Hope for Threatened Tropical Biodiversity: Lessons from the Philippines

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The Philippines is a megabiodiversity country, but it is also often seen as a country of ecological ruin whose biodiversity is on the verge of collapse. Decades of environmental neglect have pushed ecosystems to their limit, often with deadly repercussions for the human population. Is conservation in the Philippines a lost cause? We review current conservation efforts in the Philippines, considering the actions of academics, field researchers, local communities, nongovernmental organizations, the government, and other sectors of society. Remarkably, however precarious the present situation may seem, there have been some recent positive gains and signs of hope. Although there is no room for complacency, we conclude that the diversity of available indicators suggests that conservation in the Philippines, against many odds, shows signs of success, and thus deserves greater attention and increased investment.

Keywords: conservation, indicators, biodiversity, Philippines, Southeast Asia

The loss and degradation of tropical ecosystems throughout the planet are threatening numerous species with extinction and thereby driving a biodiversity crisis with serious consequences for human well-being. In Southeast Asia, the threat is greatest where human populations are dense, impoverished, and rapidly increasing (Sodhi et al. 2004). The Philippines exemplifies this critical situation. It is one of the most biologically rich regions in the world, with exceptionally high levels of endemism for a country of its size. Nearly half of its approximately 1100 terrestrial vertebrates are unique to the islands, and estimates of endemism for vascular plants range from 45% to 60% (Heaney and Mittermeier 1997). The archipelago is also a center of nearshore animal diversity, most notably of corals, reef fish, marine snails, and lobsters (Roberts et al. 2002, Carpenter and Springer 2005). However, widespread environmental destruction has made this unique and megadiverse biota one of the most endangered in the world. The country is repeatedly cited as a global conservation priority—a top hotspot for both terrestrial and marine ecosystems—and there are fears that it could be the site of the first major extinction spasm (Heaney and Mittermeier 1997, Myers et al. 2000, Roberts et al. 2002).

Exploitation of many vital habitats has brought the Philippines to the brink of ecological ruin. The archipelago was once almost completely covered by forest, but the harvesting of timber and agricultural expansion during the Spanish colonization, followed by rapid and extensive commercial logging in the 20th century (Kummer 1992, Bankoff 2007), reduced forest cover to less than a quarter of the land area (figure 1). Although primary forest cover has been reported at a mere 3% of the land area (FAO 2005), this figure is most likely an underestimate because pristine montane forests may cover an additional 3% to 5% (Alcala 1998). Rates of annual forest loss continue to be high, at approximately 1.9% (WRI 2003). Between 1918 and 1994, land covered with mangroves declined from half a million hectares (ha) to about 12,000 ha as a result of clearing and conversion to fishponds (Primavera 2000). The archipelago's extensive coral reefs are threatened by harmful fishing practices (e.g., use of dynamite and poison) and siltation, with only 5% retaining 75% to 100% of live coral cover (Gomez et al. 1994). As a consequence, the country has a high number of species at risk of extinction. Of the 1007 Philippine vertebrate species assessed for the 2006 IUCN

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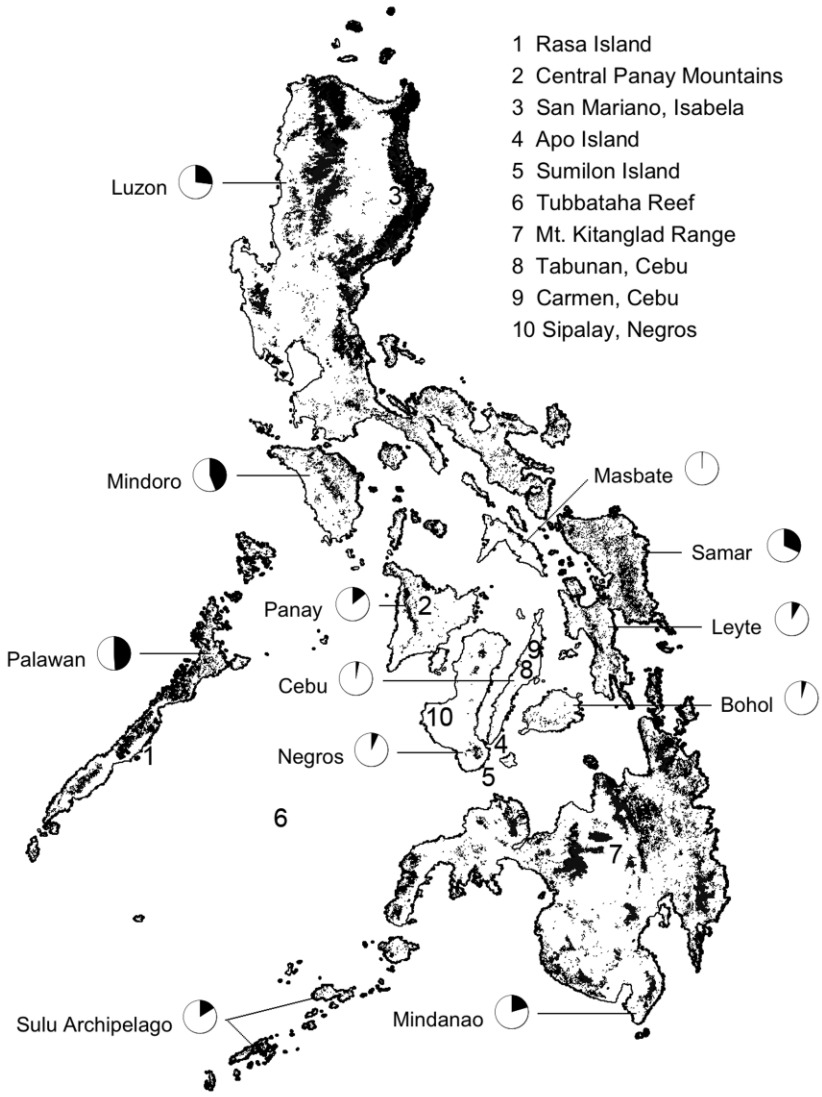

