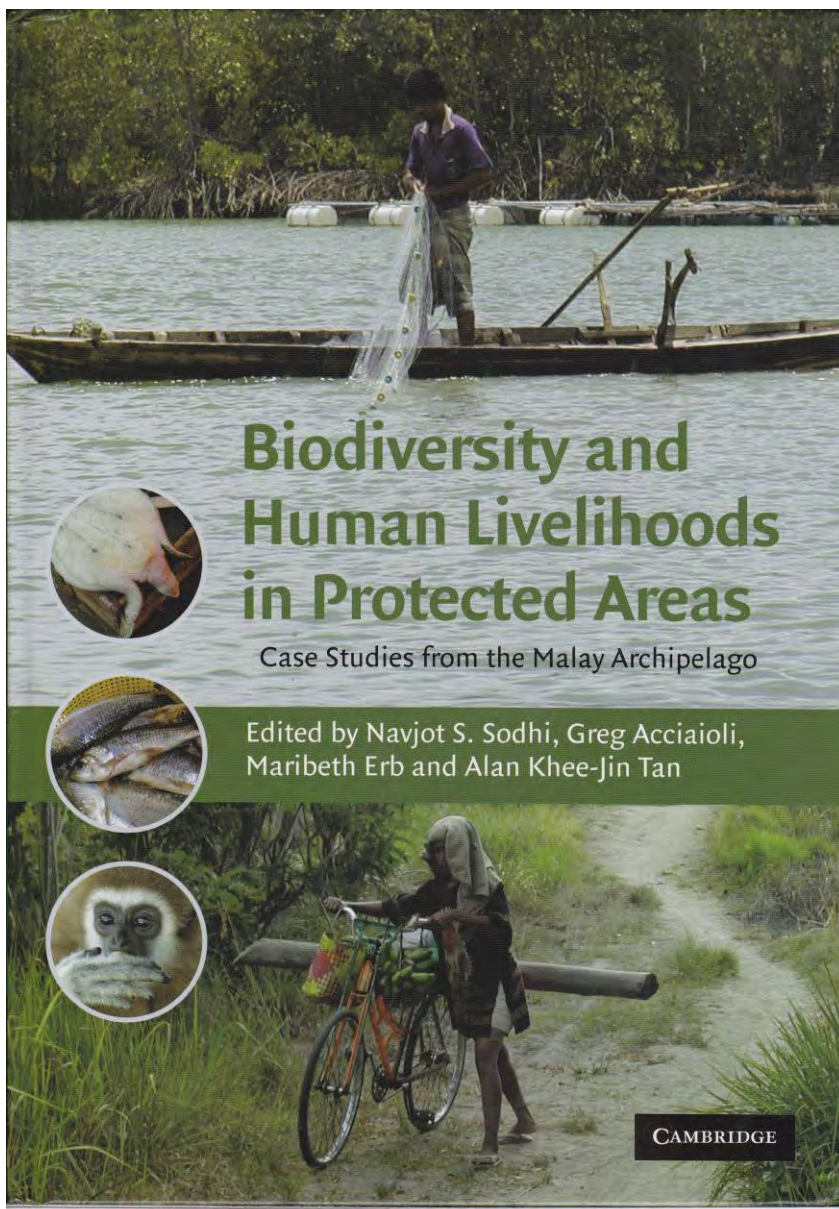




Biodiversity and Human Livelihoods in Protected Areas

Case Studies from the Malay Archipelago

Edited by Navjot S. Sodhi, Greg Acciaioli, Maribeth Erb and Alan Khee-Jin Tan

CAMBRIDGE

5

Indonesia's protected areas need more protection: suggestions from island examples

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Introduction

Intact, biodiverse ecosystems provide invaluable life-support services, raw natural resources, and cultural necessities ranging from recreational to spiritual. Moreover, they are literally economically priceless (Costanza *et al.* 1997). It is widely appreciated that 'biodiversity is good' and that ultimately, human well-being and persistence will depend on our ability to preserve it for future generations.

Biodiverse ecosystems, however, are not evenly distributed on our planet – they are patchy and concentrated in tropical regions (Myers *et al.* 2000). Likewise, costs and benefits of conserving biodiversity are not evenly distributed (Balmford *et al.* 2003). Our ability to conserve biological diversity is constrained by global trends of exploitation, pollution and habitat loss – all increasing because of human-population growth. Unfortunately, areas of accelerating human population growth overlap many areas of highest biodiversity where resources to protect this diversity are fewest (Cincotta *et al.* 2000) and land-conversion pressures greatest. As human populations continue to expand, we are faced with even more pressing needs to conserve and protect diverse ecosystems.

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Protected areas: theory meets reality

Protected areas are, by definition, designed to protect biological diversity from threats to its continued existence. They are the cornerstone of most biodiversity efforts because species need habitats and they might be the best way to ensure the long-term conservation of biodiversity (du Toit *et al.* 2004). Unfortunately, many protected areas are only 'paper parks' that are not only highly degraded, but also the target of continuing exploitation (Curran *et al.* 2004). Without enforcement of environmental regulations and a goal-oriented strategy for recovery, there is little chance that protected areas will realize their intended purpose.

