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Biodiversity patterns and the conservation of mammals in the Philippines[1]

LAWRENCE R. HEANEY[2]

The Philippine Islands support one of the richest mammal faunas in the world; at least 180 species are present, about 115 of which are endemic (*i.e.*, unique) to the country. Most species are limited to a single faunal region; each faunal region corresponds to a single island that existed from 10,000 to 18,000 years ago during a period of low sea level that was caused by one of the ice ages. Even small islands that remained isolated during the periods of low sea level (such as Sibuyan) have distinctive, unique faunas. The largest faunal regions (Greater Luzon and Greater Mindanao) each have sub-regions with several endemic species; the total number of such regions and sub-regions of biological endemism is about 15. Adequate protection of biological diversity requires that an effective and representative protected area exist in each of the 15 regions.

Forty-four species of Philippine mammals, 37 of which are endemic, are now believed to be endangered to some significant degree. Endangered species occur in all of the faunal regions; an index of faunal endangerment ranks the Greater Negros-Panay faunal region as most critical, followed by Mindoro and Greater Luzon (which have similar indices), Greater Mindanao, Greater Palawan, Sibuyan, Greater Sulu, and the Batanes/Babuyan region.

Current sites in the Integrated Protected Areas System (IPAS) program include six terrestrial parks that will contribute to protecting terrestrial vertebrate diversity; these are on Greater Luzon, Greater Mindanao, Greater Negros-Panay, and Batanes. Significant gaps remain in the system. In order to maximize protection of both diversity of endemic species and individual threatened species, careful consideration should be given to Mindoro as the most crucial region, followed by (in approximate order of importance) southern Luzon (Mt. Isarog), Sibuyan, western Panay, Palawan, Sulu, and western Mindanao as the top-priority regions in the selection of the next set of IPAS sites. In order to be maximally successful, the parks should include as much primary forest as possible; they should be as large as possible; they should be located on the largest island of a given faunal region; and they should include the full elevational range that exists in the given faunal region, from lowland rainforest to mossy forest.

KEY WORDS: biodiversity, conservation, mammals, endemism, biogeography, endangered species, parks, Philippines.

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INTRODUCTION

The mammal fauna of the Philippine Islands includes some of the most striking species in the world, including such animals as the beautiful dwarf Visayan spotted deer (*Cervus alfredi*); the tamaraw (*Bubalus mindorensis*), a dwarf water buffalo; the Mt. Isarog tweezer-beaked hopping rat (*Rhynchomys isarogensis*), a unique rodent from Luzon that feeds almost exclusively on earthworms; and the strikingly-colored Philippine tube-nosed fruit bat (*Nyctimene rabori*), found only on Negros and Sibuyan. These are only four of the 115 endemic species that are found only in the Philippines; each of the other endemics also possesses distinctive ecology and morphology, each filling a unique position in the web of life. An additional 65 species are found both within and outside of the Philippines (*i.e.*, they are non-endemic), usually in adjacent parts of Asia, bringing the total number of land mammals to 180.

As a point of comparison, much attention has been given to Madagascar in recent years, in part because of the large number of endemic species of mammals, as well as their precarious conservation status. It is interesting that, in spite of the publicity associated with Madagascar, the Philippines has more species of endemic mammals, 115 vs. 80, and the Philippines is only one-third as large as Madagascar. Given this, it is not surprising that the Philippines have the highest level of endemism of any area in the entire Indo-Malayan Realm (MacKinnon and MacKinnon, 1986). Clearly, the Philippine Islands support one of the largest endemic mammal faunas on Earth, especially on a per-area basis.

Unfortunately, like Madagascar, the mammal fauna of the Philippines also is threatened by human activities. Recent summaries of the conservation status of Philippine mammals (Hauge *et al.* 1986; Heaney *et al.* 1987; Heaney & Utzurrum 1991; Oliver 1992, 1993; Oliver *et al.* 1991, 1993; Utzurrum 1991, 1992) make it clear that immediate action is needed to stave off the extinction of several species, and that many others are declining rapidly. All of the species mentioned in the first paragraph of this paper are critically endangered and their prospects for survival have been worsening steadily.

