

Increasing Conservation Management Action by Involving Local People in Natural Resource Monitoring

There is a need for a better understanding of the status of the environment. At the same time, concerns have been raised regarding alienation of the local populace from environmental decisions. One proposed solution is participatory environmental monitoring. When evaluating the usefulness of environmental monitoring, the focus may be on accuracy, as is usually done by scientists, or on efficiency in terms of conservation impact. To test whether investment in participatory biodiversity monitoring makes economic sense for obtaining data for management decisions, we compared the cost efficiency of participatory and conventional biodiversity monitoring methods in Philippine parks. We found that, from a government perspective, investment in monitoring that combines scientific with participatory methods is strikingly more effective than a similar level of investment in conventional scientific methods alone in generating conservation management interventions. Moreover, the local populace seemed to benefit from more secure *de facto* user rights over land and other resources. Participatory biodiversity monitoring not only represents a cost-effective alternative when conventional monitoring is impossible, but it is also an unexpectedly powerful complementary approach, capable of generating a much higher level of conservation management intervention, where conventional monitoring already takes place.

INTRODUCTION

Biodiversity monitoring is being increasingly relied upon to identify areas of conservation priority (1) and to guide site-based assessments of population change (2) and subsequent management interventions (3). Monitoring also provides critical biodiversity baselines by which progress in global policy objectives can be measured (4, 5).

Because biodiversity monitoring by professional scientists is often costly (6), at least relative to the budgets of most conservation agencies (7), it is largely undertaken in financially wealthy countries. Few monitoring schemes exist in the developing world, where the biological "hot spots" are concentrated.

Where the aim of monitoring is to obtain data for management decisions, alternative approaches that involve local people with little formal education are emerging (8–10). These approaches have some practices in common, including carrying out monitoring on a local scale (11) and directly involving local people in data collection.

It has been suggested that such approaches have considerable potential to complement professional monitoring in developing countries because they may be cheap relative to the costs of professional monitoring (11, 12). The paucity of quantitative data on the cost and effectiveness of monitoring has, however, constrained any systematic assessment.

The Philippine Government's scheme for monitoring protected areas provides a unique experimental setting in which to compare participatory methods of biodiversity monitoring with conventional scientific methods without the participation of local residents in order to assess their costs and specific impact on local management decisions. This monitoring scheme comprises two sets of simple methods: one that includes local residents in data collection and one that does not. The scheme is intended to improve the information available to decision-makers in parks through the regular collection of data on natural biological resources and their utilization. The focus is on identifying trends in the important biodiversity assets of an area and the use of the area's biodiversity in order to guide park management action.

MATERIALS AND METHODS

The two sets of monitoring methods were compared across 1.1 million ha of protected areas in the Philippines. One set comprised two methods that included 350 local people in data collection and/or discussion of data.

These methods were the focus group discussion method and the field diary method (13). The *focus group discussion* method involved establishment of volunteer community monitoring groups made up of 5–8 local residents who collected information on resource use, species populations, and habitat condition on a regular basis between quarterly discussions with protected-area staff. The members of the community monitoring groups were identified in cooperation with local community leaders so as to include the most experienced hunter–forest product gatherers and fisher-people in each village. This method was intended to indicate changes in perceived harvest volume per unit effort.

The *field diary* method included standardized recording of routine observations and records provided by local people of species, habitats, and human use of wild flora and fauna by protected-area staff in a simple pocketbook or on a data sheet during patrols. For each observation, the protected-area staff recorded the name of the observer, the date and the location of the observation, the species or human resource use observed, and the number of individuals or the quantity of resources used. This method was intended to indicate changes in the relative abundance of species and resource use.

The other set of methods was composed of standardized techniques that follow normal scientific requirements for objectivity and repeatability. These methods were the fixed point photography and the line-transect method. The methods were carried out by protected-area staff without the involvement of local communities.

The *fixed point photography* method consisted of taking on-the-ground fixed point photographs of selected hillsides in priority forest blocks at regular intervals. This method was intended to indicate changes in size of vegetation type blocks and in land-use of priority areas.

