; more extensive and accessible areas south of Chittagong in Bhomariogona Forest and Chanuti Forest would be preferable. Support is needed to determine the ecological requirements of the hoolock gibbon in the latter area and to draw up a management plan for a sanctuary. This project will be augmented by a survey to determine the status of the species throughout Bangladesh and to make further recommendations for its conservation.

54. Conservation of *Trachypithecus pileatus* in the Madhupur region \$10,000

There is urgent need for action to conserve the deciduous *sal* forest of the Madhupur Tract in north-central Bangladesh, which has been reduced to a number of small patches. Madhupur National Park, for example, has only about 20 km² of natural forest and the rest is poor

quality scrub forest or cultivation. Both *Trachypithecus pileatus* and *Macaca mulatta* are found in the forest. Support is needed to determine the habitat requirements of the capped langur, including its dependence on crop-raiding in local villages, and to study the impact of local Garo villagers and cattle on the habitat and, consequently, on the welfare of the monkeys in order to develop a management plan for Madhupur National Park. The boundaries of the Park must be redefined to incorporate forest to the southeast, and elsewhere in the Madhupur Tract the status of the forest should be evaluated for inclusion in reserves.

55. Conservation of *Semnopithecus entellus* \$5,000

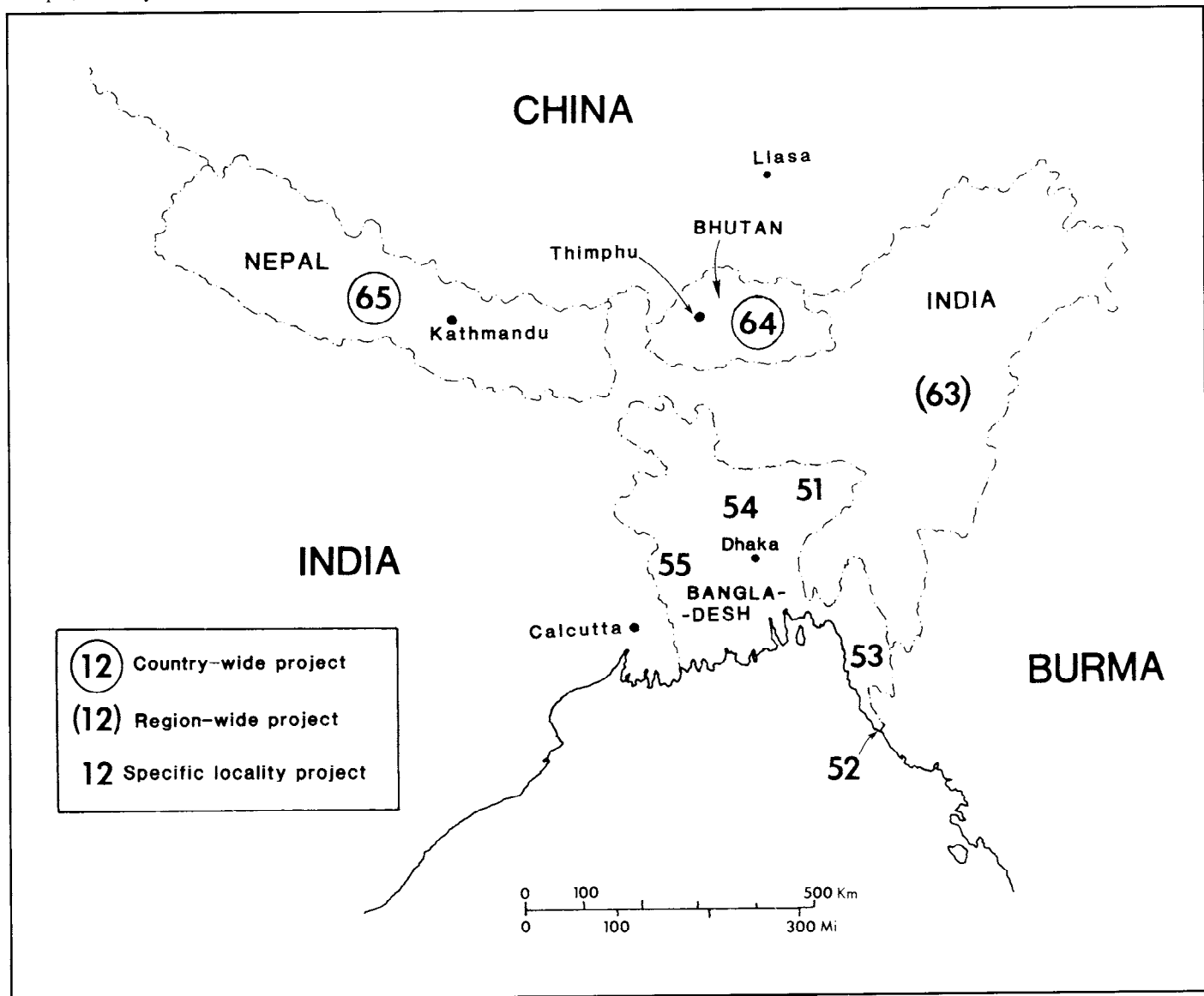
The Hanuman langur is restricted to a few villages and fruit gardens in Jessore and Kushtia districts in western Bangladesh. Support is needed to determine the precise numbers and locations of remaining groups; to ascertain the carrying capacity of their present habitat; to examine human attitudes toward the monkeys; and to recommend action to conserve the populations, including the possibility of relocation.

Sri Lanka

Ceylonese Rainforest and Ceylonese Monsoon Forest Biogeographical Provinces

56. Conservation of *Loris tardigradus* \$10,000

Four slender loris subspecies have been recorded in Sri Lanka: *Loris tardigradus tardigradus*, *L. tardigradus grandis*, *L. tardigradus nyctice-*



Map 7. Regions included in the Assam-Kra Rainforest, Bengal Rainforest, Sal, and Himalayas Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

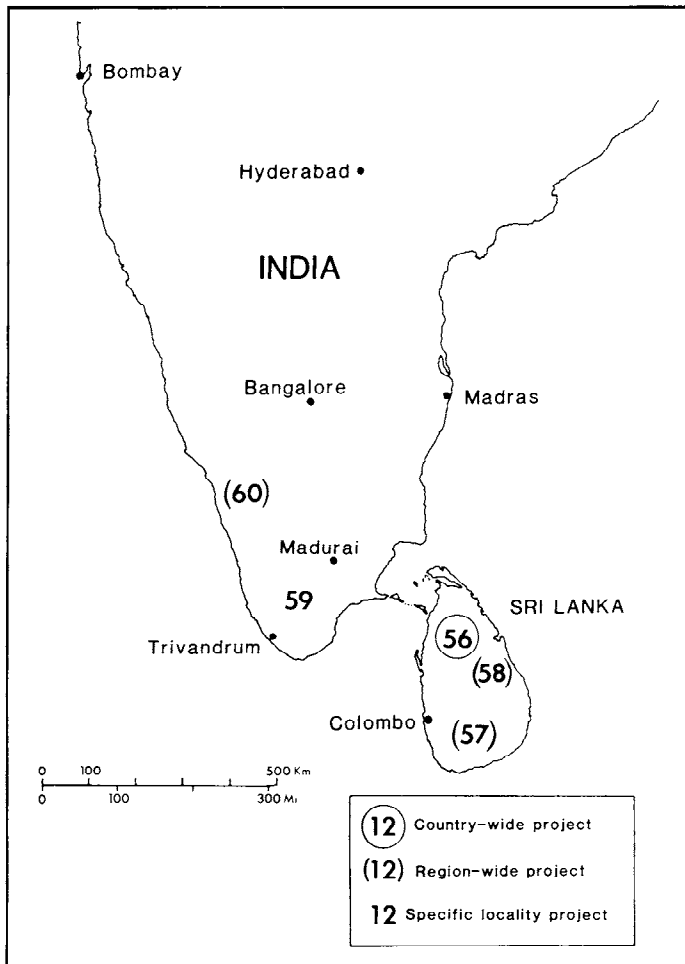
boides, and *L. tardigradus nordicus*. Surveys are needed to determine the diversity, distribution, habitat requirements, and status of the species in Sri Lanka and to assess the adequacy of the present reserve system for its protection. In addition to habitat loss, especially in the Wet Zone, the species may be threatened by hunting for medicinal use.

57. Conservation of *Trachypithecus vetulus* \$15,000

Four subspecies are recognized for the endemic purple-faced leaf monkey (*Trachypithecus vetulus*): *T. vetulus vetulus*, *T. vetulus monticola*, *T. vetulus nestor*, and *T. vetulus philbricki*. Surveys are needed to determine the abundance, habitat requirements, and status of the subspp. and to assess the adequacy of the present reserve system for their protection.

58. Monitoring the effects of habitat fragmentation caused by development projects on primate populations \$50,000

The Mahaweli river system, under a major development program, is to be dammed in at least five places. Although the numbers of all primate populations in the region may remain within reasonable ranges, the irrigation and cultivation that results may disrupt the distribution of these populations and force animals into small patches of habitat. *Macaca sinica* may be able to move from group to group through cultivated areas, although pressure on the species will increase through growing conflict with cultivators. *Trachypithecus vetulus* and *Loris tardigradus* will be most affected. Ultimately the only populations of *T. vetulus vetulus* and *T. vetulus nestor* may remain in Sinharaje Forest Reserve and Horton Plains Reserve respectively, but it is unknown if the areas are large enough to maintain these species genetically over the long term. The fragmentation of large populations into small, isolated ones must be carefully monitored with census work, producing on-going recommendations for the protection of viable populations of primates.