The purpose of this paper is to briefly summarize current knowledge of diversity patterns and the conservation status of Philippine mammals, in order to produce a broad geographical perspective on conservation needs in the archipelago. These data are then used as the basis for recommendations concerning the on-going redevelopment of the Philippine national parks system.

It should be borne in mind that information on the Philippine mammal fauna in many respects is very limited (see papers cited in Balete *et al.* 1992); as described below, new species continue to be discovered every year, and species whose ecologies were unknown are gradually being studied. Some species now being discovered are common in certain habitats, but others are already at the brink of extinction even as they are made known to the world. Some species that have not been seen for 25 to 100 years are now being shown to be common in appropriate habitats, while others are increasingly suspected to be extinct. One group, the insectivorous bats of the suborder Microchiroptera, are too poorly known to be included in this analysis, although many are endemic species (Ingle & Heaney 1992), and we suspect that several are currently endangered. Thus, the figures cited here should be seen as representing our best current knowledge,

knowing that regular updates will be necessary as our understanding expands about the extraordinary mammal fauna of the Philippines.

Mammalian Macrogeographic Diversity Patterns in the Philippines

The most recent checklist of Philippine mammals (Heaney *et al.* 1987) listed 165 species of mammals, exclusive of domestic and marine species. However, since that time, 15 species have been added to the list (Table 1). Three of these are species that previously were known outside of the Philippines but only recently have been found within the country for the first time (*Pteropus dasymallus*, Utzurrum 1992; *Hipposideros lekaguli*, Balete, pers. comm.; *Harpiocephalus harpia*, Ingle & Heaney 1992; Rickart *et al.* 1993), and two are taxa that had been recognized as subspecies but are now recognized as distinct endemic species (*Sus cebifrons* and *Sus philippensis*; Grubb 1993). The eleven remaining species are newly discovered species, nearly two per year in the six-year interval; most are now in the process of being formally described. At the same time, one species (*Hylopetes mindanensis*) was recognized to be a minor variant of another (*Petinomys crinitus*; Hoffmann *et al.* 1993), for a net gain of 15 species. The rate at which new species are being described in the Philippines currently is the highest for any country in the world, and is higher than the rate for the entire continent of North America. This rate of discovery probably will continue, if well-planned field surveys continue.

These 180 species are not distributed evenly across the Philippines; rather, they occur within distinct faunas limited to one or a few islands. Previous studies have shown that each distinct fauna is confined to one of the large, ancient islands that existed during the periods of time when sea level was low due to the development of continental ice caps;

Table 1. New discoveries of Philippine mammals, 1987-1993.

Taxon	Previous Total	New Species	New Records	Taxonomic Changes	Total
Insectivora	10	0	0	0	10
Scandentia	2	0	0	0	2
Dermoptera	1	0	0	0	1
Pteropodidae	23	2	1	0	26
Emballonuridae	3	0	0	0	3
Megadermatidae	1	0	0	0	1
Rhinolophidae	17	0	1	0	18
Vespertilionidae	21	0	1	0	22
Molossidae	4	0	0	0	4
Primates	3	0	0	0	3
Pholidota	1	0	0	0	1
Sciuridae	13	0	0	-1	12
Muridae	52	9	0	0	61
Hystricidae	1	0	0	0	1
Carnivora	7	0	0	0	7
Artiodactyla	6	0	0	+2	8
TOTAL	165	11	3	3	180

this took place during the Pleistocene epoch, commonly called the Ice Ages (Heaney 1986, 1991). During the most recent period of low sea level, which took place from about 18,000 to 12,000 years ago, sea level was 120 m lower than at present (Fairbanks, 1989); the extent of Philippine islands at that time is shown in Figure 1. Every one of these Pleistocene islands that has been investigated supports a unique fauna, even little Sibuyan Island (448 km^2), where five previously unknown species were discovered a few years ago (Goodman & Ingle 1993).