A recent review confirmed that forest cover within protected areas is being lost in all major tropical forest areas and that protected areas are becoming increasingly isolated from each other because of human disturbance and forest clearing (DeFries *et al.* 2005). This is especially true in the tropics because immediate needs of expanding local populations often supersede long-term plans to sustainably use natural resources (Balmford *et al.* 2003). Indeed, conservation of biodiversity can, in many cases, conflict with efforts to alleviate poverty (Adams *et al.* 2004). But because species extinction is an absorbing boundary (i.e. there is no short-term recovery), overexploitation passes accumulating ecosystem failures and worsening situations on to future generations. It is therefore defensible to protect biodiversity from unsustainable exploitation, even when such protection necessitates contemporary sacrifice in order to conserve intact ecosystems for the future. With little data and scant methods to measure the extent and effectiveness of protected areas (Chape *et al.* 2005), we still need to prioritize data gathering, ground-truthing and reliability. Ultimately, future generations will judge how effective we have been in ensuring their livelihoods, health and quality of life through the conservation of biodiversity, both inside and outside of protected areas.

Indonesia's island conservation context

Comprising over 17000 islands, Indonesia is a megadiverse country, containing a fantastic array of endemic organisms. Indeed, nearly the entire country falls into the Conservation International biodiversity hotspots of Sundaland and Wallacea (see Table 5.1). The only part of Indonesia that does not fall into a hotspot is the extremely biodiverse Papua Province (the western half of New Guinea), where threat levels are not considered high enough to warrant 'hotspot' status. The archipelago's complex geological history both facilitated species dispersal over Pleistocene land bridges and promoted endemism via a

Table 5.2 Extent of Protected Areas (in IUCN categories) in 1000ha from 2004–2005 data. (Data from Whitten *et al.* 1987 and World Resources Institute 2006. EarthTrends: The Environmental Information Portal. Available at <http://earthtrends.wri.org>)

Protected Area	Sulawesi	Indonesia	World
National Parks, Nature Reserves, etc. (in category I and II) ^a	1407	5668	438448
Protected Forests, Natural Monuments, etc. (in category III, IV and V) ^b	383	2939	326503
Unclassified Areas (in category VI) ^c	3867	17385	692723
Total Terrestrial Protected Area	5657	23893	1457674
Total Marine Protected Area	0	13559	417970
Number of Areas >100000ha	2	38	2091

^a Most protection, fewer allowed resource-harvesting activities, etc.

^b Less protection, more allowed resource-harvesting activities, etc.

^c No consistent level of protection, no set regulations on allowed resource-harvesting activities, etc.

education, limited access to information, and international and local governments' emphasis on development projects, which often compete or even conflict with conservation values.

Another threat to conservation in Indonesia is the preponderance of 'unclassified' protected areas (IUCN (The World Conservation Union) category VI), that have no real biodiversity protection and yet constitute 64% of the total area reported as protected in Indonesia (Table 5.2, World Resources Institute 2006; also see Table 5.1). While this unquestionably inflates the area that appears to be protected in Indonesia, the use of IUCN category VI protected areas is a conservation wildcard that could have important implications for biodiversity if those areas are indeed somewhat intact biomes. On the other hand, if these areas really do not have any value to conservation, then including them in statistics of protected areas is misleading and, ultimately, a damaging strategy.

During our ongoing efforts (Brown & Guttman 2002; Brown & Iskandar 2000; Brown *et al.* 2000; Evans *et al.* 1999, 2003a, 2003b; McGuire & Kiew 2001; McGuire 2003; Supriatna & Hedberg 1998; Iskandar & Erdelen 2006; Meijaard *et al.* 2005; Iskandar 2004; Gillespie *et al.* 2004) to better understand this complex of biological hotspots (Myers *et al.* 2000), we have worked in many protected and non-protected sites in Indonesia, particularly on the island of Sulawesi (and to lesser degrees in Java, Sumatra, Kalimantan, Bali, the Lesser Sundas and Papua). Here we describe our observations on the status of protected areas, biodiversity conservation and natural-resource management that we witnessed during recent expeditions to Indonesia, with particular emphasis on, and data from,

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Figure 5.1. Unsustainable harvest of endemic mammal species. A group of local hunters poses with Indonesian students in Gunung Ambang protected area. A Sulawesi cuscus (*Phalanger* sp.) on the left, a Yaki macaque (*Macaca nigra*) in the middle, and many forest rats (*Rattus* spp. and *Taeromys* sp.) on the far right are shown (on stakes).

the island of Sulawesi. We feel strongly that current levels of resource management, biodiversity conservation and effective environmental policy actuation are inadequate to protect biodiversity in Indonesia. If not addressed soon, this situation will result in continued and substantial deforestation and extinction of Indonesia's biodiversity, even in protected areas (Kinnaird & O'Brien 2000; Sodhi et al. 2004). We outline problems and provide possibilities and suggestions for future conservation of Indonesia's tremendous and valuable biological diversity.