Figure 1. Map of the Philippine archipelago showing approximate percentages and distribution of forest cover (including degraded forest) remaining on the major islands. Locations mentioned in the text are indicated in the legend. Source: Modified from Stibig and colleagues (2004).

(World Conservation Union) Red List, nearly 21% are classified as threatened, as are 215 of the 323 plants evaluated.

The advanced state of environmental degradation has had serious repercussions for the human population as well. The loss of soil fertility, pollution from large-scale mining operations, and reduced productivity of fisheries affect the livelihood of millions of rural inhabitants (Pineda-Ofreneo 1993). Erosion from deforestation is blamed for frequent flooding and massive landslides, which claim many lives every year (Vitug 1993).

Efforts to preserve biodiversity are hampered by socioeconomic and political problems. Entrenched corruption, weak governance, uneven distribution of wealth, and opposition by small but powerful interest groups make it difficult to change and implement sound environmental policies (Vitug 1993, Utting 2000). Remaining natural resources are continually under pressure from an increasing human population (78.6 million in 2002, and growing at a rate of 2.3% per year; WRI 2003), and national funds are constrained by external debt servicing and rarely diverted into conservation efforts (Pineda-Ofreneo 1993).

Against this backdrop, it is unsurprising that some researchers, notably Terborgh (1999), have suggested a "triage" strategy that writes off the possibility of conservation of biodiversity in the Philippines. Over the last two decades, however, mounting evidence has indicated that there is still hope for such conservation in the country. Here we review some of the evidence for this revisionary perspective and assess the implications for conservation elsewhere in the already severely degraded, but still megadiverse, tropics.

Emergence of environmental consciousness

Conservation in the Philippines is inextricably linked to social and political issues. The country was long under colonial rule, and its natural resources were traditionally controlled by the elite and powerful, whose unsustainable and inequitable exploitation devastated the environment and marginalized the poor (Broad and Cavanagh 1993, Pineda-Ofreneo 1993). People in the countryside who depended on these resources, but gained little or no economic benefit from their commercial extraction, were the first to suffer from the impacts of environmental plunder. By the 1970s, members of some communities started to actively oppose developments that threatened local ecosystems, blocking logging trucks and protesting the construction of large dams (Broad and Cavanagh 1993).

After the 1986 overthrow of Ferdinand Marcos, the revived democracy saw government agencies previously identified with corrupt practices adopt fundamental reforms. The change in political climate fostered the emergence of diverse civil society groups (e.g., nongovernmental organizations [NGOs] and people's organizations) concerned with environmental management and sustainable development. The government became more open to an agenda that emphasizes the participation of these groups. Today, the involvement of civil society in the planning, development, and implementation of environmental policies and programs has become a salient feature of conservation in the Philippines (Utting 2000). Through lobbying, civil society groups can influence government agencies to adhere to their agenda for con-

servation and to pursue continuity in policy (Broad and Cavanagh 1993).

At least on paper, considerable progress in environmental protection legislation has been made, driven in part by public advocacy. Of particular significance to biodiversity conservation are the National Integrated Protected Areas System (NIPAS) Act of 1992, the establishment of protected areas, and the 2002 Wildlife Resources Conservation and Protection Act. At the international level, the Philippines is among the signatories to the Convention on Biological Diversity and other agreements such as the Convention on International Trade in Endangered Species of Wild Flora and Fauna, and the Ramsar Convention on Wetlands. A National Biodiversity Strategy and Action Plan and a National Wetland Action Plan were formulated to satisfy part of the country's obligations under these agreements. Representatives from various sectors came together to produce these comprehensive conservation action plans, which were subsequently endorsed by the Department of Environment and Natural Resources (DENR) and the president. Of course, enactment and ratification of such laws and conventions will not by themselves ensure the conservation of Philippine biota; failure to properly design, implement, and enforce policies could render them impotent. They are, however, evidence of the growing appreciation of the value of biodiversity in the country, and they prove that sustainable development and environmental protection have become integrated into political consciousness.

Another shift in environmental governance was seen in the devolution of authority over terrestrial and marine resources from the central government, which has limited resources and reach to tackle a multitude of concerns nationwide, to local governments. Through the Local Government Code of 1991, local governments began to share the responsibilities of maintaining ecological balance and enforcing regulations within their territorial jurisdictions. This change improves the chances that actions will be effective on the ground, because management options are given to those familiar with local environmental contexts and issues. Of course, devolution carries its own risks, such as possible abuses of power (Utting 2000). On the other hand, organized communities can directly benefit from controlling their own resources, and strong support from local governments can be instrumental to the success of conservation programs.