The total number of native non-flying species (*i.e.*, not including those introduced by humans) varies among these faunal regions from 30 on Greater Luzon and Greater Mindanao to only nine on Sibuyan (Figure 1, Table 2); I exclude Greater Sulu and the Batanes/Babuyan region from this discussion because current information is very limited. The number of endemic non-flying species (i.e., those that are unique to that Pleistocene island) varies from a maximum of 23 on Greater Mindanao and 21 on Greater Luzon, to 12 on Greater Palawan, seven on Greater Mindoro, and five on Greater Negros-Panay. Among fruit bats, the number of native species varies from 10 to 15 and the number of endemic species from one to three. These are exceptionally high values for endemism, undoubtedly among the highest in the world. Indeed, it is these individually high values that combine to produce the high collective species richness for the Philippines.

It is important to emphasize that we lack enough information to include some of the Pleistocene islands in this summary. All presently available evidence indicates that the currently unknown or poorly-known Pleistocene groups, no matter how small, will support some unique species. Careful and thorough surveys of such places should be given high priority in the future. The Sulu, Batanes, and Babuyan groups deserve special attention , given the poor state of current knowledge of these important areas.

The Geography of Conservation Priorities

Although it is important that conservation programs include efforts to protect individual species, both in the wild and in captivity, the primary goal of conservation efforts should be the protection of biological diversity. This can be accomplished only by protecting organisms in their natural habitats, within the context of natural communities of organisms. In the case of the Philippines, the patterns of biological diversity have been strongly structured by the extent and topography of Pleistocene islands; thus, the first and most important level of protection should be to document and provide protection for all of the faunal regions (Hauge et al. 1986, Utzurrum 1991). On this basis, my first and most important recommendation is that each of the faunal regions, as defined by the limits of the Pleistocene islands, should be the location of at least one major national park that has a fauna and flora that is representative of that region.

Several years ago, Dr. Domingo Madulid, Head of the Botany Section at the Philippine National Museum, and I worked together to answer the question, What are the most crucial areas for protecting biological diversity on land in the Philippines? Although information for both terrestrial vertebrates and plants is incomplete, we attempted to use our personal knowledge to estimate the minimum number of general