The constant (chainsaw) buzz of development

Deforestation of Indonesia's remaining few forested areas is a tragedy that continues at astonishingly high rates (Holmes 2000) despite reports to the contrary (e.g. Sunderlin & Resosudarmo 1996). Although strictly prohibited, until recently there has been little done to stop logging and other illegal practices in protected areas (Fig. 5.1 and Tables 5.3 and 5.4), and only in the past five years have there been focused efforts to eradicate illegal logging throughout most of

Table 5.3 Protected areas visited from 2001–2005. For each protected area, we list activities witnessed. (NP = National Park; NR = Nature Reserve; PF = Protected Forest)

Protected Area	Human settlement	Hunting/trapping	Logging	Gardening	Rattan harvest	Cattle grazing	Other livestock	Land clearing/burning
Tangkoko NP/NP		x	x	x	x	x	x	x
Gunung Ambang NR	x	x	x	x				x
Bogani Nani Wartabone		x	x	x	x	x	x	x
Tanjung Api NR			x					
Morowali NR	x	x	x	x	x		x	
Lumpobatang NR		x	x					
Lore Lindu NP	x	x	x	x	x		x	x
Gunung Soputan PF		x	x	x	x			x
Gunung Kiabat PF		x	x					x
Randangan Puanu NR			x					x
Tinombala NR			x					

Table 5.4 Officially permitted (+) and prohibited (–) activities for Sulawesi's protected areas. Actual activities we witnessed from 2001–2005 are indicated as (*). Adapted from Whitten *et al.* (1987)

Activity	National Parks	Nature Reserves	Protected Forests
Gardening	– (*)	– (*)	+
Logging	– (*)	– (*)	– (*)
Hunting	– (*)	– (*)	+
Fishing	+	– (*)	+
Rattan harvesting	– (*)	– (*)	+
Human settlement	– (*)	– (*)	– (*)
Firewood harvesting	– (*)	– (*)	+
Mineral exploration	+	– (*)	+

Indonesia. We have witnessed illegal forest clearing and lumber extraction in every protected area in Indonesia that we have visited (including National Parks, Nature Reserves and Protected Forests; see Table 5.4).

Threats to protected areas range from subsistence use (e.g. gardening, squatting, slash-and-burn agriculture), overexploitation of specific resources (e.g. rattan harvesting, mammal hunting and trapping), small-scale and industrial mining and logging, to large-scale clear-cutting, all of which are common threats to tropical forest areas around the globe (van Schaik *et al.* 1997). Like most of Indonesia, Sulawesi is heavily populated with human densities of 25–130/km² and population growth rates between 1.6–3.7% (from 1990 estimates, UNFPA (United Nations Population Fund) 2000). These high human-population indices reflect trends that can only increase environmental pressures accrued in tropical developing countries and are primarily responsible for the modern biodiversity crisis (UNFPA 2000). Without a doubt, there is very little 'pristine' habitat left on the island of Sulawesi, and like the rest of Indonesia, Sulawesi is in serious environmental trouble with many ecological disasters looming on the horizon (Sodhi *et al.* 2004). Although the designation of protected areas can be an effective tool for the conservation of biodiversity (Bruner *et al.* 2001), we feel there is still a large difference between what has been reported and the reality of many protected areas, and use Sulawesi as an example.

Success vs. failure

While there are examples of conservation successes within the protected area network (e.g. Lore Lindu National Park and Bogani Nani Wartabone), several protected areas across Indonesia are failing for a variety of

reasons. Often the establishment or persistence of a protected area conflicts directly with the livelihoods of local people (Figs. 5.1 and 5.2; Tables 5.3 and 5.4). People living near or within protected areas must sacrifice some natural resource in order for the protected area to really protect something. Most if not all protected areas would benefit if local people restricted their natural resource use or curtailed their harvesting from protected areas. This sacrifice should be rewarded in tangible ways, so that local people feel that they are directly benefiting from being in close proximity to a protected area. Too often, the benefits of protected areas (potable water, clean air, fertile soils, regulation of temperatures and rainfall) are not fully appreciated because they have little or no local value until they disappear. One potential strategy to help local people value these benefits is an educational programme that focuses on the benefits and reasons for having protected areas. Providing incentives, financial or otherwise, is also a viable method for bringing more value to ecosystem processes that are hard to quantify.

Another reason for failure is the chronic high level of corruption, institutional instability and a dearth of resources at government agencies that are responsible for protected-area management. With poorly paid personnel, lack of funding and expertise for research, and politically enforced policy changes that have no scientific merits, protected areas fight an uphill battle just to remain viable on paper, let alone to actually protect biodiversity. And while the struggle to conserve the biological integrity of a protected area is a continual process, the opponents of biodiversity conservation need only to win once. Mining, logging, hunting and other exploitation interests irreversibly alter the biological integrity of a protected area, and once they have profited from an area, conservation of remaining biodiversity is compromised.

Lastly, management techniques and funding for protected areas are often administered remotely, while the real needs of management and funds occur at a local scale. A series of decentralized objectives can be implemented at the local level to make conservation strategies viable in most protected areas.

Community-based conservation?