The *line-transect* method consisted of a line-transect survey of wildlife and resource use along permanent routes. This

Table 1. Examples of monitoring results and conservation management interventions resulting from both participatory and conventional scientific biodiversity monitoring methods in Philippine protected areas.

Monitoring method	Example of monitoring result	Conservation management intervention emanating from the monitoring result
Focus group discussion	A community monitoring group reported a decline in the abundance of marine fish in Basco Bay of Batanes Island (Batanes Protected Sea and Landscape).	The municipality of Basco issued an ordinance allowing fishing with hook and line but banning the use of nets and compressors in the bay. The abundance of fish in the bay reportedly increased after only 7 months.
Field diary	Reports from local people of sightings of crocodile and the presence of crocodile hunters near San Mariano village (Northern Sierra Madre Natural Park).	The municipality of San Mariano issued an ordinance declaring the critically endangered Philippine crocodile <i>Crocodylus mindorensis</i> a municipal "flagship species" and establishing penalties for violation of previous ordinances intended to protect this species.
Fixed point photography	A new photo of a forested hill tract in the protected zone of the park showed that a swidden had been opened (Mt. Kitanglad Range Natural Park).	Park staff showed the before and after photos to the head of the village. He obtained a promise from the violators not to extend the swidden without permission from the protected-area management council.
Line transect	Fewer records of giant clams (Tridacnidae) than before on the transect swim routes in the sustainable-use zone (Apo Reef Natural Park).	The park staff raised awareness among local fishermen of the existing regulations on giant clam collection via the local radio and in person with fishermen when they requested permits to fish inside the park. In addition, staff requested assistance from a university on how to propagate the species and thus restock the wild population.

method was intended to indicate changes in wildlife population size, human intensity of resource use, and/or shift in range of wildlife/human resource extraction.

In each park, the monitoring focused on a list of 10–15 taxa and 5–10 signs of resource use (examples in 14) selected by protected-area staff in cooperation with local community members and staff of the National Protected Areas and Wildlife Bureau. Data were collected every three months with the exception of field diary data, which were compiled whenever rangers were in the field.

The data organization and analysis were undertaken locally by the protected-area staff. The importance of decision-making and management action was emphasized in the training activities and in the way the standard format for progress reporting was structured. In addition, the management councils of the protected areas were encouraged to include regular presentation and discussion of analyzed results and proposed actions in their annual work plans.

Both sets of methods were simple protocols that required only relatively little training and instruction. When the monitoring scheme was designed, these methods were selected specifically because they were field-based, possible to use in areas where specialist staff is lacking, and believed to be cost-effective (rationale for choice of methods described in 13).

The effectiveness in terms of conservation impact of biodiversity monitoring was examined in eight protected areas (Apo Reef, Bataan, Batanes, Northern Sierra Madre, Mt. Apo, Mt. Kanlaon, Mt. Kitanglad Range, and Siargao). These areas each contain 0 to 85 000 residents (mean = 21 200) who depend heavily upon forest and coastal resources, including wildlife (15). The sites were chosen on the basis of *i*) their combined coverage of Philippine flora and fauna, *ii*) the interest of protected-area communities in cooperating with government staff on resource management, *iii*) legislative status and field personnel available, *iv*) coverage of the administrative regions of the government, and *v*) the law and order situation. The protected areas were established pursuant to the National Integrated Protected Area System Act (16), which provides communities resident inside or adjacent to the areas with access and rights over some use of forest/wetland resources plus representation in a protected-area management council. This is important, since few local people would be interested in volunteering to monitor biodiversity if they had no rights over some use of resources. Protected-area staff generally held first degrees in forestry or an associated field and had received

training in biodiversity monitoring (and other aspects of protected-area management). The two sets of monitoring methods were in operation in all eight protected areas.

Conservation impact is difficult to measure by a standard scale across different habitats, and the true impact may only be discernible in the long term (14). We therefore used conservation management interventions as proxy values for the conservation impact.