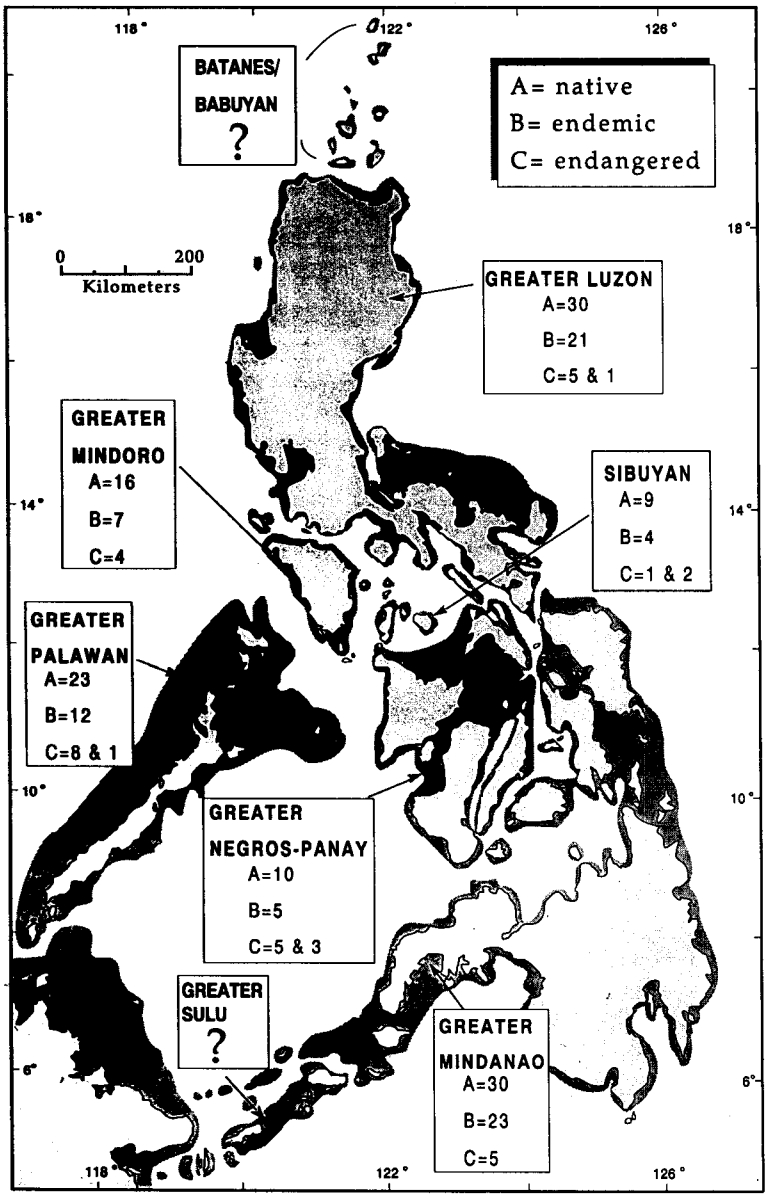

Figure 1. Map of the Philippine Islands showing the limits of faunal regions, as determined by the extent of islands during Pleistocene periods of low sea level (from Heaney 1986). For each faunal region, the following figures are given: A = number of native land mammals, excluding bats; B= number of native land mammal species that are endemic to the faunal region, excluding bats; C= number of endangered native land mammal species in the faunal region (including non-endemic species), plus the number of endangered native fruit bats. Data from Tables 2 and 4.

Table 2. Diversity of native and endemic mammal species in the Philippines.

Faunal Region	Number of Native Species[a]	Number of Endemic Species[a]	Percent of Species Endemic
Greater Luzon	30 + 14	21 + 1	70% + 7%
Greater Mindanao	30 + 15	23 + 3	77% + 20%
Greater Palawan	23 + 11	12 + 1	52% + 9%
Greater Negros-Panay	10 + 14	5 + 3	50% + 21%
Greater Mindoro	16 + 11	7 + 1	44% + 9%
Sibuyan	9 + 10	4 + 1	44% + 10%
Greater Sulu	6 + 10	1 + ?	?
Batanes/Babuyan	?	?	?

a = number of native non-flying species + the number of fruit bat species

sites that would potentially be necessary to protect at least 90% of the terrestrial flora and vertebrate fauna of the country. Our conclusion, shown in Figure 2, is that a minimum of 15 sites is essential, in the approximate places shown. Some are more important for one group than the other; for example, Samar is more important for plants than vertebrates, and Dinagat more important for vertebrates, but we were struck by how similar the needs were for the two groups. In every case, each of the Pleistocene islands requires one park, and in the case of the larger Pleistocene islands, up to four are necessary to provide protection for localized sub-regions of endemism. For example, most native mammals on Luzon are found in the Central Cordillera, but there are at least five species confined to southern Luzon (Rickart *et al.* 1991; Rickart & Heaney 1991; Oliver *et al.* 1993), and at least one (*Crunomys fallax*) is confined to the still poorly-known northern Sierra Madre. Plant distributions follow the same pattern, but also show the mountains of the Zambales Peninsula to be a center of endemism; virtually no information has been published on the mammals of Zambales, but these data indicate that a thorough survey of this subregion is needed.

The next question is, in which of the faunal regions are conservation problems most acute? It is necessary to ask this question because it is unlikely that funds will be immediately available to provide strong park protection programs in all 15 regions, and decisions must be made concerning where the first efforts should be made.

The most direct way to address this question is to ask, in which faunal regions are the greatest number of mammal species significantly threatened? I believe that the highest priority should be given to protecting those faunal regions where many species are threatened, because this situation strongly indicates that an entire biotic community is at risk.

Two approaches to answering this question are apparent. The first approach, presented in Table 3 and Figure 1, simply tallies the number of endemic mammal species that currently are believed to be threatened to a significant degree, based on assessments in Goodman & Ingle (1993), Heaney & Utzurrum (1991), Mickleburgh *et al.* (1992), Oliver *et al.* (1993), and Utzurrum (1992), plus some recent unpublished information.