Map 8. Regions included in the Ceylonese Rainforest, Ceylonese Monsoon Forest, and Malabar Rainforest Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

India

Malabar Rainforest Biogeographical Province

59. Establishment of a research center on south Indian primates \$100,000

A comprehensive program of research and conservation would help to ensure the survival of *Macaca silenus*, *Trachypithecus johnii*, other primates and the moist evergreen forests of south India. This could be accomplished through the establishment of a research center in the Mundaithurai Sanctuary, Tamil Nadu, that would focus on the Agastiyamalai Hills, the most important area for the conservation of the lion-tailed macaque in the southern part of its range, and associated ranges of the Western Ghats in Tamil Nadu and Kerala. The entire area has been proposed as a Biosphere Reserve. The center would initiate a data base and long-term monitoring for endangered primates and the tropical forests in the area. The center would provide an opportunity for the training of university students in field techniques, as well as technical advice and training opportunities for Forest Department personnel. Assessment of the means by which tribals and villagers living in and near existing reserves might benefit from protected areas without causing habitat destruction would be a responsibility of the center.

60. Conservation of unique ecosystems and rehabilitation of non-viable populations of endangered species in the Western Ghats \$100,000

Extensive deforestation has reduced the moist evergreen forest of south India, one of the world's least studied rain forests, to a series of isolated patches. At present there is a freeze on clear-felling of evergreen forest, and selective logging continues only on a small scale in the states of Kerala and Karnataka. The most serious threats to the habitat are development projects, especially hydroelectric (hydel) projects, but also roads and railroads. All such projects involve not only direct deforestation but also resettlement of the human population in the proximity of forest habitat. Long-term, intensive research is necessary to identify unique ecosystems within the Western Ghats and to obtain total protection of representative areas of undisturbed habitat. The project also would assess the viability of isolated primate groups, especially of the endangered *Macaca silenus* and *Trachypithecus johnii*, confined to degraded and isolated patches of habitat and would recommend management measures for them, including translocation from degraded habitat to those where species have been depleted by hunting. *Semnopithecus entellus* subspp., *Macaca radiata* (especially *M. radiata diluta*), and *Loris tardigradus* also would benefit from this project.

Andaman and Nicobar Biogeographical Province

61. Conservation of *Macaca fascicularis umbrosa* on the Nicobar Islands \$10,000

This endemic long-tailed macaque subspecies is found only on three of the nine islands forming the Nicobar group: Great Nicobar, Little Nicobar, and Katchall. Habitat destruction is the major threat to the Nicobar macaque, although the population on Great Nicobar Island has been hunted as an agricultural pest in violation of the local Wildlife Act. A survey is needed to determine the distribution, habitat requirements, and status of the Nicobar macaque in order to develop a conservation strategy for the population, including bringing under protection evergreen forest habitat on Great Nicobar Island.

Sal, Teak, Himalayas, and Thar Desert Biogeographical Provinces

62. Conservation of primates in north India \$40,000

Three cercopithecine monkeys, *Macaca assamensis*, *Macaca mulatta*, and *Semnopithecus entellus*, are found living under varied ecological conditions in the states comprising north India, including the western Himalaya. Deforestation during the past 20 years has changed the habitats of these species and may have had adverse effects on population status. Surveys are needed to determine the remaining natural habitats of these three species in north India. These should be followed by intensive study of the role of the cercopithecines in these ecosystems, accompanied by

monitoring the trends in the present populations. On-going results should lead to necessary recommendations for conservation action.

Assam-Kra Rainforest, Himalayas, Bengal Rainforest, and Sal Biogeographical Provinces

63. Conservation of primates in northeastern India \$50,000

Surveys are needed in northeastern India to determine the distribution, abundance, status, and habitat requirements of all primate species in order to assess the adequacy and management of reserved areas. Primates include *Hylobates hoolock*, *Macaca assamensis*, *Macaca arctoides*, *Macaca nemestrina*, *Macaca mulatta*, *Trachypithecus geei*, *Trachypithecus pileatus*, *Trachypithecus phayrei*, *Semnopithecus entellus*, and *Nycticebus coucang*. Surveys also should determine if *Rhinopithecus* occurs in any part of northeastern India.

Bhutan

Himalayas Biogeographical Province

64. Conservation of primates in Bhutan \$15,000

Surveys are needed to determine the distribution and status of primates, including *Trachypithecus geei*, *Macaca assamensis*, and *Macaca mulatta*, and to determine if *Semnopithecus entellus* occurs in any part of the country. The results should lead to recommendations for conservation action. Habitat destruction for agricultural purposes may be a threat to primate species, but the importance of Buddhism in Bhutan would appear to mitigate against the persecution of monkeys as agricultural pests.

Nepal

Sal and Himalayas Biogeographical Provinces

65. Conservation of primates in Nepal \$25,000

Surveys are needed to determine the remaining natural habitats in Nepal of *Macaca assamensis*, *Macaca mulatta*, and *Semnopithecus entellus* and to determine if *Trachypithecus geei* occurs in the country, in order to make recommendations for conservation action. Habitat destruction and a less tolerant attitude to crop-raiding, especially by macaques, may pose the greatest threats to primates. The terai, an area of moist deciduous sal forest between the Gangetic basin and the Himalaya foothills, is subject especially to increasing agricultural invasion.

Pakistan

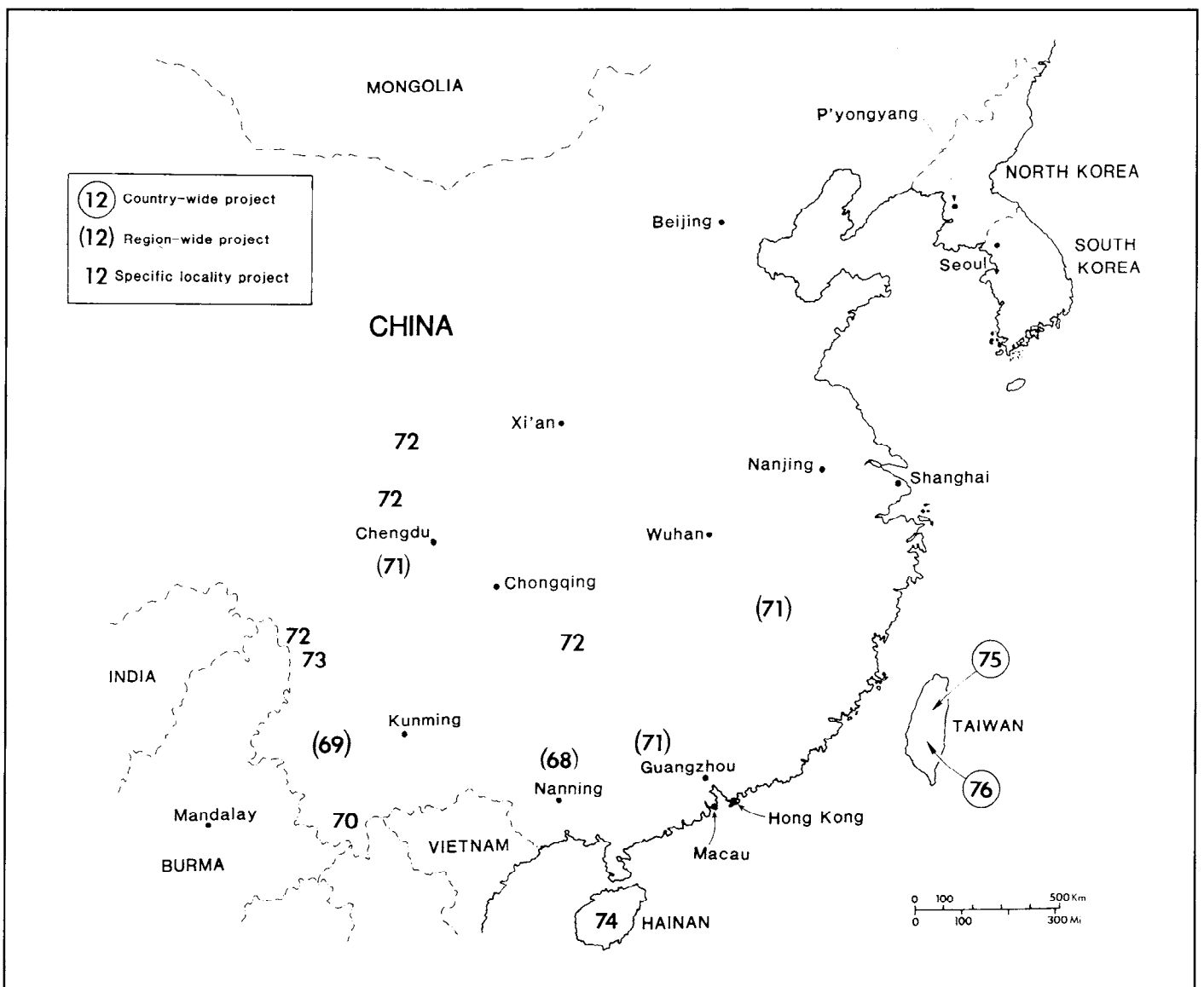
Himalayas, Pamir-Karakorum Highlands, and Sal Biogeographical Provinces

66. Survey of northern Pakistan \$15,000

Extensive surveys are needed of the habitats of the two rare rhesus macaque subspecies, *Macaca mulatta mcMahonii* and *M. mulatta villosa*, and of *Semnopithecus entellus ajax* in northern Pakistan, including Azad Kashmir. *M. mulatta mcMahonii*, especially, may be disappearing rapidly since the subspecies occurs on the Afghan border and refugees from Afghanistan have brought hundreds of thousands of livestock into Pakistan, swelling the already large populations of goats and cattle in the



Map 9. Regions included in the Sal, Teak, Thar Desert, Himalayas, and Pamir-Karakorum Highlands Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).