Integration of local communities into protected-area conservation plans has been identified as a potential strategy for biodiversity conservation (Baland & Platteau 1996; Berkes *et al.* 1989), but we are sceptical of the results so far. In theory, communities living in or near protected areas, and whose livelihoods depend on the natural resources now confined to these protected areas, would be best served if they became local stewards for conservation of the areas (Fig. 5.2). Unfortunately, there is a large discrepancy between community-based

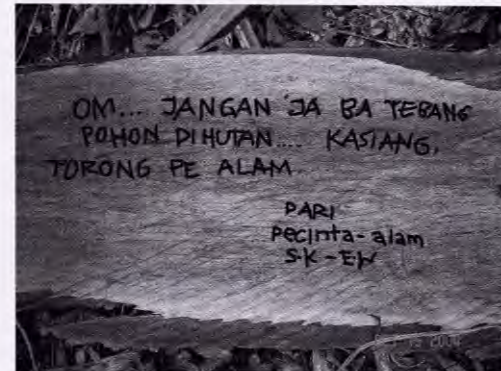


Figure 5.2. Warning sign left by hikers in Gudung Ambang protected area at site of illegal logging. Translation: 'Sir... Please do not cut down the trees in the forest... have pity on nature' written by a student outdoor group in Kotamobagu.

conservation theory and practice, sometimes brought out by biologists' ignorance of the social and cultural contexts of the protected area (West & Brockington 2006).

The idea of community-based conservation is particularly appealing because it addresses both biodiversity conservation and social needs for rural development. Because centralized management of protected areas in locations far away from protected areas may not result in tangible conservation, there has been an appreciation for more locally based programmes (Heinen 1996). Many centralized provincial or national management agencies are poorly informed, not physically present to monitor and enforce regulations, and usually have conflicting interests of resource exploitation not compatible with conservation. However, this locally based approach can only be fruitful in the context of strong national and local institutions and a solid government programme for supporting community-based conservation (Ross & Wall 1999b). Unfortunately, these requirements are seldom met in tropical developing countries where they are most needed.

Although integrating conservation and development goals sounds like a good idea, it has rarely produced effective results (MacKinnon & Wardjo 2001). Most Indonesian projects of this type do not appear to be working (Wells *et al.* 1999)

and there are specific examples from Sulawesi where these projects have failed (Ross & Wall 1999a). Protected areas still need national as well as regional and local management and will require active defence at all levels in order to effectively conserve biological diversity (see Murphy 1994; Kramer *et al.* 1997). Any long-term plans to conserve biodiversity must incorporate lessons from community-based efforts, transparent national conservation plans and international help.

In order for conservation to be effective, at least some decoupling of conservation and development goals may be necessary in some areas. For example, protected areas need to be free from excessive anthropogenic disturbances (e.g. logging, gardening, etc.) to effectively conserve biodiversity. Even though contemporary conservation will have to be in the context of sacrifice and compromise, conserving biodiversity now avoids simply passing responsibility of compounding problems to future generations (Western & Wright 1994). Protected-area buffer zones, corridors that link protected areas and educational programmes offer many possible ways to balance the constraints of conservation on development (see below).

Where there is a necessity of making protected areas work in a context of human use and local communities, we can have positive conservation outcomes by utilizing lessons learned from some recent successful projects that hinge upon just a few basic and simple premises, largely owing to innovative partnerships and collaborations.

Lessons learned from conservation projects: new directions

Although recent success stories are difficult to find, they do exist (Purnomo 2005) and can provide lessons regarding which strategies can work in Indonesia and those that do not seem to work (see Chapter 6). Among these, we outline three of what we feel are the most important core areas and reasons for recent success: decentralization, innovative collaboration and public education.

Many conservation practitioners, NGOs and local Indonesian governmental agencies are maximizing the current decentralization process by promoting more responsible stewardship at local levels around Indonesia. In fact, this strategy seems to be extremely effective in creating new support systems from NGOs with technical, institutional and logistical resources that were previously lacking in most local conservation scenarios. By bringing together the different skill sets from local governmental agencies, NGOs and conservation workers, Indonesia can capitalize on new and innovative collaborative relationships to conserve protected areas.

In a recent World Bank document on the forestry sector of Indonesia, Brown (2006) outlines two of the flagship success stories of these new multi-stakeholder relationships. Bunaken National Park (BNP) has developed an innovative collaboration with the Department of Forestry, local communities, the scuba diving ecotourism industry, and both provincial and district governments. This broad-based management committee with such a diversity of representatives from all stakeholder groups, ensures a much more reasonable park administration, a source of sustainable funding based on the continuation of biodiversity conservation (ecotourism entrance fees), and the support from local communities. The BNP Management Advisory Board collects and distributes ecotourism fees, providing sustainable funding for park management and protection and is controlled by a democratically elected group of representatives from the 30000 people living in and near the park.

Another of the most notable success stories is the Berau District Marine Protected Area in East Kalimantan. A consortium of international and local NGOs, the Berau District government and a few conservation donors developed a new 1.2 million-ha Marine Protected Area based on biological, technical and legal analyses. This is an excellent example of many different stakeholders from a variety of disciplines coming together in order to create a Marine Protected Area based around the reality of the existing legal system, the local communities' goals (represented mostly by local NGOs), biological data and biodiversity conservation initiatives. In addition, it is the first district-level Marine Protected Area in Indonesia and has a professional management team funded through the local government.