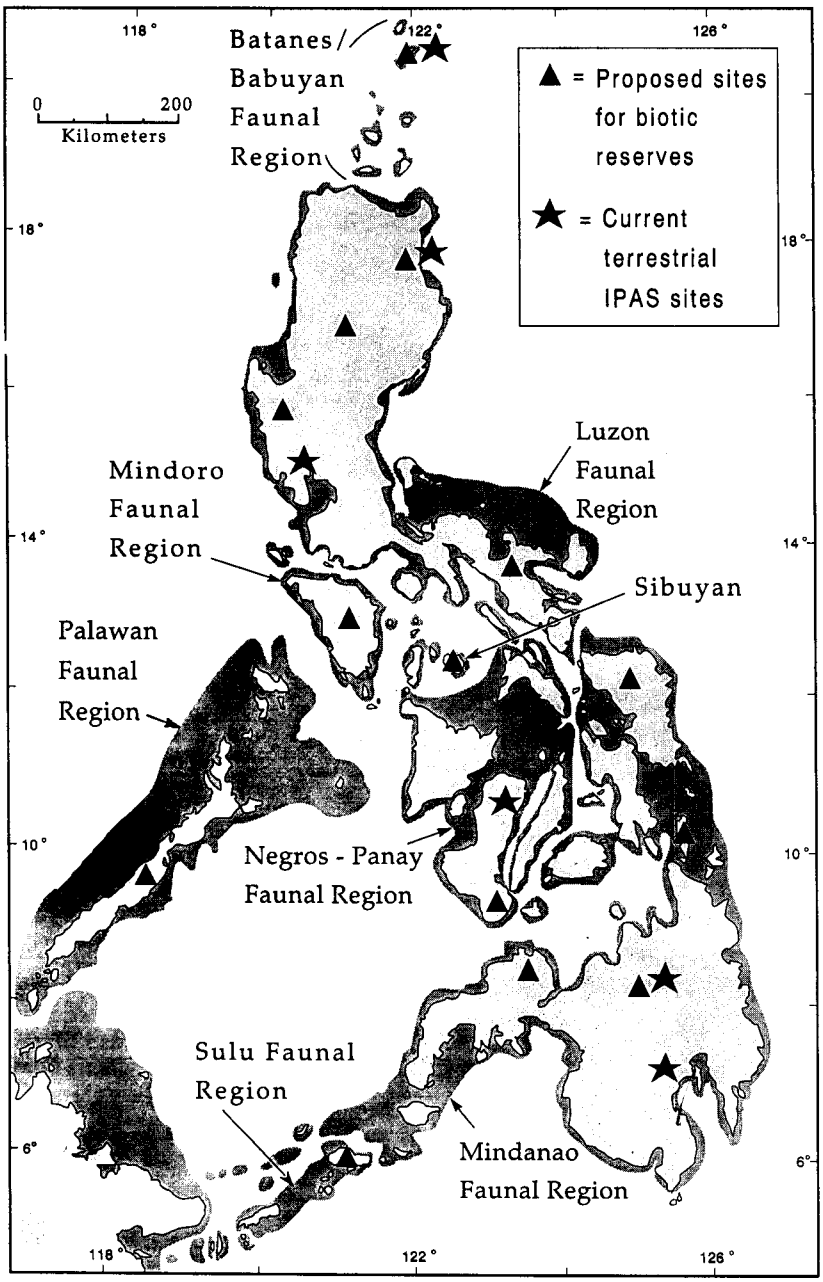

Figure 2. Map of the Philippine Islands showing the 15 critical areas for protecting biodiversity of land plants and vertebrates (triangles), and the locations of current sites in the Integrated Protected Areas (IPAS) program.

For six regions, data are sufficient for a meaningful estimate; in these, the number of native species that are threatened to a significant degree ranges from a low of three on Sibuyan, four on Greater Mindoro and Greater Palawan, five on Greater Mindanao, six on Greater Luzon, and eight on Greater Negros-Panay. By this ranking, Negros-Panay is the most critical region.

This simple approach has the disadvantage that it gives equal weight to a species that is teetering on the brink of extinction and to one that has declined but currently is stable. A more informative approach to measuring the threat to a faunal region is to construct an index of faunal endangerment, by assigning different rankings to species that are endangered to differing degrees (Tables 3 & 4), and tallying all of these into an "index of faunal endangerment" for each faunal region. Recently extinct species are given the highest ranking, because these are the surest indicators of severe disturbance to a faunal region. Those in progressively lower categories are given lower rankings, as defined in Heaney and Utzurrum (1991). The results (Table 3) show that the index of faunal endangerment varies from 28 for Greater Negros-Panay to 11 for Greater Mindoro and 10 for Greater Luzon, with values of three to six for the Batanes-Babuyan islands, Greater Mindanao, Greater Palawan, Sibuyan, and Greater Sulu.