Map 10. Regions included in the Tonkin-Chinese Rainforest, Chinese Subtropical, Transhimalayan Mountains, Sichuan Highlands, Himalayas, and Taiwan Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

country. There is a real danger of losing those groups of primates that depend on natural habitat.

67. Conservation of the Galis Forest \$75,000

The Murree Hills, north of Islamabad, was the site of a number of hill stations prior to 1948, and local access to a managed forest in the area, termed the Galis Forest, was restricted. As a consequence, it is an island of forest surrounding the villages of Dunga Gali and Nathia Gali in the largely denuded Himalaya foothills. Declaration of the Galis Forest as a protected reserve would conserve this all-important watershed area as well as natural habitat for *Macaca mulatta villosa*.

China and Taiwan

Tonkin-Chinese Rainforest and Chinese Subtropical Biogeographical Provinces

68. Conservation of primates in Guangxi \$100,000

The broad ranges of primate species have been established in China. Surveys are needed to determine the present distribution, abundance, habitat requirements, and status of species on a regional basis and to make necessary recommendations for conservation action. Loss of forest habitat and hunting, especially for medicinal purposes, constitute serious threats to primates throughout much of their distribution. The primates

in Guangxi include *Trachypithecus francoisi*, including *T. francoisi leucocephalus*, which may consist of no more than 400-600; the rare *Macaca arctoides* and *Macaca assamensis*, as well as *Macaca mulatta*; and *Nycticebus coucang*. Existing reserves should be strengthened and/or new ones established, and more effective protection against hunting should be instituted. Population trends should be monitored in reserves as a means of assessing the effectiveness of conservation action.

Transhimalayan Mountains Biogeographical Province

69. Conservation of primates in Yunnan \$100,000

Surveys are needed to determine the present distribution, abundance, habitat requirements, and status of primate species in western, central, and southern Yunnan. The primates in this region include *Nycticebus coucang*, *Trachypithecus phayrei*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca mulatta*, *Macaca arctoides*, *Hylobates hoolock*, *Hylobates lar*, and *Hylobates concolor*, including the subspecies *H. concolor concolor*, *H. concolor jingdongensis*, *H. concolor furvogaster*, and the light-cheeked *H. concolor leucogenys*. Surveys of *H. concolor concolor* have been initiated in Jingdong County in the province. Existing reserves should be strengthened and/or new ones established, and more effective protection against hunting should be instituted. Population trends should be monitored in reserves as a means of assessing the effectiveness of conservation action.

70. Conservation of moist evergreen forest in southern Yunnan \$100,000

The only moist evergreen forest (or tropical rain forest) in Yunnan occurs in the southernmost part of the province in Xishuang Banna. Primates reported for the region are *Trachypithecus phayrei*, *Macaca nemestrina*, *Macaca assamensis*, *Macaca arctoides*, *Nycticebus coucang*, and the only known population of *Hylobates concolor leucogenys* in China. At present there is only one reserve in the area. Support is needed to establish a research center at Jinghong, the capitol of the region, for long-term monitoring of the endangered primates and lowland tropical forests in southern Yunnan.

Sichuan Highlands and Chinese Subtropical Biogeographical Provinces

71. Conservation of *Macaca thibetana* \$30,000

The endemic Tibetan macaque is the least known of all macaque species and, until recently, commonly has been regarded as a subspecies of *Macaca arctoides*. The broad distribution of extant populations of *M. thibetana* has been established. Surveys are needed to verify population numbers, habitat requirements, and status throughout the distribution of the species and to make recommendations for conservation action, including the declaration of reserved areas. No reserves have been established yet for the protection of the species. Reserves potentially should be established in different kinds of habitat, for example, in Sichuan, Jiangxi-Fujian-Zhejiang, and Guangdong. *M. thibetana* is reported to be relatively abundant in Ruyuan County, northwestern Guangdong.

Himalayas, Sichuan Highlands, and Chinese Subtropical Biogeographical Provinces

72. Conservation of *Rhinopithecus* spp. \$300,000

Three species of the endangered snub-nosed monkeys are endemic to China: *Rhinopithecus roxellana*, *Rhinopithecus brelichi*, and *Rhinopithecus bieti*. All three species occur outside of China's moist tropical regions in the south. *R. bieti*, numbering perhaps as few as 600-800, and *R. brelichi*, totaling perhaps no more than 500-670, are the more endangered species, but *R. roxellana* may number less than 15,000. Long-term ecological studies and population and status monitoring are needed for all three species, as well as an assessment of the adequacy of reserves in respect to habitat requirements of the three species and of protection against hunting. All reserves appear to have substantial human populations in residence. Bai Ma Xi Shan in northwestern Yunnan would appear to be an appropriate site to establish effective habitat protection and patrols against hunting for *R. bieti*, while a nature reserve has been declared at Mt. Fanjingshan for *R. brelichi*. Stricter protection benefiting *R. roxellana* should be enforced in Wolong and Baihe Nature Reserves.

73. Captive breeding program for *Rhinopithecus bieti* \$50,000

Rhinopithecus bieti is found only in a narrow strip of mountainous land extending from northwestern Yunnan into southeastern Tibet. It may number as few as 600-800. A captive breeding program would help to ensure the survival of this endangered species. A new breeding/research facility for endangered wildlife is under construction near Beijing.

Tonkin-Chinese Rainforest Biogeographical Province

74. Captive breeding program to recover the endemic subspecies *Hylobates concolor hainanus* on Hainan Island \$50,000

A conservation-oriented captive breeding program is needed to recover the Hainan gibbon, whose population appears to be restricted to a total of 30-40 individuals at only four localities. The Hainan population of *Hylobates concolor* probably is the most endangered of all Chinese primates.

Taiwan Biogeographical Province

75. Conservation of *Macaca cyclopis* \$20,000

Surveys are needed to determine the distribution, abundance, varying habitat requirements, and status of the endemic *Macaca cyclopis* throughout Taiwan, in order to make recommendations for conservation action. Habitat destruction through logging is the major threat to

the species, although monkeys also are hunted or trapped for food or medicinal purposes and formerly were trapped for export, primarily to Japan.

76. Implementation of conservation policies in Taiwan \$100,000

In 1984 Taiwan approved a National Conservation Strategy. Four national parks have been declared since 1982, of which Kenting National Park (326 km² including 149 km² of marine area) in the sub-tropical climatic zone at the southern tip of Taiwan contains *Macaca cyclopis*. Additional reserved areas are needed to protect *Macaca cyclopis* and other wildlife in the diverse forest habitats of Taiwan. The training of law enforcement personnel should be an integral part of the development of reserved areas. Effective management of wildlife will have to address competing interests, including the logging industry and aboriginal hunting patterns.

Japan

Japanese Evergreen Forest and Oriental Deciduous Forest Biogeographical Provinces

77. Development of alternative methods for controlling crop-raiding by *Macaca fuscata* \$25,000

Loss of habitat, especially through large-scale forest conversion, is a serious threat to populations of the endemic Japanese macaque and makes them vulnerable to persecution as crop-raiders. Surveys are needed for the assessment of the present status of populations, habitat quality, and ongoing local extinctions to make necessary recommendations for urgent conservation actions and/or administration. Damage control devices should be developed and sound conservation management should be introduced to replace pest control.