Effective actions: Implementing conservation through civil society

The Philippine environmental movement gets much of its momentum from committed people who belong to civil society groups. In most cases, these groups are small nonprofit organizations that tackle the multifarious facets of biodiversity conservation. Social issues, such as land tenure and poverty alleviation through alternative livelihood, are often addressed concurrently with the actual protection of biodiversity. Laudably, a number of efforts by local communities and NGOs have made direct impacts on conserving species and habitats.

One program that has achieved remarkable success to date involves work with the endemic Philippine cockatoo *Cacatua haematuropygia*. Considered a critically endangered species, it was historically known from 45 islands, but is now extirpated or rare throughout much of its range as a result of habitat loss and poaching for the pet trade (Collar et al. 1999). An integrated conservation program that was initiated in the early 1990s, led by government agencies and academic institutions, resulted in the formation of the Katala Foundation, an NGO that implements the Philippine Cockatoo Conservation Program. Key strategies of the program include awareness and education campaigns, nest protection, monitoring, captive breeding, and ecological research. The program recruited former poachers and trained them to be wardens, and the export of birds was restricted, which led to a decline in the illegal trade in wild birds (Boussekey 2000, Widmann et al. 2006). The local government endorsed the creation of the Rasa Island Wildlife Sanctuary in 1997 to protect and manage a resident cockatoo population. Since then, there have been clear signs of recovery (figure 2). Similar schemes are being implemented in additional areas, and there are indications of recovering populations on Palawan and Polillo Islands (Indira Lacerna-Widmann, Katala Foundation, Palawan, Philippines, personal communication, 21 November 2007).

The Philippine Endemic Species Conservation Project (PESCP) is undertaking a similar initiative to protect the critically endangered Visayan wrinkled hornbill *Aceros waldeni* on the island of Panay. A decade ago, the estimated population of this species was 60 to 80 breeding pairs across its range (Collar et al. 1999). Since starting a nest-protection program with 32 nests in 2002, the PESCP has monitored and protected an increasing number of nest holes, reporting 502 successfully fledged broods in 2006 (Curio 2007). Aside from its work with the hornbill as a flagship species for conservation on Panay, the PESCP lobbies to have essential forest

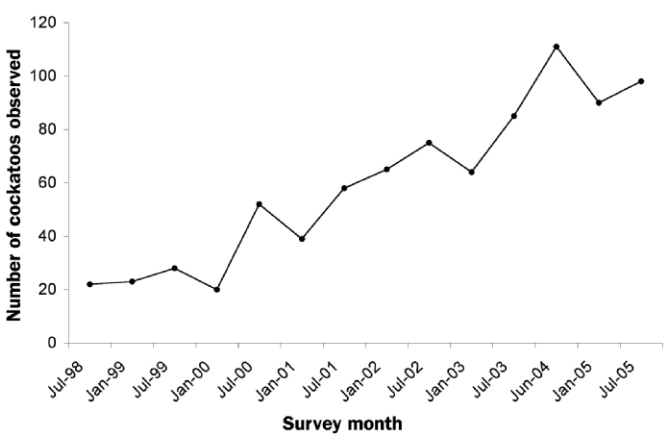

Figure 2. Numbers of the Philippine cockatoo* Cacatua haematuropygia *counted at the roosting site on Rasa Island, Narra, Palawan. Source: Modified from Widmann and colleagues (2006).

habitats declared as protected areas, supports enforcement actions to reduce illegal logging, and studies the island's other endemic and endangered wildlife.

Another emerging success story is the *in situ* conservation of the critically endangered Philippine crocodile *Crocodylus mindorensis*. Past efforts had focused on captive breeding, but the discovery of a small wild population in the municipality of San Mariano at the foot of Luzon's Sierra Madre range led to a conservation program that prompted the local government to establish a sanctuary and ban the killing of crocodiles, with positive results (figure 3; van der Ploeg and van Weerd 2004). Education and information campaigns were designed to change negative perceptions of crocodiles and engage the community in their protection. The Mabuwaya Foundation runs the Crocodile Rehabilitation, Observance, and Conservation Project, with the goals of scaling up efforts and expanding the work to include other areas in the Sierra Madre with known crocodile populations (van der Ploeg and van Weerd 2006).

One of world's most threatened birds, the critically endangered Philippine eagle *Pithecophaga jefferyi*, has long been a flagship species for Philippine conservation. Since initiatives to protect the eagle began in the 1980s, critical information on the species' biology and ecology has been gathered (Miranda et al. 2000, Salvador and Ibanez 2006). Recent reanalyses of population estimates using new data suggest that the species may have a larger population, and confirmed records from new localities indicate a much wider distribution (Collar et al. 1999). Populations remain highly fragmented, however, and are severely threatened by continuing habitat loss and poaching (Bueser et al. 2003). Actions by the Philippine Eagle Foundation, including conservation breeding, education, field research, and community-based initiatives (Salvador and Ibanez 2006), have had moderate success. An alliance of major local and international conservation organizations and government agencies was formed to pool resources and coordinate groups working to conserve the Philippine eagle. The recent expansion of the Peñablanca Reserve, which links several protected areas in the Sierra Madre range, is good news—the eagle's survival *in situ* will be secure only if forests are protected.