The extreme threat to the entire faunal region of Greater Negros-Panay is made clear by this ranking scheme, leaving no doubt about the need for immediate action. Greater Mindoro, too, is clearly facing serious threat. It should be noted that if the species on Palawan that are found elsewhere in Asia were included in the list, Palawan would increase appreciably in ranking. It is interesting that, although Luzon and Mindanao support the most diverse mammal faunas, they have relatively few endangered species, and most of them are in the lower categories of endangerment; both Mindoro and Sibuyan have roughly equal rankings of faunal endangerment, even though they are much smaller, clearly because larger proportions of their faunas are endangered. It is interesting to note that, in every case, the number of threatened species in a given region is correlated with the degree of deforestation in that region.

It should be noted that, as more information becomes available, these values will change. I suspect that Greater Sulu and the Batanes/Babuyan region will be found to have additional endemic species, and the amount of habitat disturbance in those areas almost certainly has had an impact on those species. I also strongly suspect that more species currently are endangered on Mindoro, but available information is quite limited.

Priorities for the Development of a Protected Areas System

After a period of several decades of neglect and decline, the Philippine national park system now is receiving a great deal of attention and funding for re-development (IUCN 1991; Dee, this volume). The primary action is being taken under the Integrated Protected Areas System (IPAS) project, which has as its primary objective the protection of the nation's biological diversity. The IPAS project has received $2 million under a debt-for-nature swap, and $20 million from the Global Environmental Fund of the World Bank; additional funds recently were pledged by the European Community. In the current phase of the IPAS project, 10 sites have been selected for development as primary national parks, three of which are marine parks and one of which is a freshwater marsh chosen for its importance for migratory water-birds; these deal with issues

Table 3. Distribution of endangered endemic Philippine mammals. For a list of species and their status, see Table 4. For Palawan, the number of non-endemic endangered species are given in parentheses. Total = total number of endangered endemic species in the given faunal region. Index = index of faunal endangerment, as defined in the text.

	Category						
	5	4	3	2	1		
Faunal Region	Presumed Extinct	Severely Threatened	Seriously Threatened	Declining	Vulnerable	TOTAL	INDEX
Luzon	0	0	0	4	2	6	10
Mindanao	0	0	0	1	4	5	6
Palawan	0	0	1(+2)	0(+2)	3(+1)	4(+5)	6
Negros-Panay	2	1	4	1	0	8	28
Mindoro	1	1	0	0	2	4	11
Sibuyan	0	0	1	1	1	3	6
Sulu	0	0	0	1	2	3	4
Batanes/Babuyan	0	0	1	0	0	1	3
Widespread	0	0	0	5	0	5	10
TOTAL	3	2	9	15	15	44	-

outside of the concerns of this paper, and will not be discussed. The remaining six sites are forest parks, intended to protect terrestrial biotic communities; these fall within the topic of this paper.

The locations of the six terrestrial IPAS sites are shown in Figure 2. As may be seen, most of them match well with the preferred sites that are shown. The Palanan Wilderness Park is the ideal site for protecting the Sierra Madre biotic region, and Mt. Katanglad Nature Park supports richest vertebrate fauna on Mindanao, and perhaps in all of the Philippines (Heaney, Tabaranza & Rickart, in prep. on mammals; Peterson *et al.*, in prep. on birds). Data are insufficient to know which specific area is best in the Batanes-Babuyan group, but the current IPAS site is certainly in the right region. Subic Bay on Luzon and Mt. Canlaon on Negros are both in very good regions, but both have some draw-backs. Subic Bay does not include a full elevational gradient in the proposed protected area, which is crucial to protecting both watersheds and the usually diverse and endemic-rich upland habitats (Heaney *et al.* 1989; Musser & Heaney 1992; Rickart *et al.* 1991; Rickart, this volume). Mt. Canlaon has been deforested heavily and is reported to be almost entirely lacking in lowland forest, and most of the Negros-Panay endemics have not been demonstrated to be present, although this may reflect poor knowledge rather than actual absence; the Cuernos de Negros region of southern Negros has more forest and most of the endemic species, and may be a better site. At least one species, the Panay bushy-tailed cloud rat, is restricted to the mountains of western Panay, emphasizing the importance of that region as well.