What these two success stories share is a sustainable source of funding that is reliant upon the protection of biological diversity. In other words, the financial stability of these projects is dependent upon intact biodiversity, ensuring a sustainable equity base for conservation management operations, salaries, incentives for local participation and overhead costs.

Decentralization can help conservation and protected areas

In an optimistic review of the most recent achievements of conservation work in Indonesia, Purnomo (2005) shows how various Indonesian governmental agencies have worked to protect new areas, strengthened conservation law enforcement, revitalized previously planned (but neglected) protected area projects, started restoration and reforestation initiatives, and developed new partnerships to develop and meet conservation goals. There is general agreement that benefits straddling socioeconomic boundaries, improving local livelihoods and achieving results that are meaningful to local

stakeholders have tremendously better potential for success than other approaches that do not include such benefits for local stakeholders (Brown 2006). These innovative partnerships, however, need to be removed from the same category as 'community-based' projects or those that appear to join conservation and development goals. This is because new partnerships (besides just local people and NGO workers) are being forged, bringing together stakeholders with varied backgrounds, goals, experiences and expectations.

Perhaps one of the most powerful ways that the Indonesian government has helped conservation efforts is through the recognition and promotion of partnerships involving many stakeholders participating in the management of protected areas. Testimony to the success of these management councils are Bunaken National Park and Komodo National Park, with less well-known examples on virtually every other large island (Bali, Java, Borneo, Sulawesi and New Guinea) in the archipelago (Purnomo 2005; but see Chapters 12 and 14).

Partnerships between public (governmental) and private (usually NGO) groups have also been responsible for all of the major recent success stories in protected-area conservation and have shown how new innovative relationships can be expanded and replicated. For example, resolving protected-area boundary conflicts have had huge impacts in East Nusa Tenggara (Indonesia), demonstrating how involving local communities and empowering them with real responsibilities (in the context of conservation goals and community resource use) can positively contribute to the management of community-owned land inside protected areas.

Other examples of how effective partnerships with local communities can benefit protected-area management and the conservation of biodiversity are found in the legitimization and adoption of traditional practices by communities adjacent to or in protected areas (Little 1994). For example, setting aside fewer mature and more young trees in local-community forest management on Sumba island, Nusa Tenggara has been fruitful for conservation, while customary fishing practices limiting catches in protected areas of the Padaido Islands, West Papua are also very effective for sustainable use of natural resources and the conservation of biodiversity inside and outside of protected areas. Because these practices stem from traditional peoples' existing conservation ethics, adopting them into a protected-area management plan can help cement support from people living in and around the protected area.

These examples from most islands of Indonesia provide an optimistic outlook about local cooperative-management strategies that, at least in some cases, can reverse the general degradation of protected areas and achieve real conservation goals by enhancing management effectiveness and local attitudes towards protected areas.

Environmental education is important

Although public education focused on the environment is not a new idea, it has thus far only had a small-scale and short-term precedence in Indonesia. A long-term plan prioritizing large-scale efforts can be achieved by pulling together different partners. In a focus more on public awareness, nation-wide programmes have already been shown to be effective. Attempts by the Global Environmental Facility (GEF) and the United States Agency for International Development (USAID) have improved protected-area conservation efforts by promoting pride in endemic Indonesian biodiversity and concern over its future. Aimed at training journalists to run public-awareness projects, the most successful endeavours have focused on advertisements and short documentaries, and have targeted very specific audiences like teachers, policy makers and religious leaders.

Including religious groups in conservation is also a new initiative that has shown tremendous promise in Indonesia. There are many potential applications of conservation ideas and protected-area management that are prevalent in most religions. Projects that glean pro-conservation excerpts from religious texts, tree-planting exercises by mosques, churches and temples, and the possibility of promoting conservation awareness through religious teachings, meetings, schools and services are all ideas that can be utilized more.

Direct involvement with governmental public-school systems has also been a product of relatively recent decentralization efforts and many successful environmental education programmes are in place in schools all over Indonesia. A key to success in this area seems to be including a variety of partners with different skills, funding opportunities or resources. For example, including local governmental and educational agencies, textbook publishers, school supply stores, parents, and both conservation and development NGOs can ensure a well-rounded and positive environmental education programme for most schools. One of the drawbacks, however, seems to be the difficulty in finding and maintaining funding, since some of the environmental educational programmes require more funding than is currently being allocated by the Indonesian government.

Market strategies like mass-media advertising are also extremely effective at raising public awareness and at least disseminating a small set of important facts to many people for a relatively small investment per person. Although mass-media advertising campaigns can never replace a real core curriculum for students, they can target other important audiences, and affect policy makers, and other community leaders by raising issues that would otherwise not be widely recognized.

Finding conservation funding

As mentioned above, a recurrent theme in most environmental educational programmes is lack of funding, a theme that is also common for most conservation programmes outside of education. The Indonesian government does not currently have sufficient funding to manage existing protected areas. Educational programmes, enforcement of conservation laws and other projects are equally under-funded and in need of a sound business strategy.