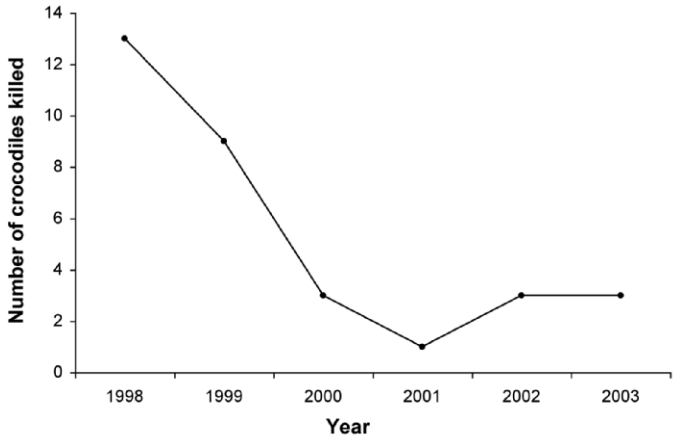

Figure 3. Reported crocodile killings in the municipality of San Mariano. Source: van der Ploeg and van Weerd (2004).

Such success stories are encouraging, and without the efforts of concerned groups, these species' prospects for survival would certainly have deteriorated rather than improved, but these species remain endangered. Elsewhere in the country, a number of other NGOs are playing crucial roles by providing services to, or acting on behalf of, different sectors of society involved in conservation. By forging links among the government, funding agencies, and local communities, and serving as project implementers, facilitators, trainers, and researchers, the NGOs can be catalysts for effective action. Their work is often local in scale but nonetheless important, providing enormous potential for replication in conserving other highly threatened species.

Progress in protected areas and resource management

Although parks had been established in the Philippines under the 1932 National Parks Law, a restructuring of the country's existing protected areas came with the enactment of the NIPAS Act in 1992. The act designates protected areas to secure the perpetual existence of all native plants and animals in a comprehensive and integrated system. Among its aims are the assessment of the biodiversity value of existing parks and the establishment of new marine and terrestrial protected areas of biological significance. It incorporates scientific, cultural, and socioeconomic dimensions in its framework, and it exemplifies a participatory process by guaranteeing stakeholder representation in site-specific Protected Area Management Boards (PAMBs). More than 300 parks of various categories are now included or are being evaluated for inclusion in the protected-areas system (DENR-PAWB 2003). Of these, 160 (roughly 8% of the Philippine land area) fall under IUCN categories I–V for terrestrial protected areas (WDPA 2007).

Although the NIPAS Act and its policy framework are necessary and progressive measures for conserving natural areas for their biodiversity, their actual implementation has been convoluted and problematic (Custodio and Molinyawe 2001). Implementing government agencies are often strapped for funding, resources, and technical capability. Bureaucratic red tape and political maneuverings by interest groups create conflicts in the management of areas and prolong the process of conferring protected status. Above all, because sites are rarely free of inhabitants who are dependent on limited natural resources, the establishment of protected areas can cause controversy (Urich et al. 2001). Consequently, effective management becomes more than a problem of simple environmental education or "fences and fines" enforcement (Custodio and Molinyawe 2001, White et al. 2002). Collaborative approaches to protected-area management through the PAMB or other partnerships involving resource users, although complex and time-consuming, seem to provide the best resolution to these conflicts.

Perhaps the best examples of the integration of human resource use and conservation are the community-based marine protected areas (MPAs) managed by coastal communities across the Philippines. Pioneered in the 1970s at Sumilon and Apo islands, reserves are designed with sections of reef designated as "no-take" zones, and local fishers become responsible for enforcing restrictions (Russ and Alcala 1999). No-take marine reserves both protect near-shore habitats and enable local residents to use resources in a sustainable manner (Russ and Alcala 1999); the reserves also have been shown to increase fish biomass (figure 4). This template has been highly accepted by fishing communities, with local governments implementing ordinances under the Local Government Code, Fisheries Code, or the NIPAS Act. Such strong stakeholder involvement is an essential element of their success (White et al. 2002), and more than 600 MPAs have been established. A survey of 156 MPAs reported that 44.2% had good to excellent management (Alcala and Russ 2006). Ultimately, however, small and scattered MPAs, even if they are successful, cannot protect biodiversity and sustain fisheries nationally in the Philippines. Recognizing these limitations, there have been calls for larger programs to build upon the success of MPAs by integrating them into larger, more holistic coastal management programs (White et al. 2002, 2005).

Understanding site-specific circumstances and adjusting to them can be key to an effective management plan, even for larger protected areas. An example of a tailored approach is the management of the Tubbataha Reef National Marine Park, a reef complex in the Sulu Sea and a UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Site. The unique characteristics of the park—its remote marine location, lack of inhabitants, tourism potential, and a stakeholder community composed of local and international fishing groups—require a high-level, dedicated collaboration among the governmental, nongovernmental, and private sectors. Activities of tourists and scuba divers, monitored to prevent damage, generate revenue to support the administration of the park. Management and protection measures, such as a ban on destructive fishing practices, have greatly improved living coral substrate cover (White et al. 2002) and restored the park's value as one of the last secure breeding and roosting areas for rare seabirds (Arne Erik Jensen, Wild Bird Club of the Philippines, Manila, Philippines, personal communication, 22 January 2008).