Table 4. List of all species tallied in Table 3; the number that follows the name of each species indicates the conservation status category into which that species is placed. An asterisk indicates that the species is found outside of the Philippines (that is, it is non-endemic), as well as within the indicated region. Based on information in Goodman & Ingle (1993), Heaney & Utzurrum (1991), Musser & Heaney (1993), Oliver *et al.* (1993), Utzurrum (1992), and recent unpublished data.

Greater Luzon region
Pteropus leucopterus (2), *Crateromys schadenbergi* (2), *Phloeomys cumingi* (2), *Phloeomys pallidus* (2), *Archboldomys luzonensis* (1), *Rhynchomys isarogensis* (1).

Greater Mindanao region
Crateromys australis (2), *Podogymnura aureospinula* (1), *Crocidura grandis* (1), *Crunomys melanius and rabori* (1), *Tarsomys echinatus* (1).

Greater Palawan region
*Felis bengalensis** (3), *Tragulus napu** (3), *Cervus calamianensis* (3), *Manis javanica** (2), *Arctictis binturong** (2), *Acerodon leucotis* (1), *Sundasciurus rabori* (1), *Palawanomys furvus* (1), *Aonyx cinerea** (1).

Greater Negros-Panay region
Acerodon lucifer (5), *Dobsonia chapmani* (5), *Cervus alfredi* (4), *Nyctimene rabori* (3), *Crateromys* sp. (from Panay) (3), *Felis bengalensis** (3), *Sus cebifrons* (3), *Crocidura negrina* (2).

Greater Mindoro region
Crateromys paulus (5), *Bubalus mindorensis* (4), *Crocidura mindorus* (1), *Anonymomys mindorensis* (1).

Sibuyan region
Nyctimene rabori (3), *Chrotomys* sp. (2), *Haplonycteris* sp. (1).

Greater Sulu region
Rattus tawitawiensis (2), *Pteropus speciosus** (1), *Nycticebus coucang** (1).

Greater Batanes/Babuyan region
*Pteropus dasymallus** (3).

Widespread endemic Philippine species
Acerodon jubatus (2), *Eonycteris robusta* (2), *Sus philippensis* (2), *Cervus mariannus* (2).

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and neither has any functioning protected area. Palawan ranks at about the same level, although it should be noted that some species in the Palawan region are found elsewhere in Asia, and so are not included in the index; however, these almost certainly have better prospects for survival than the species that are endemic to the Philippines. If priority is to be given to protecting endemic species only, then the priority ranking for Palawan

If we assume that these sites have been fixed, the most important issue is the location of the next set of sites. If the primary purpose of the parks is protection of biological diversity, then the highest priority for the next set of sites should be those faunal regions that have no IPAS parks at present. Among these, highest priority should be given to the faunal regions where the threat to the fauna is greatest. Given these restrictions, Mindoro clearly is the most important area; both of the indices developed above indicate that the Mindoro faunal region is under severe threat.

Other critical sites for inclusion in the IPAS system are Sibuyan and Greater Sulu, since both are unique centers of diversity, have high percentages of species in danger, remains relatively low. In the next level of priority would come some of the biotic subregions, including (in approximate order of importance) southern Luzon (especially Mt. Isarog), Panay (especially the western mountains), the Zamboanga Peninsula (especially Mt. Malindang), the Central Cordillera of northern Luzon, Dinagat Island, and the low mountains of eastern Samar.

As additional information on the terrestrial biota of the Philippines becomes available, it seems likely that additional regions of endemism will be found. In order to be fully successful, the protected areas system in the Philippines should remain flexible enough to add such areas as they are documented.

Selection of Sites for Parks

All of the analysis and discussion above focuses on the selection of regions for parks, rather than specific locations. Several guidelines can be suggested for choosing sites, base on current data on within-region patterns of biodiversity.