We defined a "conservation management intervention" as a purposeful action by a managing body to conserve or achieve a more sustainable use of the biological resources. Examples of management interventions are provided in Table 1. Several monitoring methods sometimes simultaneously led to one intervention. For instance, eroded hillsides revealed by fixed point photography and overgrazing by goats of the same area reported by a community monitoring group both led to the organization of a workshop to develop a local pasture management plan. At other times, data indicated that environmental conditions were stable or improving, and this usually did not lead to any management intervention.

The usefulness of the interventions and whether they had actually been carried out was examined by discussions with protected-area staff and local community members and by cross-checking with the minutes of protected-area management council meetings and other written documentation. Decisions that did not lead to action and those that were only part of the management system (e.g., improve functioning of protected-area council) were omitted from the analysis.

Other written documentation with which we compared the monitoring data included previously published studies (15, 17, and 18) and the following unpublished materials: Department of Environment and Natural Resources (DENR) Integrated Protected Area System management plans; technical reports of DENR, Nipa, and the Conservation of Priority Protected Areas Project on local government administration, park management, human use, indigenous people, marine resources, vegetation, flora, butterflies, shellfish, marine turtles, birds, mammals; DENR protected-area suitability assessments; and semiannual World Bank supervision-meeting briefing materials and aide memories 1996–2002.

We included conservation management interventions undertaken between December 1998 and July 2001 ($n = 156$; see 19). Management interventions were undertaken in the protected areas of Apo Reef (7 interventions), Bataan (10), Batanes (16), Northern Sierra Madre (28), Mt. Apo (21), Mt. Kanlaon (13),

Table 2. Cost per conservation management intervention resulting from participatory and conventional scientific biodiversity monitoring methods in Philippine protected areas.

Monitoring method	Travel (USD y ⁻¹)	Materials* (USD y ⁻¹)	Equip-ment† (USD y ⁻¹)	Park staff time‡ (USD y ⁻¹)	Total cost (USD y ⁻¹)	Total no. of inter-ventions	Cost per inter-vention (USD)	No. of inter-ventions targeting key threats	Cost per intervention targeting key threats (USD)	No. of interventions leading to policy change	Cost per intervention leading to policy change (USD)
Focus group discussion	6952 [§]	400	0	6600	13 952	89	418.0	38	979.0	52	715.5
Field diary	2680 [#]	1000	1236	6000 [#]	10 916	82	355.0	42	693.1	39	746.4
Fixed point photography	2573	1460	2228	5760	12 021	14	2289.7	8	4007.0	6	5342.7
Line transect	2626	1000	1540	5880	11 046	21	1402.7	6	4909.3	12	2454.7

Note: Based on 2001 data (54 Philippine pesos per US dollar [USD], December 2005); excluding expenditures on training/capacity building and time spent on monitoring by local community members. *Estimated cost of paper sheets, Xeroxing, identification materials, batteries, films, etc. †Based on 20% depreciation per year. When equipment was used for several monitoring methods in a protected area, the expenses were split between each method. ‡Estimated time used on field work, analysis, and reporting, based on the assumption that the same amount of time was used on analysis/reporting as on field work. §Including cost of community meetings. #Estimated expenses based on the assumption that 50 person-days were devoted to field work with the field diary method in each protected area every year; the amount of time spent was difficult to quantify because this method was designed to be carried out as an integral part of the patrolling.

Mt. Kitanglad Range (36), and Siargao (25). Before the monitoring scheme was established, the monitoring activity of park staff was largely restricted to regular assessment of the amount of extracted timber. Very few, if any, management interventions emanated from this.

We compiled data on conservation management interventions and reviewed written documentation on these at two national workshops on biodiversity monitoring with protected-area staff and during 62 field visits of 3–7 d each. In addition, we reviewed 316 protected-area council resolutions and 60 quarterly reports from local to central government for conservation management interventions. Data lumping across sites was possible because the same person scrutinized and evaluated all the interventions.

We used three variables to investigate the quality of the conservation management interventions taken: *i*) whether the interventions addressed the most serious threats to the protected areas' conservation values, *ii*) whether they resulted in policy change, and *iii*) whether they addressed the resource use by local resident people or outsiders. If interventions do not address the greatest threats, the activities probably waste scarce conservation resources. If the interventions do not lead to policy change within local government and community institutions, they are unlikely to have a lasting impact (see also 14, p. 2643). If the interventions only target a limited group of resource users, the problem identification may be incorrect. For instance, monitoring methods based on the involvement of local residents may not be useful if they only lead to actions intended to control the resource use by people from other places.