In Mount Kitanglad Range Natural Park (MKRNP), the first area protected by law after the NIPAS Act, significant progress has been made to assemble elements of an effective social contract to protect biodiversity. The MKRNP, the ancestral domain of indigenous tribes, is part of a major watershed spanning several municipalities in the province of Bukidnon. It was critical to harmonize the interests of the DENR, local government units, NGOs, and indigenous peoples by involving them in the decision-making process regarding the park's management. The PAMB assisted tribes in establishing

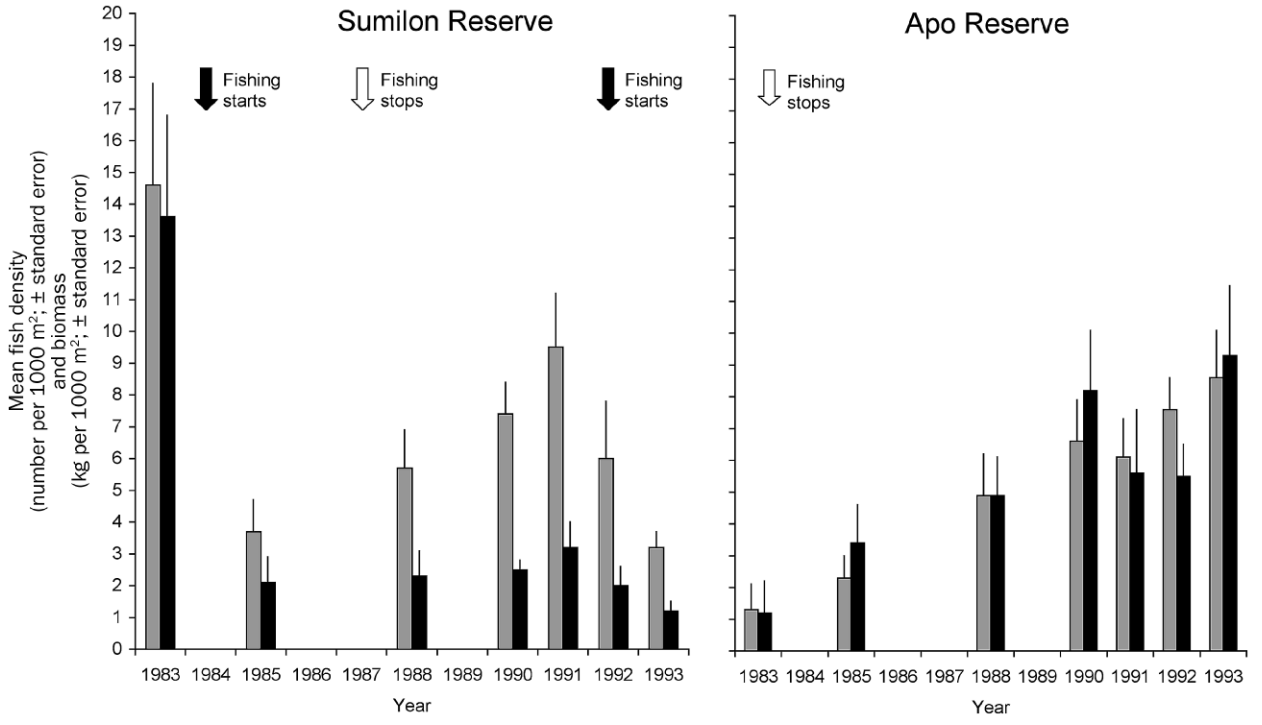

Figure 4. Mean number (left column for each year) and mean biomass (right columns, in kilograms) of large predatory reef fish per 1000 square meters in the Sumilon and Apo Reserves from 1983 to 1993. Number estimated by visual census. Sumilon Reserve had been protected from fishing for almost 10 years in 1983; protection in Apo Reserve began in 1982. Solid arrows indicate when fishing in Sumilon began (1984, 1992), and the open arrows indicate when fishing in the reserves ceased (1983, 1987). Source: Modified from Russ and Alcala (1999).

a Council of Elders to serve as advisers and representatives on the board (Saway and Mirasol 2004). There was a revival of traditional guards (Kitanglad Guard Volunteers), who, in addition to enforcing tribal justice systems, are instrumental in enforcing policies against prohibited acts in the park; moreover, they are front-runners in suppressing forest fires (Sumbalan 2001, Saway and Mirasol 2004). NGOs in the MKRNP promote sustainable livelihood systems (including tree planting in the buffer zones), which have led to a dramatic decline in violations committed inside the park (Catacutan et al. 2000). Such moves for community development enhance the awareness and foster the participation of people in surrounding areas beyond the park jurisdiction, helping to alleviate encroachment. The management experience in the MKRNP demonstrates that sensitivity, recognition of cultural tradition and local knowledge, strong enforcement, and flexibility to negotiate with various stakeholders can sustain many local initiatives (Sumbalan 2001).

The concept that communities themselves are often in the best position to manage and protect their resources is also the backbone of the government's social forestry initiatives. The community-based forest management program was adopted in 1995 as a strategy to achieve ecological stability and social equity. In this scheme, local communities are entrusted with the responsibility for forest rehabilitation, protection, and conservation. Tree planting can have various management goals, such as biodiversity protection, forest regeneration, and agroforestry. The right to use forest resources and the right to tenure security are intended to be incentives to plant trees and defend forestland against illegal logging (Lasco and Pulhin 2006).