We would encourage the use of funding sources that are reliant upon a minimum baseline of biodiversity conservation in order to be sustained. Understanding that this both promotes (primary generation of conservation monies) and potentially weakens (if the biodiversity is gone, so is the funding) biodiversity protection, it is a double-edged sword that must be carefully wielded in order to reap the potential benefits for protected areas (Kiss 2004). New taxes or fees on natural resource extraction are one easy way to generate money, but need to be carefully planned and executed so conservation efforts themselves are not overly taxed. Entrance fees and tourism taxes are another potential source of conservation dollars, but cannot be relied upon for every situation, especially in absolute protected areas with restricted access. Other possibilities can be specifically designed for each protected area and can include biodiversity research as a business, handicraft items made by local communities within protected areas, and other spin-off businesses in local communities, such as bird-watching tours, that rely on protected-area biodiversity.

Increasing incentives for biodiversity conservation

If Indonesia's natural resources are to be conserved, Indonesia and the international community can strengthen the effectiveness of protected areas in biodiversity conservation in the tropics by prioritizing protected-area management. Because contemporary resources are inadequate, priorities must be carefully chosen to balance the scientific integrity of the conservation objectives with the basic limits and logistics of funds and personnel. A feasible series of reviews of the national protected areas would be a solid beginning and be an immediate way to legitimize grass-roots efforts and attract international collaboration and funding.

Another immediate strategy would be to formulate incentives for local people to become more involved in protected-area management. Paying a cohort of local people from each of the communities around the protected areas to act as rangers is one simple example of how such strategies can be implemented. Other incentives may be to give local stakeholders access to the natural

resources they want (at a sustainable level) but make them responsible for the resources' long-term viability. This would necessitate an educational programme focused on the particular natural-resource needs (e.g. water, nutrients, sunlight, pollination for a rattan plant) and also enforced prevention of other groups harvesting the same resource. By making a local group of stakeholders effective stewards and 'owners' of the resource, they will value the resource more, realize that they have a corner on the market, and commit to conserving the resource for the long term.

To change stakeholders' attitudes towards a protected area, increased economic benefits directly from protected areas into local communities is a good strategy. To be effective, however, benefits should be tied directly to the preservation of biodiversity, so that people have incentive to promote activities that protect and conserve biodiversity while curtailing or completely stopping activities that exploit or decrease biodiversity. Resource management of adjacent land can also be integrated with the objectives of the protected area through establishing buffer zones, sustainable harvesting and habitat corridors that link protected areas.

To ensure ongoing protection and effective biodiversity conservation of protected areas, full integration with the local socioeconomic context is imperative. The extent of a protected area's long-term viability hinges completely on its integration with the local people; the conservation objectives of the protected area need to be complementary and positive in regard to the local peoples' livelihoods and ways of life. Instead of purposefully excluding local people, the protected areas should try to engage them in the activities that will ensure the effective conservation of biodiversity within the protected area. If this means taking poachers and turning them into park rangers and guides, then the local people will see former exploiters as protectors and stewards. These kinds of role models may be the most effective means of changing the local peoples' attitudes from opposition to helping and nurturing protected areas.

New push for protected areas in Indonesia is underway

The Indonesian government has pledged to create and strengthen protected areas in a focused effort to protect at least 10% of the land area. In some areas this means simply protecting conservation areas and enforcing laws. On Sumatra, this means expanding the protected-area system, increasing total area under protection and preserving important habitat for critically endangered species such as the Sumatran tiger (*Panthera tigris sumatrae*), the Sumatran elephant (*Elephas maximus sumatrensis*), the Sumatran rhino (*Dicerorhinus sumatrensis sumatrensis*) and many other constituents of endemic flora and fauna. The

Sumatran context for protected areas, however, is a complicated matrix of local indigenous communities with traditional land-use practices and modern means of exploitation.

The story is not a pessimistic one, however. As one of the foremost examples of success in the establishment of new protected areas in Indonesia, we highlight Tesso Nilo on the island of Sumatra. The area of Tesso Nilo is the last remaining contiguous primary lowland rainforest on Sumatra, and was saved from complete transformation to industrial plantations by a new partnership between conservation organizations and local governmental agencies. Unfortunately, Tesso Nilo had already lost a third of a million hectares from 1984 to 1998 and had fewer than 350 Sumatran elephants when it was declared a protected area. A partnership between the World Wide Fund for Nature (WWF) and more than 20 local NGOs and governmental organizations, however, has secured funding from the Critical Ecosystem Partnership Fund and shown how broad-scale collaboration between NGOs and governmental agencies can be effective in delivering conservation goals.