We defined "threats" as the human activities with the most negative impact on the areas' conservation values. Based on existing information on each park from other sources, the three most serious threats of each site were identified as industrial and road development (four sites), logging and timber poaching (four sites), small-scale agriculture (four sites), large-scale agriculture (three sites), and commercial marine fishing (three sites), along with gathering of nontimber forest and wetland products, grazing, wildlife hunting, and quarrying (one site each). Even if the main threats to each area are known, monitoring is important to guide detailed decision-making. We defined "policy change" as new resolutions, ordinances, bylaws, or guidelines. We defined "outsiders" as people not living in or adjacent to the protected area.

The number of conservation management interventions was compared between the four methods using chi-square tests (20). When interventions were associated with the simultaneous use of several monitoring methods, they were attributed to each method (as each method alone was in other instances sufficient to trigger an intervention).

RESULTS

Our data on conservation management interventions show that, for approximately the same recurrent government investment (Table 2), far more interventions result from participatory biodiversity monitoring methods as compared with conventional scientific ones ($\chi^2_3 = 90.8$, $p < 0.01$; Fig. 1a). This pattern also holds if we restrict the analysis to those interventions that only target the three most serious threats to species populations and habitats at each site ($\chi^2_3 = 46.7$, $p < 0.01$; Fig. 1b). Moreover, if

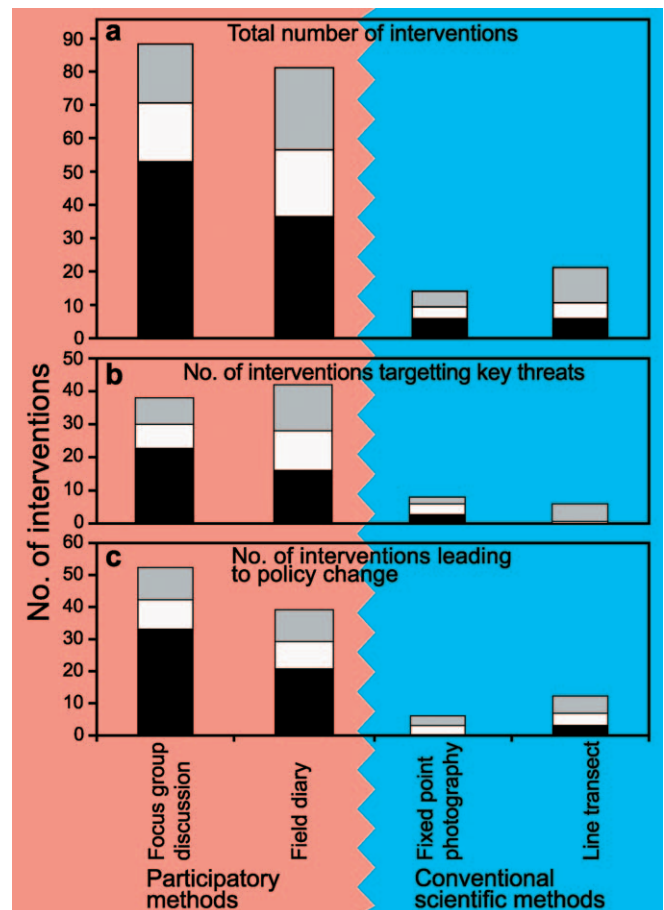


Figure 1. Effectiveness of participatory and conventional scientific biodiversity monitoring methods in generating conservation management interventions intended to improve the way local people (black), outsiders (white), and both (gray) manage Philippine protected-area resources. (a) The total number of interventions generated by each method. (b) The number of interventions that targeted the three most serious threats to the biodiversity of each site. (c) The number of interventions that led to policy change within local government and community institutions.

we look at interventions that led to policy change with a potential long-term impact on sustainable development (i.e., new resolutions or bylaws), the same pattern emerges ($\chi^2_3 = 52.7$, $p < 0.01$; Fig. 1c).