Chokkalingam and colleagues (2006) reviewed forest rehabilitation in the Philippines and found that forest cover increased in 28 of 46 sites that had significantly reduced human pressures and continued maintenance and protection. Rehabilitation efforts, especially those in which mixed species are planted and undergrowth regeneration is allowed, appear to contribute to biodiversity enhancement and to increase faunal diversity (Chokkalingam et al. 2006, Lasco and Pulhin 2006). Forestry programs that are showing positive outcomes include sites at Alcoy in Cebu, the Makiling Forest Reserve in Laguna, an initiative of the local government unit in Nueva Vizcaya, and the Landcare movement on Mindanao (Chokkalingam et al. 2006, Lasco and Pulhin 2006). Forest area under plantation was reported to increase by 5% between 1990 and 2000 (WRI 2003). However, although considerable funding and effort have been expended, much uncertainty remains regarding the long-term survival and growth of plantations. In addition, their effectiveness for biodiversity conservation and their impacts on soil and water properties need to be evaluated.

Research and returns from the grave

The environmental movement in civil society has been paralleled in academia by renewed interest in biodiversity research. Studies in areas such as biogeography, systematics, and phylogenetics have greatly broadened understanding of processes that affect diversity in the archipelago. A search of three ISI Web of Knowledge databases (Biosis Previews, Web of Science, and Zoological Records) for the period 1985 to 2006 reveals an increasing number of publications pertaining to biodiversity and conservation (figure 5). Labors of frontline field researchers contribute considerably to knowledge of Philippine biota. Nearly a hundred new species of mammals, reptiles, and amphibians are currently being described; these descriptions are expected to increase tetrapod diversity and endemism by 8% and 50%, respectively (Lawrence R. Heaney, Field Museum, Chicago, personal communication, 21 October 2007; Rafe M. Brown, University of Kansas, Lawrence, personal communication, 7 October 2007; Angelo C. Alcala, Silliman University, Dumaguete City, Philippines, personal communication, 15 October 2007); even species as conspicuous as *Rafflesia* are still being discovered (Barcelona et al. 2006).

Along with the continuing discovery and descriptions of new species, there have also been exciting rediscoveries of species feared to have become extinct. As early as the 1900s, ornithologists noted that the island of Cebu had lost most of its original forest cover (Bankoff 2007). In 1959, a paper by Rabor reported the disappearance of the Cebu flowerpecker (*Dicaeum quadricolor*) and eight other avian subspecies endemic to the island. As the Cebu flowerpecker had not been recorded since 1906, it was considered extinct until its rediscovery in 1992 in a small patch of limestone forest at Tabunan (Dutson et al. 1993). Although clearance has reduced the size of Tabunan forest over the last 15 years, subsequent surveys have revealed the species' presence in other patches of forest, and conservation efforts on the island, such as those being undertaken by the Cebu Biodiversity Conservation Foundation, have been revived. Field surveys also unexpectedly uncovered populations of the Philippine bare-backed fruit bat (*Dobsonia chapmani*), a cave-dwelling species not recorded since 1964 despite intensive searches. In 2001, three of these bats were netted in an agricultural clearing at Carmen on Cebu (Paguntalan et al. 2004), and two years later, another five were found at Sipalay, on nearby Negros Island, in degraded karst habitat (Alcala et al. 2004). The Philippine parachute gecko *Ptychozoon intermedium*, described from a single specimen collected in 1912 that was destroyed during World War II, was found again in 1993 (Brown et al. 1997). Similarly, the Philippine forest turtle *Siebenrockiella leytensis* had been considered extinct from the island of Leyte for more than 80 years, until natural populations were found on Palawan (Diesmos et al. 2005).

A valuable lesson can be drawn from these rediscoveries: the uncritical acceptance of a species' extinction may lead researchers to give up on the species prematurely, and thus the assumption of its demise may become self-fulfilling (Collar 1998). The rediscoveries also underscore the value of basic biodiversity surveys. However, the state of deforestation in the Philippines means that these species, with their typically small populations, are far from out of danger of extinction and

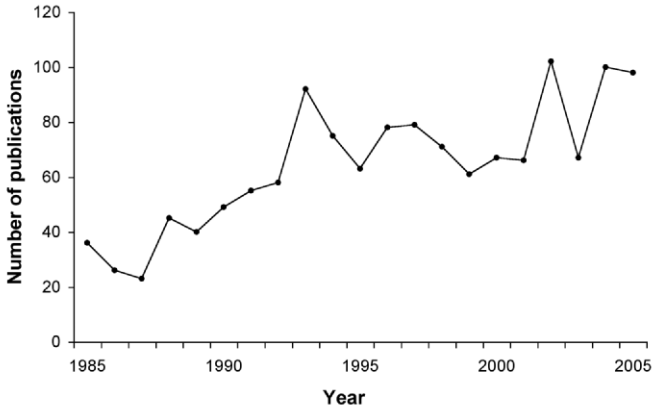

Figure 5. Number of publications on Philippine biodiversity and conservation obtained from searching three ISI Web of Knowledge databases (Biosis Previews, Web of Science, and Zoological Records).

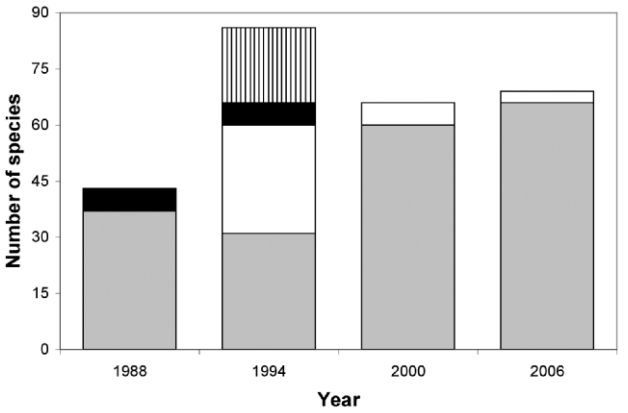

Figure 6. Stability of Philippine bird species considered threatened in four global conservation assessments for the IUCN Red List (Collar and Andrew 1988, Collar et al. 1994, BirdLife International 2000, 2006). Bars indicate numbers of species considered threatened in a given assessment, with shading showing if they are also considered threatened in the preceding and following assessments (solid gray), no longer considered threatened in the subsequent assessment (black), newly considered threatened since the previous assessment (white), or considered threatened in neither the preceding nor the subsequent assessment (vertical stripes).

require urgent conservation action to ensure their survival. In addition, there are many other "lost" and poorly known species, and fieldwork is necessary to ascertain their status (WCSP 1997).