First, the vast majority of Philippines mammals (as well as other vertebrates and plants) require native primary forest for their survival (e.g., Brown & Alcala 1986; Heaney *et al.* 1987, 1989; Heideman & Heaney 1989; Rickart *et al.* 1991). Therefore, any given site for a park should include all primary forest in the area.

Second, it is clear that much of the biodiversity of the country is associated with elevational gradients, with some groups most abundant at low elevations, and others at high elevations (Goodman and Gonzales, 1990; Heaney *et al.* 1989; Rickart, this volume; Rickart *et al.* 1991, 1993). Parks should therefore extend from lowland rainforest to mossy forest on the highest peaks, with the maximum amount of each type of habitat that is possible.

Third, densities of many species are low under natural conditions, and human hunting pressures often reduce the population sizes of many species (*e.g.*, Heideman & Heaney 1989; Ingle 1992; Heaney *et al.* 1989; Rickart *et al.* 1991, 1993). Parks must be large in order to support enough individuals of the rare species to maintain healthy populations. Although there is no single rule concerning what is "large enough", deforestation has already reduced tracts of forest so much that nearly all are already too small to be ideal, so that the parks should contain all available forest, and usually should have active programs of reforestation around the periphery of the forest to encourage the regrowth of natural vegetation.

Fourth, because the most diverse fauna within a given faunal region usually will be found on the largest island of the region (Heaney 1986), parks should usually be located on the largest island of that region. It should be noted that many of the faunal regions

are small (*e.g.*, Sibuyan and Batanes) but still deserve recognition as distinct faunal regions with pressing need for effective parks. Moreover, in some special cases it may be best to locate parks on small islands, for example where rare species are found only (or most abundantly) on those small islands. In general, though, the largest tracts of forest and the greatest elevational gradients will be found on the largest island in a given faunal region, and the major parks typically will be most successful in such places.

CONCLUSION

In order to successfully protect the terrestrial biota of the Philippines, current evidence indicates that 15 regions require protected areas. Six of these are the locations of protected areas included within the IPAS project; the other nine should be given high priority in the future, and some modifications to the current sites should be considered to increase their likelihood of success. Past studies have provided evidence that parks should be chosen extremely carefully; in order to be maximally successful, they should include the following features: they should include as much primary forest as possible; they should be as large as possible; they should be located on the largest island of a given faunal region; and they should include the full elevational range that exists in the given faunal region, from lowland rainforest to mossy forest (Heaney 1986; Heaney *et al.*, 1989; Rickart, this volume; Rickart *et al.* 1991, 1993; Utzurrum 1991).

The flora and fauna of the Philippines is extraordinarily diverse, with the number of endemic species among the highest of any place on earth. These species provide great potential for an internationally attractive eco-tourism industry; they may provide the raw materials for many new pharmaceutical drugs; they can and should provide the basis for sustainable harvesting of wood, rattan, medicinal plants, ornamental plants, and game species of mammals and birds. Of course, in every case, this requires active, successful management of the resource, rather than the unbridled destructive exploitation of the past.

More importantly, protection of the native forests is critical for the protection of watersheds. Intact forest serves as a giant sponge when typhoons hit a region, absorbing the water into its deep soil and releasing it slowly throughout the year, providing the clean water that is essential for agriculture, industry, aquaculture, and household use. Barren, deforested slopes hold no water, and typhoon rains rush to the sea, carrying huge loads of eroded soil; along the way, the floods destroy agricultural land, industry, and people's homes; and in the sea, the silt load smothers the already beleaguered coral reefs. During the dry season, no water remains to feed the rivers or ground-water systems, causing increasingly severe droughts. The catastrophic floods that struck Ormoc in November 1991 are a prime example.

But perhaps most importantly, the natural biota of the Philippines is a crucial component of the national patrimony. The loss of a uniquely Filipino species diminishes the culture and society of the nation, whether it is the Philippine eagle that disappears, or a unique rodent that feeds only on earthworms. A stable and successful system of national parks should be the source of as much national pride to the Philippines as it is to other nations around the world, and should do as much to improve the quality of life for all of its citizens.

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