This general difference held true whether we considered resources used by local people or by outsiders (Fig. 1a). It also holds true both if we look at interventions that target the most serious threats to each site's biodiversity (Fig. 1b) and those with a potential long-term impact (Fig. 1c). Our data suggest that participatory monitoring effectively generates conservation management interventions not only to address resource use by locals but also by people from other places.

DISCUSSION

To our knowledge, these are the most comprehensive data on conservation management interventions resulting from a developing country biodiversity monitoring scheme. However, they have three important limitations (described in 14 and summarized below). Firstly, the recorded interventions may not accurately reflect the actions taken. Some interventions may have been overlooked, particularly actions taken by community monitoring group members. In addition, a few interventions would perhaps have been taken even without the monitoring, e.g., as a result of community management by other initiatives in the same parks. The consistent application of the definition of management interventions also proved difficult on occasions, although the definition was intended to be clear, objective, and straightforward. This problem was minimized, however, by letting the same person scrutinize and evaluate all the interventions. Our assessment of the main threats to the parks' conservation values may also be biased by insufficient or inaccurate information on some of the parks (particularly Siargao) from other existing sources.

Secondly, we used conservation management interventions as surrogate information for the overall conservation impact. Since an intervention implies that somebody has taken an action intended to improve the conservation or sustainable use of resources, management interventions may have a conservation impact in the wider sense. The scale of the impact may, however, differ substantially from one intervention to the next (see examples in Table 1). In addition, although we know the interventions were made and that 98% of them were, or probably were, meaningful, justified, and soundly linked to the underlying observations (14), we do not know whether the interventions led to threat reduction on the ground. Further study would be required to assess the outcome of the interventions.

Thirdly, the monitoring methods were different not only in their degree of local participation but also in the conditions they measured (Table 1). Comparison of the same method with and without local participation was impossible because the focus group discussion method requires the involvement of local people. Additional environmental variables were not included because the study was part of a capacity-building program in which conservation, and not research, was the primary objective.

Despite these limitations, our results suggest that, from a government perspective, participatory biodiversity monitoring is more effective than conventional monitoring in terms of generating local conservation management interventions in Philippine protected areas (Table 2). The interventions seemed to be relevant for biodiversity conservation because a large proportion addressed the most serious threats to the biodiversity of the sites (Fig. 1b) and led to changes in local policies with potentially long-term impacts (Fig. 1c). Community involvement in the participatory methods was entirely voluntary. We did not

quantify the community's investment in time, but this investment was small. We also did not assess the initial costs of training and capacity-building. These costs were probably highest for the focus group discussion method. Facilitating discussions for the purpose of monitoring biodiversity was not as straightforward as the other methods (13) but required an independent way of thinking on the part of the park staff.

We do not know how general our findings are. The cause-effect linkages that the management interventions dealt with were in a large part relatively simple (Table 1). In Philippine parks, local people are, to a large extent, the *de facto* day-to-day managers of the biological resources, given their physical proximity to them and their often intimate knowledge of fauna, flora, and habitats (see also 21). The role of the government is limited due to its remoteness and persistent shortage of funds. In addition, in many parks, people maintain traditional community-based systems for controlling and monitoring access to certain sites and resource uses. Community leaders and people regularly discuss the availability and quality of natural resources. The participatory monitoring methods benefited from these existing informal monitoring systems. Our findings may be general to areas where the cause-effect and interventions operate in fairly simple ways (11), where the benefits to local people of involvement exceed the costs (6), and where the government embarks on shared management of resources with local people, and the authorities and local people therefore have a common interest in the parks' management objectives (see, e.g., 22, 23). On the other hand, in areas where changes, threats, or interventions operate in complex fashions, where rural people do not depend on the use of natural resources and there are no real benefits flowing to the local people from doing monitoring work, or where there is a poor relationship between the authorities and the local people (14, p. 2645), participatory methods are probably less likely to yield useful data and management solutions than conventional scientific approaches. The motivations for community members to participate in monitoring work are primarily linked to a number of important socioeconomic benefits of monitoring, which range from enhanced *de facto* user rights to land and resources, to local status, pride in an area, and potentially enhanced training opportunities (11). Participatory methods are only continued when local people benefit from participation in the monitoring (6). Monitoring schemes that simply offload the costs of monitoring onto the local communities without associated benefits are unlikely to be sustained (see also 24–26).