Although there are many problems that plague the effectiveness of biodiversity conservation in protected areas, most share two common ultimate causes: lack of awareness and overpopulation. The effects of these issues can be mitigated with a series of comprehensive public awareness plans and/or community education programmes. These plans and programmes must be realistic and focus on the facts and not on opinions. Simply reducing the scale of human-population growth and enabling a fact-driven curriculum of basic environmental biology and ecology could make the difference between losing all or just some of the remaining biological diversity. Incorporating new approaches from the fields of anthropology and psychology with explicit treatment of human emotions, identities and values can help conservation efforts tremendously (Saunders *et al.* 2006). In addition, it will be increasingly important to weigh different types of spending (e.g. education, social programmes, protected-area fences, etc.) in order to achieve biodiversity conservation (see Cleary 2005); sometimes the best way to spend conservation money is not to directly invest in programmes that have short-term effects, but manage funds and invest in long-term projects or sustainable programmes with the possibility of generating more funding in the future. Most of our suggestions can be implemented in a comprehensive educational programme aimed at various audiences within Indonesia (see Brewer 2006), including governmental support of many programmes already underway. Other suggestions require a substantial and dependable international investment in global biodiversity; we believe that this investment should be managed by a third party who also manages a monitoring programme gauging the effectiveness of the conservation plans being implemented (see below).

Suggested strategies

One of the best ways to halt further habitat alteration and degradation is to restore and reforest degraded land within and around protected areas, prioritizing corridors linking existing protected areas. Although not an easy endeavour, by investing in habitat restoration formerly degraded land can be used to connect protected areas and take advantage of opportunities for expanding protected areas through buffer zones, biodiversity corridors, new land-use policies or other ways that may not be under the control of government agencies. Conservation workers can designate buffer zones around core protected areas to accommodate local uses (like natural-resource harvesting) and benefit conservation objectives by trading lower degrees of protection for local stakeholder support. This will mandate the need for enforced boundaries of protected areas and identification of zones within them as areas of total protection where no harvesting or hunting will take place.

Another important suggestion is to clearly define conservation goals and communicate them to all concerned parties in an unbiased way. Doing this as early as possible is important to ensure that all stakeholders fully understand their part in the process and success of the protected area (Agardy 2000; Mascia 2003). Establishing objectives specific to each protected area by including the suggestions of all stakeholders is a way to initiate these communications.

Making the objectives of each protected area as cost-effective as possible by using alternative methods, training and hiring local people, and using other local resources whenever possible helps conservation dollars go further. Augmenting the social and economic value of protected areas by boosting benefits to the people living in and around them, will encourage people to be a part of the protected-area management and increase the chances for its long-term viability. This is a business-model-based strategy that needs outside expertise and multidisciplinary collaboration (Cleary 2005). Developing an economic incentive programme wherein people receive financial benefit for conserving biological diversity could be at the core of such a programme, but we realize that it is a complex issue with many other important aspects that should be considered before being implemented (Folke 2006).

In a similar fashion, quantifying and advertising benefits that the local people enjoy from the protected area will put more emphasis on what people are receiving from conservation, and not what they are giving up, ensuring that local communities value protected areas. Designing monitoring projects that track benefits through time and include stakeholders in the monitoring processes will be critical for communicating these benefits. Including all types of information (e.g. scientific and local knowledge) in long-term monitoring

strategies to assess successes in the scientific, social and economic aspects of conservation is important. By obtaining international support and funding to conserve these resources, we can also encourage international monitoring of parks, protected areas and natural resources.

Population stabilization is perhaps the first place to start any realistic long-term biodiversity conservation and environmental protection plans. Completing the governmental goals of the Population Control Act through community education, outreach and family planning incentives will encourage more compliance in places where population growth rates are still extremely high. This is one of the most relevant subjects for an environmental education programme aimed at biodiversity conservation and development and has Indonesian governmental support.

Implementation and enforcement of a complete moratorium on illegal logging in protected areas should be a top conservation goal, on Sulawesi and the rest of Indonesia. This will mean targeting corruption (see Smith *et al.* 2003) by eliminating the benefits of corruption, enforcing anticorruption laws, and rewarding lawful practices and illegal deforestation whistle-blowers. Again, we appreciate the complexity and difficulty of such a strategy, but we feel that it is critical to make a concerted effort now instead of waiting until we are forced to act. We also applaud the concerted efforts of the new Indonesian government and their discrete targeting of corruption and illegal logging across the archipelago.

To make conservation strategies more realistic and effective, we suggest broadening environmental education at all levels aiming at issues that face Indonesia: pollution, overpopulation, resource management, watershed protection, air quality, slash-and-burn agriculture, protected-area management, endangered-species protection and fisheries management. As natural-resources are squandered (often with financial support from non-Indonesian sources), many local people are not aware of what they are losing. A corollary should also be to communicate and educate current natural-resource exploiters and harvesters so that they realize that unsustainable harvesting means there will be no resources for their grandchildren to enjoy. Employing these people as park rangers, guides and stewards of protected areas can be a measure of success.

Indonesians can also make protected-area management more of a priority by promoting local and national public awareness through educating local people about the biodiversity found within each area. Promoting pride in protected areas by increasing awareness of endemic organisms found nowhere else on the planet is an excellent strategy that can also elicit funding from international supporters. Appointing local leaders from areas with some stake in the continued services of intact biological systems (air and water purification, etc.) to sit on local management committees is one way to include local people. By empowering them

with tools and resources, they can transmit information to everyone in the area, and implement rules, traditional and otherwise, that the local management committees will use to govern and enforce the use of natural resources.