78. Recovery of forest habitat for *Macaca fuscata* \$50,000

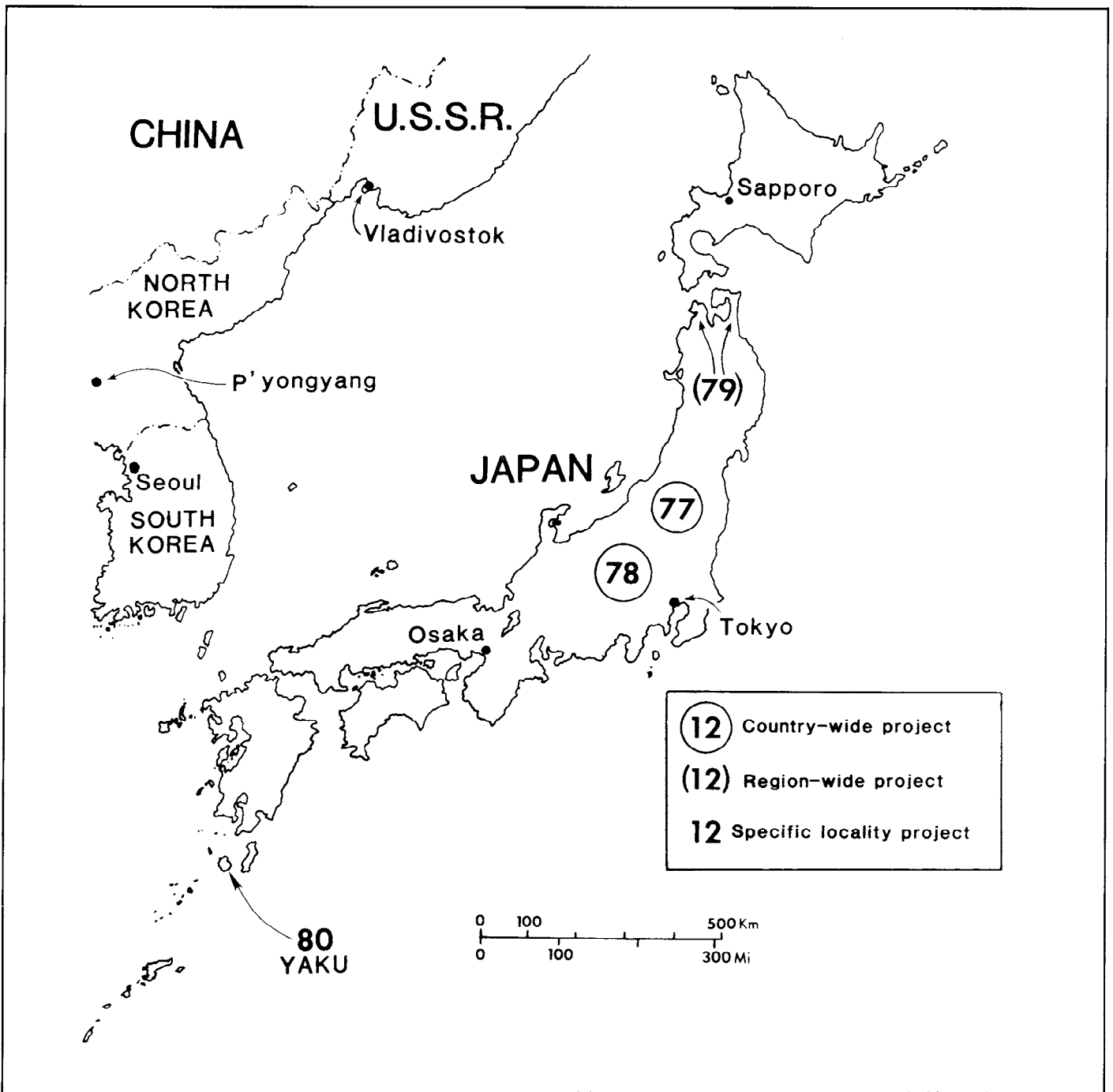
About one-fifth of the total population of Japanese macaques is maintained through provisioning in "habitat islands" located on the outskirts of urban areas, in conflict with the surrounding community. Management practices need to be supported that include recovery of forest habitat in the adjoining (original home range) areas as well as developing protection of the monkey populations themselves against human pressures. Investigations are needed into more productive methods of managing the sites to minimize monkey-human conflict, such as relocation of the monkeys to a more remote area without dislocating them from their original areas.

79. Conservation of *Macaca fuscata* in Shimokita and Tsugaru Peninsulas and Akaishi-Shiragami Range \$25,000

The northernmost distribution of primates is known from Aomori prefecture at the northern end of Honshu. Populations of *Macaca fuscata* are found in isolated relict patches in Shimokita and Tsugaru Peninsulas and Akaishi-Shiragami Range. Clear-cutting of the natural forest has been the main force threatening the survival of the monkeys in Tsugaru and Shimokita and is now a threat in the Akaishi Range. Although the Shimokita monkeys have been designated a Natural Treasure and their ranges are in national forest, only a part of their distribution is exempted from timbering operations. At least core areas or the principal part of their dispersed ranges should be set aside as totally protected areas (and as a Natural Treasure in Shimokita) to safeguard the populations. Surveys would help to determine the most appropriate areas for total protection, and population trends should be monitored in these reserves as a means of assessing the effectiveness of conservation action.

80. Conservation of *Macaca fuscata yakui* \$25,000

The subspecies *Macaca fuscata yakui* is found only on Yaku Island (Yakushima), 60 km south of Kyushu. A crude estimate of the size of the monkey population is 3,000. The island is part of the Kirishima-Yaku National Park, and an ecosystem reserve was created in a low altitude sector of the island containing about 450 monkeys. In the rest of the island conversion of natural forest to conifer plantations has caused



Map 11. Regions included in the Japanese Evergreen Forest and Oriental Deciduous Forest Biogeographical Provinces showing location of recommended projects, numbered as in text (map by Stephen Nash).

several tens of troops to become crop-raiders, especially in orange plantations. These monkeys are trapped in large numbers, and, if the present level of trapping continues, the population will dwindle to a few hundred in several years. A comprehensive wildlife management scheme

needs to be adopted to resolve the problem. Surveys are needed to determine the abundance and status of the population throughout the island. Consideration should be given to declaring the population a National Treasure.

Project Priorities

Although all these projects are needed, some have a higher priority than others because they involve large numbers of seriously threatened forms and/or a seriously threatened area supporting many primate species or several endemics. These priorities have been quantified by rating projects on the parameters that follow, in agreement with the Action Plan for African Primate Conservation (Oates, 1985). Appropriate modifications have been made in the scales used here to compensate for the lesser diversity generally found in Asian primate communities.

- A. Number of species in project area with a high conservation priority rating (a rating of 11-7 overall) or acknowledged as being vulnerable (threat rating 3 or greater) or at risk (threat rating 2), scored on a scale of 1 to 5:
1. 1 or more vulnerable or at risk species
 2. 1-2 high priority species
 3. 3-4 high priority species
 4. 5-6 high priority species
 5. 7 or more high priority species
- B. Imminence of threat to the ecosystem under consideration, scored on a scale of 1 to 4:
1. Low degree of threat
 2. Moderately threatened
 3. Highly threatened (e.g., larger in size, but still under serious threat from conversion and/or traditional slash and burn agriculture or hunting)
 4. Very highly threatened (e.g., small in size and subject

to major conversion for agriculture or logging or technological development, such as hydroelectric projects, and/or intense slash and burn agriculture or hunting)

- C. Overall primate species diversity in project area, rated on a scale of 1 to 3:
1. 3 or fewer species
 2. 4-7 species
 3. 8 or more species
- D. Number of endemic primate forms in the project area (species or subspecies found only in the biogeographical province of which the project is a part), rated on a scale of 1 to 4:
1. 1 or more populations living under marginal conditions
 2. 1 or 2 endemic subspecies in the area
 3. 1 endemic species, or more than 2 endemic subspecies
 4. 2 or more endemic species in the area

Tables 3-6 present the results of this project rating in four groups: (1) Surveys for Specific Populations and Small-Scale Regional Surveys, (2) Large-Scale Regional and Countrywide Surveys, (3) Reserve Development and Management Projects, and (4) Special Projects. The different kinds of projects generally require considerably different commitments of time, personnel, and money, and probably should be considered in somewhat different ways by funding agencies.

As with the earlier species conservation priority ratings, it should be borne in mind that these ratings are inevitably somewhat arbitrary, are based only on information available to the compiler (which often is incomplete), and are provided only as a general guide to the relative significance of different areas.



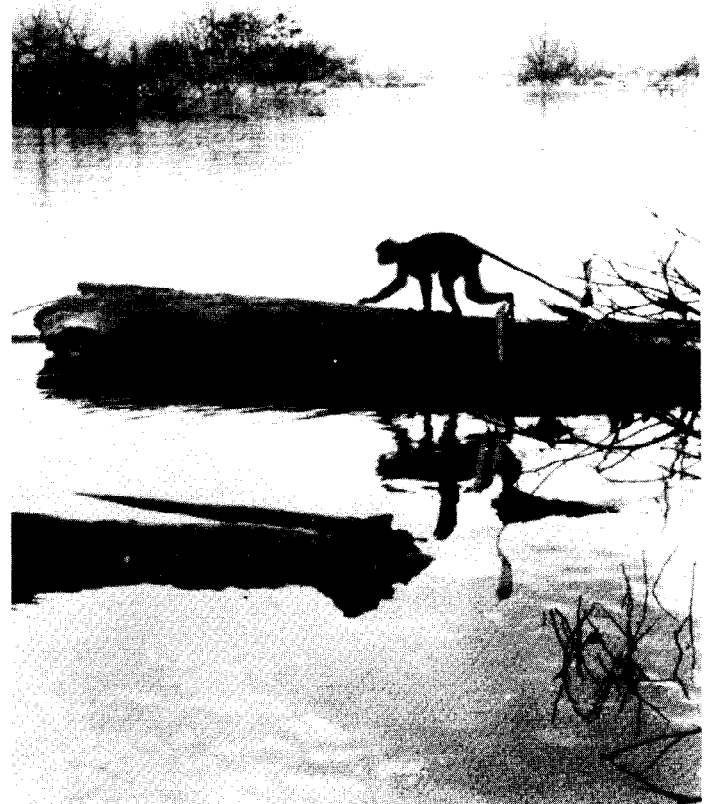
The red-shanked Douc monkey (*Pygathrix nemaeus*), known only from Vietnam and Laos, is one of the "odd-nosed" colobine monkeys. Prolonged warfare in Indochina has increased the threat to the species due to habitat loss (photo by Ron Garrison, Zoological Society of San Diego).