One may argue that the most important fact is that interventions to control land and resource use are being implemented, but, if the trends perceived by locals are false or the problem identification is incorrect, participatory methods may lead to incorrect decisions (27, 28). Few comparisons have been made about the accuracy of participatory and conventional methods (e.g., 29–32; review in 11), and their results are too inconsistent for firm conclusions to be drawn. Further scientific tests of the accuracy of participatory monitoring methods are therefore essential (33), particularly in the developing world where the potential for involving people with little formal education in biodiversity monitoring is especially high (10).

At the World Summit on Sustainable Development in 2002, countries agreed to ambitious targets for reducing biodiversity loss by 2010 (34, 35). If properly coordinated, participatory biodiversity monitoring could serve as a practical tool for generating management action, simultaneously complementing conventional monitoring and allowing an increase in sample size and area with which to assess progress toward these targets (36, 11). Our findings suggest that, at the protected-area level, participatory monitoring may not only represent a cost-effective

alternative when conventional monitoring is impossible but also an unexpectedly powerful complementary approach that is capable of generating a much higher level of conservation management intervention where conventional monitoring is already taking place.

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Finn Danielsen is a senior ecologist. He recently co-edited a special thematic issue of *Biodiversity and Conservation* on locally based monitoring of biodiversity (www.monitoringmatters.org/cases.htm). His address: Nordic Agency for Development and Ecology (NORDECO), Skindergade 23-III, DK-1159 Copenhagen, Denmark. Tel. +45 33 91 90 30; fax +45 33 91 90 32; E-mail: fd@nordeco.dk

Marlynn M. Mendoza is a wildlife biologist and Chief of the Protected Areas Community Management Office of the Department of Environment and Natural Resources. Her address: Protected Areas and Wildlife Bureau, Ninoy Aquino Parks and Wildlife Center, North Avenue, Diliman, Quezon City, Metro Manila, 1100, Philippines. E-mail: mmendoza@i-manila.com.ph

Anson Tagtag is a wildlife biologist with responsibility for the protected-area biodiversity monitoring scheme of the Department of Environment and Natural Resources (DENR). He is assigned to the Wildlife Management Office of DENR. His address: Protected Areas and Wildlife Bureau, Ninoy Aquino Parks and Wildlife Center, North Avenue, Diliman, Quezon City, Metro Manila, 1100, Philippines. E-mail: wildlife@pawb.gov.ph

Phillip A. Alviola is a wildlife field biologist who works with biodiversity research and establishment of biodiversity monitoring schemes in protected areas. His address: University of the Philippines, Los Ba os, Laguna, Philippines. E-mail: phillip.alviola@lycos.com

Danilo S. Balete is a senior wildlife biologist who specializes in biodiversity research and is piloting the establishment of biodiversity monitoring schemes in numerous protected areas. His address: Laksambuhay Conservation, Inc., 10241 Mt. Bulusan St., U-2, Umali Subd., Batong Malaki, Los Ba os, Laguna, Philippines. E-mail: dsbalete@yahoo.com

Arne E. Jensen is a senior environment and natural resources management specialist and protected-area planner currently working for the World Bank and United Nations Development Programme. His address: Nordic Agency for Development and Ecology, Skindergade 23, DK-1159 Copenhagen, Denmark. E-mail: nordeco@nordeco.dk

Martin Enghoff is a senior rural sociologist. His address: Nordic Agency for Development and Ecology, Skindergade 23, DK-1159 Copenhagen, Denmark. E-mail: me@nordeco.dk

Michael K. Poulsen is a senior ecologist who has worked with building capacity in participatory natural resource monitoring in Laos, the Philippines, Tanzania, and Nicaragua. His address: Nordic Agency for Development and Ecology, Skindergade 23, DK-1159 Copenhagen, Denmark. E-mail: mkp@nordeco.dk