As the amount and quality of biodiversity information increases, some evidence has emerged that certain endemic species are less extinction-prone than feared. For instance, some mammals are more abundant and widespread than previously thought (e.g., the Mindanao gymnure *Podogymnura truei*), and other mammals maintain good populations even in disturbed habitats, (e.g., the Philippine tarsier *Tarsius syrichta* and the Philippine flying lemur *Cynocephalus volans*) (WCSP 1997). Robust data for birds, however, show no consistent pattern in connection with the growth of knowledge about conservation status (figure 6). The first conservation status assessment of the world's birds listed 43 Philippine species as threatened (Collar and Andrew 1988). The second listed 86 (Collar et al. 1994), of which 26 were downlisted from threatened status by the third (BirdLife International 2000). Most of these changes involved new information; only two relate to genuine negative changes in status (Butchart et al. 2004)—increasing threat to the blue-winged racquet-tail *Prioniturus verticalis* in the early 1990s and to the Philippine duck *Anas luzonica* in the late 1990s. Since then, knowledge of the conservation status of Philippine birds appears to have stabilized, with 69 species considered threatened in the most recent assessment (BirdLife International 2006, IUCN 2006).

Networking conservation

Cooperative interactions between sectors involved in Philippine biodiversity conservation are on the rise. Echoing the participatory legislative framework, programs often seek to address various facets of conservation, and sharing of knowledge is now moving to the synthetic level. Researchers have drawn attention to previously overlooked biodiversity-rich areas for designation as protected areas, and their knowledge of faunistic and floristic distribution has been critical in pinpointing a comprehensive set of key biodiversity areas as priority targets for inclusion in the NIPAS (Mallari et al. 2001, CI-Philippines et al. 2006). Organizations such as the World Agroforestry Centre are assessing the policy support, potentials, and constraints in current management arrangements to develop better environmental service payment schemes benefiting rural people with ecologically sound practices (Boquiren 2004).

One of the most important positive signs is the increasing number of professional scientists, conservationists, and volunteer groups that are actively promoting conservation education, research, and advocacy work. The Wildlife Conservation Society of the Philippines is a professional organization formed in 1992 to advance wildlife research and conservation in the country. Today, it has a diverse membership from academia, government, NGOs, and people's organizations (WCSP 1997). Participation in its yearly biodiversity symposium, which provides a unique forum for interaction across sectors, has grown steadily in attendance and membership (figure 7). The Philippine Association of Marine Science also holds a well-attended symposium on marine biology. Another pioneer organization is the Haribon Foundation (*www.haribon.org.ph*), which started out as a bird-watching club in 1972 and is now one of the largest conservation NGOs in the country. More recently formed, the Wild Bird Club of the Philippines (*www.birdwatch.ph*) is the country's first group to regularly conduct bird-watching activities in important bird areas, bringing thousands of urbanites in direct contact with avian biodiversity in native habitats.

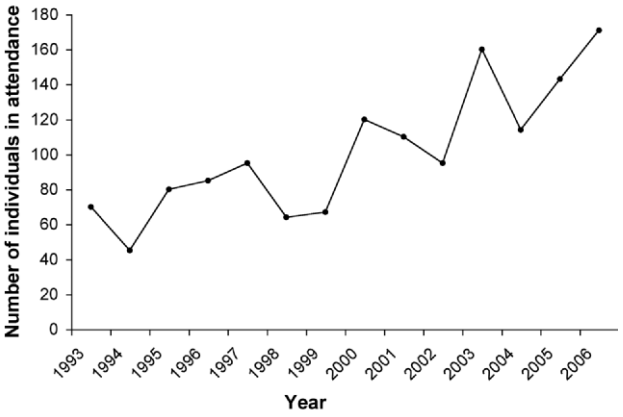

Figure 7. Attendance at the annual symposium on biodiversity by the Wildlife Conservation Society of the Philippines.

Other sectors are also putting the environment on their agendas. Working for environmental media advocacy, Bantay Kalikasan is the environmental arm of the ABS-CBN Broadcasting Corporation's sociocivic foundation. In addition to creating environmental themed series and broadcasting public service messages, Bantay Kalikasan has undertaken the rehabilitation of the La Mesa watershed, which supplies potable water to millions of residents in Metro Manila, the nation's capital. Similarly, the Center for Environmental Awareness and Education (*www.ceae.org*) is producing Filipino nature documentaries and training educators. Large companies, such as the Ayala Corporation, have created foundations for corporate social responsibility that support conservation efforts as well. The Philippine Center for Investigative Journalism has published a sourcebook to encourage environmental reporting, recognizing that this is no longer a "soft" issue for the press (Severino 1998). With the private sector and media beginning to take environmental concerns more seriously, we can expect that more Filipinos will embrace biodiversity conservation.