We also believe that developed countries should start making direct payments for the conservation of biodiversity (Ferraro & Kiss 2002). In Indonesia, this could mean providing financial benefits to people living on the edges of protected areas, salaries for park rangers and monies for environmental education. To help secure funding and infrastructure support for these programmes, we suggest the recruitment of other international conservation organizations and local governmental agencies. As well as establishing and strengthening existing programmes, involving both governmental and non-governmental organizations (NGOs) will facilitate natural-resource management by providing direct technical and financial assistance to communities and leaders. To gain access to conservation monies through direct payments, transparent monitoring of conservation goals must accompany protected-area management plans. We suggest that these be managed by a third party, whose biases will not jeopardize the success of the conservation project (i.e. avoid corrupt practices, kick-backs, boodles and pay-offs).

Conclusions

Protected areas currently contribute to conserving biodiversity in Indonesia, but if conservation practitioners want to improve actual conservation benefits, there are many changes that can be made to contemporary management techniques. Explicit conservation objectives (e.g. 150 breeding pairs of palm cockatoos (*Probosciger aterrimus*); complete effective moratorium on logging, hunting and trapping; educational interpretive centre built for school tours; ranger workshop completed) need to be set and met for effective protected-area management. Moreover, local socioeconomic integration of each protected area should be established (see Mascia *et al.* 2003). For example, a protected area will not shield wildlife from hunting if people living in the adjacent areas are chronically poor or undernourished. In order for protected areas to work, the people living in and around the park must be satisfied with, appreciate and value the objectives of the protected area. Including and educating local stakeholders is a crucial aspect of a successful protected-area management scheme (Wells *et al.* 1992).

We realize that the tasks at hand are daunting, require tremendous re-evaluation of individual and societal goals, and will be difficult in the best situations. We also know that people from widely disparate disciplines can and will have to work together in order for cohesive and feasible management plans

and conservation strategies to be made effective (see Adams *et al.* 2004). Our hope is to see an integration of human-welfare and poverty-alleviation projects with biodiversity conservation in and outside of protected areas. A multi-disciplinary approach to these problems will need to involve experts in business, conservation biology, environmental law and social sciences, with policy makers and individual members of the society playing lead roles. Academic institutions, governmental and non-governmental agencies alike must find a reasonable balance of development and conservation by working together, finding financial support and facilitating interdisciplinary conservation projects that focus on protected areas.

Conservation in Indonesia presents similar challenges to those of other tropical rain forest areas in Southeast Asia (Stolton & Dudley 1999). Although the islands of Indonesia have specific differences in levels of endemism, species diversity and composition, the same trends are occurring throughout the area (Sodhi *et al.* 2004). Environmental education, enforcement of natural-resource regulations, family planning and local economic incentives to conserve biological resources may be critical answers to some of the most serious challenges to biodiversity conservation. At the national level, however, increasing pressure has to be exerted on transparent land-use planning, effective protected-area management, and equitable use of natural resources. Careful implementation of these strategies should be done with the help of local and international conservation NGOs as well as support from government sponsored agencies and programmes. The education and empowerment of local communities that utilize natural resources in protected areas should be more of a conservation target than the complete exclusion of these stakeholders. Only by enlisting their help will protected areas be effectively and sustainably managed. Defending protected areas for conservation means changing attitudes about natural-resource exploitation and offering viable alternatives to habitat destruction and unsustainable practices of natural-resource use.

One of the most important approaches gleaned from case studies seems to be transparent inclusion and communication with all stakeholders in an unbiased manner. Moreover, even though incorporating local people into a 'conservation and development' scheme has been heavily criticized, we suggest that local stakeholders be included whenever possible and that education programmes be specifically aimed at people that live in and around protected areas. Delivering concise conservation strategies and reasonable alternatives to natural-resource exploitation should be at the heart of these education programmes. Another widely successful approach is to give all stakeholders the same set of conservation goals with distinct objectives that are to be completed in order to fulfil the goals. While these and other general guidelines can be used for most

situations, we remind conservation workers that each protected area should be treated as a unique scenario. Many of these approaches are already in practice to some degree in Indonesia and on Sulawesi; increased financial support from the international community can increase their effectiveness.

Summary

As we learn more from experiences garnered through the successes and failures of conservation areas, our depth of understanding of effective strategies grows. Implementation of new ideas (e.g. including more stakeholders in partnerships for protected-area management) and conservation tools (e.g. business marketing and public awareness campaigns) has augmented our ability to both maintain existing protected areas and recruit new ones. Based on our collective experiences across the Indo-Malaya Archipelago we have reviewed both the problems we have seen in protected areas and suggest approaches to successfully increase conservation effectiveness across the region. Although we feel that current measures of protection are not being effectively activated in most protected areas we have worked in, there is reason to believe that realistic conservation strategies can be effectively supported and existing inefficient trends can be reversed. We suggest the expansion of the current protected area through restoration and reforestation, linking existing areas through a network of corridors, inclusion and education of all possible stakeholders, explicit demarcation and communication of conservation goals, and monitoring of the social, economic and biological indicators of success.

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