Table 3
Priority Ratings of Surveys for Specific Populations and Small-Scale Regional Surveys Required in Asia to Identify Conservation Needs and Potential Reserve Areas

Project #, Species and/or Area (Details in text)	# of High Priority Spp. in Area	Imminence of Threat to Area	Primate Sp. Diversity In Area	# Endemic Primates In Area	Total Rating
8. <i>Presbytis</i> spp., Sumatra, Indonesia	1	3	1	3	8
10. Batu Islands, Indonesia	1	1	1	2	5
11. Riau Islands, Indonesia	1	2	2	2	7
14. Sipora Island, Indonesia	3	4	1	4	12
17. Bali, Indonesia	1	2	1	2	6
20. <i>Nasalis larvatus</i> , Kalimantan, Indonesia	2	3	2	3	10
21. <i>Presbytis frontata</i> , Kalimantan, Indonesia	1	2	2	3	8
25. Natuna Islands, Indonesia	1	3	2	3	9
26. Karimata Island, Indonesia	1	2	1	2	6
27. <i>Macaca ochreata</i> and <i>M. brunnescens</i> , Sulawesi, Indonesia	2	2	1	4	9
31. <i>Pongo pygmaeus</i> , Sabah, Malaysia	2	3	2	2	9
33. <i>Nasalis larvatus</i> and <i>Trachypithecus cristatus</i> , Sabah, Malaysia	2	3	1	3	9
38. <i>Presbytis femoralis</i> , Sarawak, Malaysia	1	4	2	2	9
41. <i>Tarsius syrichta</i> and <i>Macaca fascicularis</i> , Philippines	2	3	1	3	9
51. <i>Macaca nemestrina leonina</i> , Bangladesh	1	4	1	1	7
52. <i>Macaca fascicularis</i> , Bangladesh	1	4	1	1	7
55. <i>Semnopithecus entellus</i> , Bangladesh	1	4	1	1	7
56. <i>Loris tardigradus</i> , Sri Lanka	2	3	2	3	10
57. <i>Trachypithecus vetulus</i> , Sri Lanka	2	3	2	3	10
61. <i>Macaca fascicularis umbrosa</i> , Nicobar Islands, India	1	3	1	2	7
62. North India	1	3	1	2	7
64. Bhutan	1	1	2	3	7
65. Nepal	1	3	1	2	7
66. Northern Pakistan	1	4	1	2	8
75. <i>Macaca cyclopis</i> , Taiwan	2	3	1	3	9
79. <i>Macaca fuscata</i> , Northern Honshu, Japan	2	3	1	3	9
80. <i>Macaca fuscata</i> , Yaku Island, Japan	2	4	1	3	10

Table 4
Priority Ratings of Large-Scale Regional and Country-wide Surveys Required in Asia to Identify Conservation Needs and Potential Reserve Areas

Project # and Area (Details in text)	# of High Priority Spp. in Area	Imminence of Threat to Area	Primate Sp. Diversity In Area	# Endemic Primates In Area	Total Rating
42. Laos	5	3	3	3	14
43. Kampuchea	3	3	3	4	13
44. Vietnam	5	3	3	3	14
46. National parks and wildlife sanctuaries, Thailand	2	3	3	3	11
50. Burma	2	3	3	3	11
63. Northeastern India	2	2	3	3	10
68. Guangxi, China	2	3	2	2	9
69. Yunnan, China	3	3	3	3	12



A dusky leaf monkey (*Trachypithecus obscurus*) on a log behind Trengganu Dam, Peninsular Malaysia. Development projects, such as hydroelectric dams, are contributing to forest loss and habitat fragmentation throughout Asia (photo by Graham M. Hardy).



The proboscis monkey (*Nasalis larvatus*) is endemic to the island of Borneo. In Sarawak the population may be as low as 1,000, and most known populations are declining, especially where there is heavy exploitation of mangrove forest (photo by Russell A. Mittermeier).

Table 5
Priority Ratings of Reserve Development and Management Projects for Asian Primate Conservation

Project # and Area (Details in text)	# of High Priority Sp. in Area	Imminence of Threat to Area	Primate Sp. Diversity In Area	# Endemic Primates In Area	Total Rating
1. Gunung Leuser National Park, Indonesia	3	4	3	3	13
2. Public awareness, Gunung Leuser National Park, Indonesia	3	4	3	3	13
3. Simeulue, Indonesia	1	4	1	2	8
6. Kerinci-Seblat National Park, Indonesia	2	4	2	3	11
7. Way Kambas, Indonesia	1	4	2	3	10
12. Siberut Biosphere Reserve, Indonesia	3	4	2	4	13
13. South Pagai Island, Indonesia	3	4	1	4	12
16. West Java, Indonesia	2	4	2	4	12
18. Kutai National Park, Indonesia	2	4	3	4	13
19. Tanjung Puting National Park, Indonesia	2	3	3	4	12
22. Cagar Alam Bukit Bati Kap Reserve, Indonesia	2	2	2	4	10
23. Gunung Betung Dan Kariman Reserve, Indonesia	2	2	2	4	10
24. Bukit Raya Reserve, Indonesia	2	2	2	4	10
28. Dumoga-Bone National Park, Indonesia	3	2	2	4	11
29. South Sulawesi, Indonesia	2	4	1	4	11
30. North Sulawesi, Indonesia	2	3	1	4	10
34. Samunsam Wildlife Sanctuary, Sarawak, Malaysia	2	4	2	3	11
35. Maludam River (proposed) Wildlife Sanctuary, Sarawak, Malaysia	2	4	2	3	11

36. Gunung Mulu National Park, Sarawak, Malaysia	2	3	3	4	12
37. Lanjak Entimau Wildlife Sanctuary, Sarawak, Malaysia	2	3	2	4	11
39. Ulu Temburong Conservation Forest, Brunei Darussalam	1	2	2	4	9
45. Vietnam	5	3	3	3	14
47. Khao Yai National Park, Thailand	2	4	2	3	11
48. Huai Kha Khaeng Wildlife Sanctuary, Thailand	2	4	3	2	11
53. Bhomariogona and Chanuti Forests, Bangladesh	2	3	2	2	9
54. Madhupur National Park, Bangladesh	1	4	1	2	8
59. South Indian Primate Research Center, India	3	4	2	4	13
67. Galis Forest, Pakistan	1	4	1	2	8
70. Southern Yunnan Research Center, China	2	3	2	2	9
72. <i>Rhinopithecus</i> spp., China	3	3	1	4	11
76. Taiwan	2	3	1	3	9

Table 6
Priority Ratings of Special Projects for Asian Primate Conservation

Project # and Area (Details in text)	# of High Priority Sp. in Area	Imminence of Threat to Area	Primate Sp. Diversity In Area	# Endemic Primates In Area	Total Rating
3. Habitat alteration in Sumatra, Indonesia	3	3	3	4	13
4. Alternative controls, Gunung Leuser National Park, Indonesia	1	4	1	1	7
9. Monitoring trapping of macaques, Sumatra, Indonesia	1	3	1	1	6
15. Captive breeding of southern Mentawai primates, Indonesia	3	4	1	4	12
32. <i>Pongo pygmaeus</i> translocation, Sabah, Malaysia	2	4	1	2	9
40. Restoration of primate fauna, Brunei Darussalam	2	2	2	3	9
49. Rural development and national parks, Thailand	2	3	3	3	11
58. Monitoring habitat fragmentation, Sri Lanka	2	4	2	4	12
60. Ecosystem conservation and rehabilitation of endangered species, Western Ghats, India	3	4	2	4	13
73. Captive breeding of <i>Rhinopithecus bieti</i> , China	2	4	1	3	10
74. Captive breeding of <i>Hylobates concolor hainanus</i> , China	2	4	1	2	9
77. Alternative controls of <i>Macaca fuscata</i> , Japan	2	4	1	3	10
78. Habitat recovery for <i>Macaca fuscata</i> , Japan	2	4	1	3	10

Conclusion

The total estimated cost of all the projects listed here is \$4,246,000 (see Table 7). Action must be taken on all these projects if we are to ensure that the current diversity of Asian primates survives into the next century. However, projects identified as having the highest priority ratings deserve particular attention and should be initiated at the earliest possible opportunity.