Issues and challenges

Throughout this article, we have highlighted cases of positive progress attained through efforts to conserve the threatened biodiversity of the Philippines. Immense challenges and obstacles remain, however, and we discuss some of them in this section.

Political will is needed from the central government to enforce environmental laws. There is a need to harmonize and clarify policies and resolve inconsistencies or contradictions that create conflicts, such as overlapping responsibilities and a lack of coherency between environmental and economic strategies (Chokkalingam et al. 2006). Bureaucratic malpractice and pressure from politically influential commercial interests continue to undermine legislation (Utting 2000). Major threats to the environment, such as pollution and climate change, must be addressed at the national level, and so must poverty and overpopulation, which are the ultimate drivers of environmental exploitation.

Globalization has stimulated a large Philippine diaspora in recent decades, with roughly 9% to 10% of the national population now living or working outside of the country (Hugo 2007). International migration can result in a decline in rural populations and a reduction of local pressure on natural resources, as remittances from emigrants may provide nonagricultural income and reduce reliance on subsistence farming (Carr et al. 2005). However, the dynamics of emigration and environment in the Philippines have not been evaluated, and the potential of remittances to be harnessed for community development has not been realized (Hugo 2007).

Effectiveness of community-based conservation depends to a large degree on adequacy of knowledge and capabilities of the communities (Utting 2000). Community organization and social preparation are essential for gaining support from the stakeholders and cultivating responsibility for resources (Utting 2000, Boquiren 2004, Alcala and Russ 2006). Stakeholders must be further empowered to plan, implement, enforce, and monitor their own programs (Sodhi et al. 2008). To be truly sustainable, community-based approaches must provide tangible benefits and be financially stable. Market support for sustainable-use practices and the products of social forestry is necessary, if these are to become viable, income-generating alternatives to direct exploitation (Chokkalingam et al. 2006).

Social forestry and rehabilitation can reduce pressures on remaining forests, but the establishment of well-managed nature reserves where biodiversity is high remains imperative. There is still a long way to go before the goals of the NIPAS Act are fully realized. Many parks are legally designated on paper, but resources allocated by the central government are insufficient to maintain them. The process of declaring protected areas remains cumbersome and protracted, and should be expedited for identified priority sites (Mallari et al. 2001, CI-Philippines et al. 2006). Other available instruments, such as designation of critical habitats as provided for by the Wildlife Act, should be harnessed. Full enforcement of even the most basic policies is lacking; for instance, illegal logging still takes place in national parks, often with the collusion of local officials (Vitug 1993). Finally, connecting smaller, community-managed protected areas into networks, such as incorporating MPAs into integrated coastal management programs, may enhance their overall value for biodiversity protection.

Scientific knowledge of Philippine biota has taken great steps forward in recent years; however, much remains to be learned. Basic biological information for many species is poor, and many areas still need to be surveyed. Moreover, the apparent ecological flexibility of some species, including rare endemics, indicates that attention should also be directed to degraded habitats. Scientists must become more involved in projects to better inform management plans and evaluate outcomes. Fostering collaborations with international organizations and developing strong links among institutions of

learning would enrich the capability of local scientists and conservation workers to conduct biodiversity research. There is much untapped data in "gray literature" (Lacanilao 1997), and available information is poorly distributed to the wider community. In this regard, one resource that is underutilized is the Internet, which can serve as a powerful tool for data sharing.

Funding continues to be a limiting factor in conservation efforts at all scales, inhibiting the ability to sustain small but effective conservation projects and maintain the value of many larger protected areas. Continued support from the global conservation community can have an enormous impact, especially for local initiatives whose costs are relatively low. Investments must be made over the long term because short timescales and "contractual culture" often produce ineffective and unsustainable results (Utting 2000). Alternative revenue-generating mechanisms must be actively explored and developed—for instance, prospects are good for scaling up payment schemes and markets for environmental services to finance the management of important biodiversity areas across the country (Boquiren 2004). Greater participation from the private sector should be fostered, not just through donations but also through genuine corporate social responsibility.

Conclusions

It could be said that the Philippine environmental movement was born out of necessity. Greater environmental advocacy and changes in policy have coincided with the near destruction of essential habitats and ecosystems. Progress has been generally slow over the past three decades of active conservation efforts in the Philippines, and as measured by many quantitative indicators, such as a reduction in the number of threatened species or an increase in forest area, still fares poorly. However, significant developments have been made in other, less quantifiable areas, such as capacity building. Moreover, despite flaws and challenges, much knowledge has been gained, and mechanisms for resource management and biodiversity protection are now in place. Committed conservation groups can be found throughout the country, striving to salvage the hotspot from its precarious environmental position.

As the Philippines had done, other countries in Southeast Asia are pursuing economic progress at the expense of biodiversity (Sodhi et al. 2004). With a biodiversity crisis looming throughout the region, it is crucial to evaluate which strategies are effective in conserving species and habitats. In the Philippines, greater involvement, organization, and networking of the stakeholders from many sectors have resulted in encouraging trends for conservation. Ensuring the future of tropical ecosystems hinges on finding the balance between diverse and often conflicting interests; different contexts will require different solutions. Nevertheless, that positive progress has been made—despite immense obstacles—in a country seen as a worst-case scenario suggests that grounds for optimism remain for biodiversity conservation both in the Philippines and in tropical countries worldwide.

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