In Table 3, the species-oriented and small-scale regional surveys with the highest priority (total rating 9-12) are for these populations and/or areas:

Sipora Island, Indonesia
Nasalis larvatus, Kalimantan, Indonesia
Natuna Islands, Indonesia
Macaca ochreata and *M. brunnescens*, Sulawesi, Indonesia
Pongo pygmaeus, Sabah, Malaysia
Nasalis larvatus and *Trachypithecus cristatus*, Sabah, Malaysia
Presbytis femoralis, Sarawak, Malaysia
Tarsius syrichta and *Macaca fascicularis*, Philippines
Loris tardigradus, Sri Lanka
Trachypithecus vetulus, Sri Lanka
Macaca cyclopis, Taiwan
Macaca fuscata, Northern Honshu, Japan
Macaca fuscata, Yaku Island, Japan

In Table 4, the large-scale regional and countrywide surveys with the highest priorities (total rating 11-14) are in these areas:

Laos
Kampuchea
Vietnam
National parks and wildlife sanctuaries, Thailand
Burma
Yunnan, China



Fresh water peat swamp habitat of proboscis monkeys (*Nasalis larvatus*) on the main Sekonyer River in Tanjung Puting National Park, Central Kalimantan, Indonesia (photo by Trevor Blondal/Carey Yeager).



Captive Simeulue macaque (*Macaca fascicularis fuscus*), photographed in Aceh province, Sumatra, Indonesia (photo by Arthur Mitchell).

In Table 5, the reserve development and/or management projects with highest priority (total rating 11-14) are:

Gunung Leuser National Park, Indonesia
Public awareness, Gunung Leuser National Park, Indonesia
Kerinci-Seblat National Park, Indonesia
Siberut Biosphere Reserve, Indonesia
South Pagai Island, Indonesia
West Java, Indonesia
Kutai National Park, Indonesia
Tanjung Puting National Park, Indonesia
Dumoga-Bone National Park, Indonesia
South Sulawesi, Indonesia
Samunsam Wildlife Sanctuary, Sarawak, Malaysia
Maludam River (proposed) Wildlife Sanctuary, Sarawak, Malaysia
Gunung Mulu National Park, Sarawak, Malaysia
Lanjak-Entimau Wildlife Sanctuary, Sarawak, Malaysia
Vietnam
Khao Yai National Park, Thailand
Huai Kha Khaeng Wildlife Sanctuary, Thailand
South India Primate Research Center, India
Rhinopithecus spp., China

In Table 6, the following special projects have the highest priority (total rating 10-13):

Habitat alteration, Sumatra, Indonesia
Captive breeding of southern Mentawai primates, Indonesia
Rural development and national parks, Thailand
Monitoring habitat fragmentation, Sri Lanka
Ecosystem conservation, and rehabilitation of endangered species, Western Ghats, India
Captive breeding of *Rhinopithecus bieti*, China
Alternative controls of *Macaca fuscata*, Japan
Habitat recovery for *Macaca fuscata*, Japan

The long-term success of any conservation efforts for primates in Asia will depend on the extent to which nationals are involved as investigators and implementers and likewise the extent to which local people benefit directly (e.g., monetarily) or indirectly (e.g., watershed protection) from specific actions. Those projects that offer an opportunity for the in-country training of primatologists and wildlife biologists, especially those that include field research programs affiliated with local universities and/or wildlife conservation agencies, should receive special scrutiny.

Table 7
Summary of Funding Requirements by Country for 1987-1991

Indonesia			
1. Conservation of Gunung Leuser National Park	\$	100,000	
2. Public awareness program for Gunung Leuser National Park		100,000	
3. Habitat alteration in northern Sumatra		90,000	
4. Alternative controls in Gunung Leuser National Park		10,000	
5. Conservation of <i>Macaca fascicularis fuscus</i>		50,000	
6. Development of Kerinci-Seblat National Park		100,000	
7. Conservation of Way Kambas		75,000	
8. Surveys of <i>Presbytis</i> spp. in south Sumatra		15,000	
9. Monitoring commercial trapping of macaques		50,000	
10. Batu Islands survey		5,000	
11. Riau Islands survey		10,000	
12. Development of Siberut Biosphere Reserve		150,000	
13. Creation of a reserve on South Pagai Island		100,000	
14. Sipora Island survey		7,000	
15. Captive breeding of southern Mentawai primates		100,000	
16. Conservation of west Javan primates		100,000	
17. Bali survey		10,000	
18. Conservation of Kutai National Park		75,000	
19. Conservation of Tanjung Puting National Park		75,000	
20. Conservation of <i>Nasalis larvatus</i> in Kalimantan		50,000	
21. Surveys of <i>Presbytis fromata</i>		20,000	
22. Extension of the proposed Cagar Alam Bukit Batikap Reserve		75,000	
23. Support for Gunung Betung Dan Kariman Reserve		100,000	
24. Support for Bukit Raya Reserve		75,000	
25. Natuna Islands survey		15,000	
26. Karimata Island survey		4,000	
27. Surveys of <i>Macaca ochreata</i> and <i>M. brunescens</i>		20,000	
28. Conservation of Dumoga-Bone National Park		50,000	
29. Conservation of <i>Macaca maura</i>		75,000	
30. Conservation of <i>Macaca hecki</i>		75,000	
SUBTOTAL		\$1,781,000	
Malaysia			
Sabah			
31. Conservation of <i>Pongo pygmaeus</i>	\$	50,000	
32. Translocation of <i>Pongo pygmaeus</i>		50,000	
33. Survey of <i>Nasalis larvatus</i> and <i>Trachypithecus cristatus</i>		20,000	
SUBTOTAL		\$ 120,000	
Malaysia			
Sarawak			
34. Conservation of <i>Nasalis larvatus</i>		NFR	
35. Conservation of lowland swamp forest		NFR	
36. Protection of hill and montane forest		NFR	
37. Extension of Lanjak-Entimau Wildlife Sanctuary		NFR	
38. Survey of <i>Presbytis femoralis</i>	\$	10,000	
SUBTOTAL		\$ 10,000	
Brunei Darussalam			
39. Declaration of Ulu Temburong Conservation Forest		NFR	
40. Restoration of primate fauna in lowland forest	\$	10,000	
SUBTOTAL		\$ 10,000	
Philippines			
41. Surveys of <i>Tarsius syrichta</i> and <i>Macaca fascicularis</i>	\$	75,000	
Laos			
42. Country-wide survey of primates	\$	50,000	
Kampuchea			
43. Country-wide survey of primates	\$	30,000	
Vietnam			
44. Country-wide survey of primates	\$	50,000	
45. Reserve management and protection		200,000	
SUBTOTAL		\$ 250,000	
Thailand			
46. Surveys of national parks and wildlife sanctuaries	\$	75,000	
47. Conservation of <i>Hylobates</i> spp. in Khao Yai National Park		30,000	
48. Development of Huai Kha Khaeng Wildlife Sanctuary		150,000	
49. Rural development and national parks program		100,000	
SUBTOTAL		\$ 355,000	
Burma			
50. Country-wide survey of primates	\$	50,000	
Bangladesh			
51. Conservation of <i>Macaca nemestrina leonina</i>	\$	5,000	
52. Conservation of <i>Macaca fascicularis</i>		5,000	
53. Conservation of <i>Hylobates hoolock</i>		10,000	
54. Conservation of <i>Trachypithecus pileatus</i>		10,000	
55. Conservation of <i>Semnopithecus entellus</i>		5,000	
SUBTOTAL		\$ 35,000	
Sri Lanka			
56. Conservation of <i>Loris tardigradus</i>	\$	10,000	
57. Conservation of <i>Trachypithecus vetulus</i>		15,000	
58. Monitoring effects of habitat fragmentation		50,000	
SUBTOTAL		\$ 75,000	
India			
59. South Indian primate research center	\$	100,000	
60. Conservation of ecosystems and rehabilitation of endangered species in the Western Ghats		100,000	
61. Conservation of <i>Macaca fascicularis umbrosa</i>		10,000	
62. Regional survey in north India		40,000	
63. Regional survey in northeastern India		50,000	
SUBTOTAL		\$ 300,000	
Bhutan			
64. Country-wide survey of primates	\$	15,000	
Nepal			
65. Survey of primate habitats	\$	25,000	
Pakistan			
66. Survey of northern Pakistan	\$	15,000	
67. Conservation of the Galis Forest		75,000	
SUBTOTAL		\$ 90,000	
China			
68. Regional survey of Guangxi	\$	100,000	
69. Regional survey of Yunnan		100,000	
70. Southern Yunnan research center		100,000	
71. Conservation of <i>Macaca thibetana</i>		30,000	
72. Conservation of <i>Rhinopithecus</i> spp.		300,000	
73. Captive breeding of <i>Rhinopithecus bieti</i>		50,000	
74. Captive breeding of <i>Hylobates concolor hainanus</i>		50,000	
SUBTOTAL		\$ 730,000	
Taiwan			
75. Conservation of <i>Macaca cyclopis</i>	\$	20,000	
76. Implementation of conservation policies		100,000	
SUBTOTAL		\$ 120,000	
Japan			
77. Alternative controls of <i>Macaca fuscata</i>	\$	25,000	
78. Habitat recovery for <i>Macaca fuscata</i>		50,000	
79. Conservation of <i>Macaca fuscata</i> in northern Honshu		25,000	
80. Conservation of <i>Macaca fuscata yakui</i>		25,000	
SUBTOTAL		\$ 125,000	
TOTAL: ALL OF ASIA, 1987-1991		\$4,246,000	

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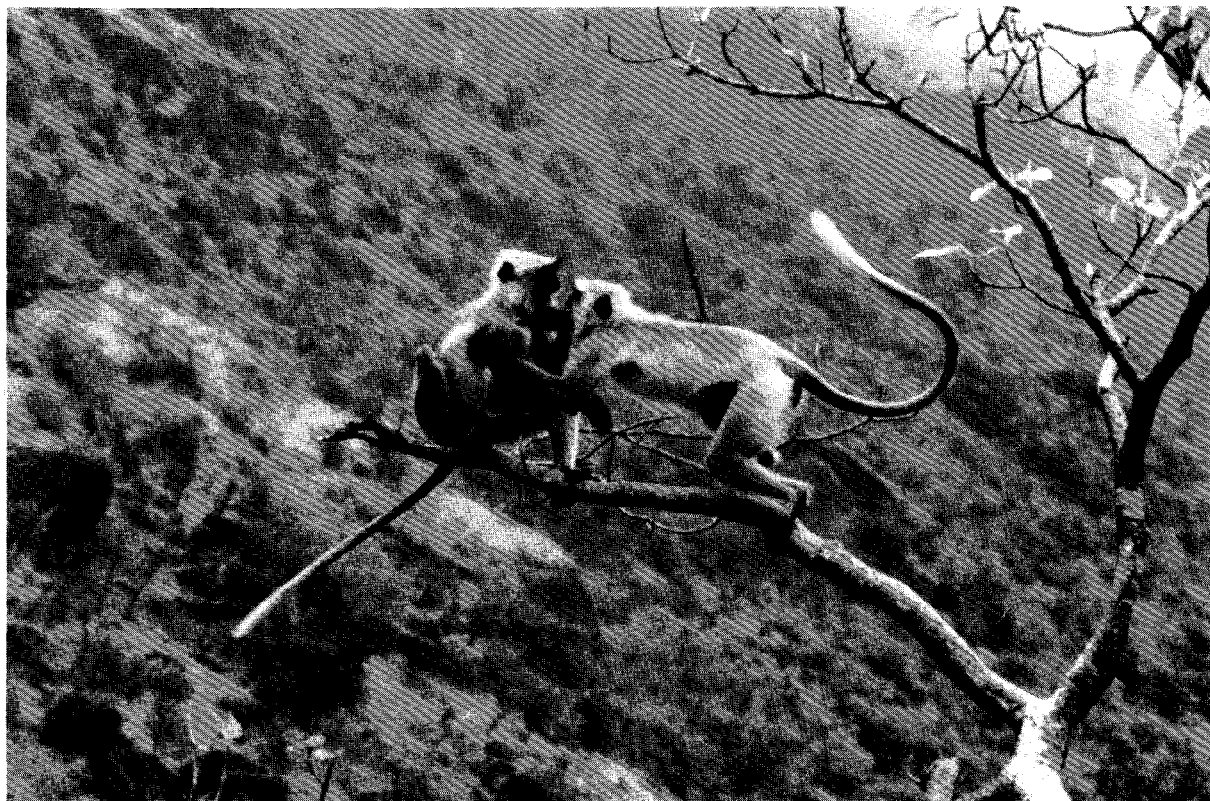
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Juvenile Hanuman langurs (*Semnopithecus entellus*) play fight against the backdrop of Mt. Abu, Rajasthan, India. Fifteen subspecies are recognized for the langur, which ranges from the Himalaya over the Indian subcontinent to Sri Lanka and occupies a wide diversity of habitats (photo by Jim Moore/Anthro-Photo).

Appendix 1

Lists of Primates for Individual Asian Countries

The review of the communities of Asian primates undertaken earlier in this plan has established the frequent diversity of ecosystems within countries. Indonesia, for example, includes eight biogeographical provinces with primate faunas and has the longest species list. The size of this insular country (over 1,900,000 km²) on the Sunda Shelf and the extent of its equatorial rain forest contribute to its species and ecosystem diversity, but its climatic and biotic history also are significant factors. The contribution of bioclimatic factors, as contrasted with land area alone, to species and ecosystem diversity is demonstrated further by Vietnam and Laos, which are respectively about 17% and 12% the size of Indonesia: both contain four biogeographical provinces and probably more than 14 species.

In Asia, any programs or plans to approach conservation issues on an international basis, such as the development of a Himalayan study center or the establishment of contiguous reserves in Thailand and Peninsular Malaysia, should be encouraged. However, the development of national conservation strategies and action programs to protect the diversity of ecosystems and primates within countries may be more essential to guarantee sufficient adaptive potential for long-term survival and change.

Species whose presence in a country is questionable are indicated by a query in brackets [?]. The number of species for each country recognized in this plan may be followed in parentheses () by the range in number of species for that country which reflects classificatory disputes (see sections on Classification and Distinct Communities and Ecosystems for specifics). Endemic species, definitely known only from a single country, are indicated by an asterisk (*). Former names of species are included in parentheses.

No primates are recorded for the following countries: Bahrain, Iran, Iraq, Israel, Jordan, North Korea, South Korea, Kuwait, Lebanon, Macao, Oman, Qatar, Syria, United Arab Emirates (see also Kavanagh and Bennett, 1984).

Afghanistan 650,000 km², 1 species

Family Cercopithecidae
Subfamily Cercopithecinae
Macaca mulatta

Bangladesh 144,000 km², 10 species

Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
Family Cercopithecidae
Subfamily Cercopithecinae
Macaca nemestrina
Macaca assamensis
Macaca fascicularis
Macaca mulatta
Macaca arctoides
Subfamily Colobinae
Semnopithecus entellus (*Presbytis entellus*)
Trachypithecus phayrei (*Presbytis phayrei*)
Trachypithecus pileatus (*Presbytis pileata*)
Family Hylobatidae
Hylobates hoolock

Bhutan 46,600 km², 3-4 species

Family Cercopithecidae
Subfamily Cercopithecinae
Macaca assamensis
Macaca mulatta
Subfamily Colobinae
Semnopithecus entellus [?] (*Presbytis entellus*)
Trachypithecus geei (*Presbytis geei*)

Brunei Darussalam 5,765 km², 9 species

Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
Family Tarsiidae
Tarsius bancanus
Family Cercopithecidae
Subfamily Cercopithecinae
Macaca nemestrina
Macaca fascicularis
Subfamily Colobinae
Presbytis hosei
Presbytis rubicunda
Trachypithecus cristatus (*Presbytis cristata*)
Nasalis larvatus
Family Hylobatidae
Hylobates muelleri

Burma 676,580 km², 12 species

Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
Family Cercopithecidae
Subfamily Cercopithecinae
Macaca nemestrina
Macaca assamensis
Macaca fascicularis
Macaca mulatta
Macaca arctoides
Subfamily Colobinae
Trachypithecus cristatus (*Presbytis cristata*)
Trachypithecus obscurus (*Presbytis obscura*)
Trachypithecus phayrei (*Presbytis phayrei*)
Trachypithecus pileatus (*Presbytis pileata*)
Family Hylobatidae
Hylobates hoolock
Hylobates lar

China 9,761,000 km², 15 species (15-17 species)

Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
Family Cercopithecidae
Subfamily Cercopithecinae
Macaca nemestrina
Macaca assamensis
**Macaca thibetana*
Macaca mulatta
Macaca arctoides
Subfamily Colobinae
Semnopithecus entellus (*Presbytis entellus*)
Trachypithecus francoisi (*Presbytis francoisi*)
Trachypithecus phayrei (*Presbytis phayrei*)
**Rhinopithecus roxellana* (*Rhinopithecus roxellanae roxellanae*)
**Rhinopithecus bieti* (*Rhinopithecus roxellanae bieti*)
**Rhinopithecus brelichi* (*Rhinopithecus roxellanae brelichi*)
Family Hylobatidae
Hylobates concolor
Hylobates hoolock
Hylobates lar

Hong Kong 1,013 km², 1 species; 2-3 introduced species

Family Cercopithecidae
Subfamily Cercopithecinae
Macaca mulatta
Macaca fuscata (introduced)
Macaca fascicularis (introduced)
Macaca cyclops (?) (introduced)

India 3,287,000 km², 15 species (15-17 species)

Family Lorisidae

Subfamily Lorisinae

Loris tardigradus
Nycticebus coucang

Family Cercopithecidae

Subfamily Cercopithecinae

**Macaca silenus*
Macaca nemestrina
**Macaca radiata*
Macaca assamensis
Macaca fascicularis
Macaca mulatta
Macaca arctoides

Subfamily Colobinae

Semnopithecus entellus (*Presbytis entellus*)
**Trachypithecus johnii* (*Presbytis johnii*)
Trachypithecus geei (*Presbytis geei*)
Trachypithecus phayrei (*Presbytis phayrei*)
Trachypithecus pileatus (*Presbytis pileata*)

Family Hylobatidae

Hylobates hoolock

Indonesia 1,919,300 km², 33 species (29-35 species)

Family Lorisidae

Subfamily Lorisinae

Nycticebus coucang

Family Tarsiidae

Tarsius bancanus
**Tarsius pumilus*
**Tarsius spectrum*

Family Cercopithecidae

Subfamily Cercopithecinae

Macaca nemestrina
**Macaca maura*
**Macaca nigra*
**Macaca nigrescens*
**Macaca ochreata*
**Macaca brunneus*
**Macaca tonkeana*
**Macaca hecki*
**Macaca pagensis*
Macaca fascicularis

Subfamily Colobinae

**Presbytis comata* (*Presbytis aygula*)
Presbytis femoralis
Presbytis frontata
Presbytis hosei
**Presbytis melalophos*
**Presbytis potenziani*
Presbytis rubicunda
**Presbytis thomasi*
**Trachypithecus auratus* (*Presbytis cristata pyrrhus* and
P. c. kohlbruggei)
Trachypithecus cristatus (*Presbytis cristata*)
Nasalis larvatus
**Simias concolor*

Family Hylobatidae

Hylobates syndactylus
**Hylobates klossii*
Hylobates agilis
Hylobates lar
**Hylobates moloch*
Hylobates muelleri

Family Pongidae

Pongo pygmaeus

Japan 369,562 km², 1 species

Family Cercopithecidae

Subfamily Cercopithecinae

**Macaca fuscata*

Kampuchea 181,035 km², 8 species

Family Lorisidae

Subfamily Lorisinae

Nycticebus coucang

Family Cercopithecidae

Subfamily Cercopithecinae

Macaca nemestrina
Macaca fascicularis
Macaca arctoides

Subfamily Colobinae

Trachypithecus cristatus (*Presbytis cristata*)
Pygathrix nigripes

Family Hylobatidae

Hylobates concolor
Hylobates pileatus

Laos 236,800 km², 15 species (13-17 species)

Family Lorisidae

Subfamily Lorisinae

Nycticebus coucang
Nycticebus pygmaeus

Family Cercopithecidae

Subfamily Cercopithecinae

Macaca nemestrina
Macaca assamensis
Macaca fascicularis
Macaca mulatta
Macaca arctoides

Subfamily Colobinae

Trachypithecus cristatus (*Presbytis cristata*)
Trachypithecus francoisi (*Presbytis francoisi*)
Trachypithecus phayrei (*Presbytis phayrei*)
Pygathrix nanae
Pygathrix nigripes

Family Hylobatidae

Hylobates concolor
Hylobates pileatus
Hylobates lar [?]

Malaysia 330,079 km², 16-17 species**Peninsular Malaysia** 131,690 km², 9-10 species

Family Lorisidae

Subfamily Lorisinae

Nycticebus coucang

Family Cercopithecidae

Subfamily Cercopithecinae

Macaca nemestrina
Macaca fascicularis
Macaca arctoides [?]

Subfamily Colobinae

Presbytis femoralis (*Presbytis melalophos*)
Trachypithecus cristatus (*Presbytis cristata*)
Trachypithecus obscurus (*Presbytis obscura*)

Family Hylobatidae

Hylobates syndactylus
Hylobates agilis
Hylobates lar

Sabah 73,940 km², 10 species

Family Lorisidae

Subfamily Lorisinae

Nycticebus coucang

Family Tarsiidae

Tarsius bancanus

Family Cercopithecidae

Subfamily Cercopithecinae

Macaca nemestrina
Macaca fascicularis
Subfamily Colobinae
Presbytis hosei

Presbytis rubicunda
Trachypithecus cristatus (*Presbytis cristata*)
Nasalis larvatus

- Family Hylobatidae
Hylobates muelleri
- Family Pongidae
Pongo pygmaeus
- Sarawak** 124,449 km², 12 species
- Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
- Family Tarsiidae
Tarsius bancanus
- Family Cercopithecidae
Subfamily Cercopithecinae
Macaca nemestrina
Macaca fascicularis
- Subfamily Colobinae
Presbytis frontata
Presbytis femoralis (*Presbytis melalophos*)
Presbytis hosei
Presbytis rubicunda
Trachypithecus cristatus (*Presbytis cristata*)
Nasalis larvatus
- Family Hylobatidae
Hylobates muelleri
- Family Pongidae
Pongo pygmaeus
- Nepal** 140,800 km², 3-4 species
- Family Cercopithecidae
Subfamily Cercopithecinae
Macaca assamensis
Macaca mulatta
- Subfamily Colobinae
Semnopithecus entellus (*Presbytis entellus*)
Trachypithecus geei [*?*] (*Presbytis geei*)
- Pakistan** 800,000 km², 2 species
- Family Cercopithecidae
Subfamily Cercopithecinae
Macaca mulatta
- Subfamily Colobinae
Semnopithecus entellus (*Presbytis entellus*)
- Philippines** 299,400 km², 3 species
- Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
- Family Tarsiidae
**Tarsius syrichta*
- Family Cercopithecidae
Subfamily Cercopithecinae
Macaca fascicularis
- Saudi Arabia** 2,253,300 km², 1 species
- Family Cercopithecidae
Subfamily Cercopithecinae
Papio hamadryas
- Sri Lanka** 65,584 km², 4 species
- Family Lorisidae
Subfamily Lorisinae
Loris tardigradus
- Family Cercopithecidae
Subfamily Cercopithecinae
**Macaca sinica*
- Subfamily Colobinae
Semnopithecus entellus (*Presbytis entellus*)
**Trachypithecus vetulus* (*Presbytis senex*)
- Singapore** 580 km², 2-3 species
- Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang [*?extinct*]
- Family Cercopithecidae
Subfamily Cercopithecinae
Macaca fascicularis
- Subfamily Colobinae
*Presbytis femoralis*¹ (*Presbytis melalophos*)
- Taiwan** 35,962 km², 1 species
- Family Cercopithecidae
Subfamily Cercopithecinae
**Macaca cyclopis*
- Thailand** 513,517 km², 13 species
- Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
- Family Cercopithecidae
Subfamily Cercopithecinae
Macaca nemestrina
Macaca assamensis
Macaca fascicularis
Macaca mulatta
Macaca arctoides
- Subfamily Colobinae
Presbytis femoralis (*Presbytis melalophos*)
Trachypithecus cristatus (*Presbytis cristata*)
Trachypithecus obscurus (*Presbytis obscura*)
Trachypithecus phayrei (*Presbytis phayrei*)
- Family Hylobatidae
Hylobates agilis
Hylobates lar
Hylobates pileatus
- Vietnam** 334,330 km², 14-15 species (13-20 species)
- Family Lorisidae
Subfamily Lorisinae
Nycticebus coucang
Nycticebus pygmaeus
- Family Cercopithecidae
Subfamily Cercopithecinae
Macaca nemestrina
Macaca assamensis
Macaca fascicularis
Macaca mulatta
Macaca arctoides
- Subfamily Colobinae
Trachypithecus cristatus (*Presbytis cristata*)
Trachypithecus francoisi (*Presbytis francoisi*)
Trachypithecus phayrei (*Presbytis phayrei*)
Pygathrix nemaeus
Pygathrix nigripes
**Rhinopithecus avunculus*
- Family Hylobatidae
Hylobates concolor
Hylobates pileatus [*?*]
- Yemen Arab Republic** 194,250 km², 1 species
- Family Cercopithecidae
Subfamily Cercopithecinae
Papio hamadryas
- People's Democratic Republic of Yemen**
338,000 km², 1 species
- Family Cercopithecidae
Subfamily Cercopithecinae
Papio hamadryas

¹ *Presbytis femoralis femoralis* recently has been sighted after presumption that it had become extinct in Singapore (V. Weitzel, in litt. 1987).

Appendix 2

Asian Primate Species included in the 1986 IUCN Red List of Threatened Species ^{1 2}

Family Tarsiidae		
<i>Tarsius bancanus borneaus</i>	Borneo	I
<i>Tarsius syrichta</i>	Philippines	E
Family Cercopithecidae		
Subfamily Cercopithecinae		
<i>Macaca pagensis</i>	Indonesia	I
<i>Macaca silenus</i>	India	E
Subfamily Colobinae		
<i>Presbytis potenziani</i>	Indonesia	I
<i>Trachypithecus johnii</i>	India	V
<i>Trachypithecus geei</i>	Bhutan, India	R
<i>Nasalis larvatus</i>	Borneo	V
<i>Simias concolor</i>	Indonesia	E
<i>Pygathrix nemaeus</i>	Indochina	E
<i>Rhinopithecus roxellana</i>	China	R
Family Hylobatidae		
<i>Hylobates concolor</i>	China, Indochina	I
<i>Hylobates klossii</i>	Indonesia	V
<i>Hylobates moloch</i>	Indonesia	E
<i>Hylobates pileatus</i>	Indochina, Thailand	E
Family Pongidae		
<i>Pongo pygmaeus</i>	Borneo, Sumatra	E

Definitions of categories:

ENDANGERED (E) Taxa in danger of extinction and whose survival is unlikely if the casual factors continue to operate.

VULNERABLE (V) Taxa believed likely to move into the 'Endangered' category in the near future if the causal factors continue operating.

RARE (R) Taxa with small world populations that are not at present 'Endangered' or 'Vulnerable,' but are at risk.

INDETERMINATE (I) Taxa *known* to be 'Endangered,' 'Vulnerable' or 'Rare' but where there is not enough information to say which of the three categories is appropriate.

¹ The IUCN Conservation Monitoring Centre (1986). International Union for Conservation of Nature and Natural Resources/United Nations Environment Programme.

² Nomenclature and distribution may have been changed to agree with Action Plan.



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