Biodiversity and Conservation (2005) 14:2591–2610
DOI 10.1007/s10531-005-8390-1

Projects come, projects go: lessons from participatory monitoring in southern Laos

MICHAEL KØIE POULSEN[1,*] and KHAMPHAY LUANGLATH[2]
[1]*NORDECO (Nordic Agency for Development and Ecology), Skindergade 23, DK-1159 Copenhagen K, Denmark;* [2]*Provincial Agricultural and Forestry Services, That Luang Colony, Pakse, Lao P.D.R.;*
**Author for correspondence (e-mail: nordeco@nordeco.dk; fax: +45-33919032)*

Received 16 April 2004; accepted in revised form 15 November 2004

Key words: Co-management, Forest, Laos, Locally-based monitoring, Natural resource management, Participation, Participatory monitoring, Sustainability

Abstract. This paper examines how a biodiversity monitoring system based on data collected by protected area staff and local communities was established and maintained in Xe Pian national protected area, Laos. Monitoring activities commenced with project support in 1998. Protected area staff, district forestry staff and villagers continued the monitoring work after 2001 when the external advisers left. More than 2500 records of wildlife, natural resource use and threats to the protected area were collected by villagers and protected area staff, mainly through use of patrols, village discussions and village logbooks. The management interventions that followed the monitoring activities were a reaction to immediate threats or perceived trends in biodiversity rather than to trends revealed by analyses of the collected data. Patrols and village discussions came to a virtual standstill when external funding ceased, probably because of lack of supporting national policies. The annual running cost of the monitoring system was only about US$ 4000 or 0.02 per ha of forest habitat.

Introduction

We currently know little about the most feasible methods, the costs, sustainability, accuracy or even relevance of biodiversity monitoring in developing countries. For this reason, the experience of trying to establish a low cost monitoring system in Xe Pian protected area in southern Laos may be of relevance to other areas where similar systems are envisaged across large areas of high conservation priority habitat and where the local communities are, to a large extent, the *de facto* day-to-day managers of natural resources.

The protected areas in Laos are termed National Biodiversity Conservation Areas (NBCAs). They were created to manage and protect natural resources, particularly forests and wild animals. The criteria for site selection were based on a biogeographic analysis. The Forestry Law of 1996 made the NBCAs one of the five legally defined forest types in Lao PDR (MAF 1996). Application of the Forestry Law to NBCAs has since been clarified by implementing regulations (MAF 2001). The Government of Laos' (GoL) approach to conservation management is largely one of co-management arrangements between relevant government agencies, local stakeholders and, in particular, the local communities living in and adjacent to the protected area.

During 1989, whilst developing a national protected area system in Laos with support from the Lao–Swedish Forestry Project, a field team asked villagers to provide details of wildlife in 19 villages in and around the present Xe Pian reserve (Salter et al. 1990). Surveys of threatened large mammals were undertaken during March–May 1991 on behalf of the World Conservation Union (IUCN) and the Kouprey Conservation Trust. Threatened wildlife was discussed with villagers from several of the current Xe Pian focal villages (Cox et al. 1992). An expedition conducted by students from Cambridge University from November 1992 to May 1993 made Xe Pian the most intensely surveyed area in Laos at that time, with more than half a year's presence of survey workers in the field recording habitat, birds and mammals (Duckworth et al. 1994, 1995; Thewlis et al. 1996; Duckworth 1997; Timmins and Duckworth 1999).

The GEF/World Bank Forest Management and Conservation Program (FOMACOP), which began in 1995, chose Xe Pian as one of four protected areas to receive support at the field level. Xe Pian was seen as providing an opportunity to develop and demonstrate co-management approaches to protect areas of management in Laos (FOMACOP 2000). Technical advisory support began in March 1998. Among the activities were participatory rural appraisals in 27 villages and Rapid Biodiversity Assessment activities by WWF-Thailand during November 1996–July 1997. The Rapid Biodiversity Assessment activities included the use of semi-structured interviews, participatory mapping and production of timelines, ranking and seasonal calendars with villagers (WWF 1997). This, and subsequent work by Xe Pian staff, identified seven focal villages for the development of co-management. The villages were selected on the basis of either their proximity to and/or use of areas identified as being of highest biodiversity value.

This paper reviews the establishment of the locally based monitoring system that was developed during the period of donor support to the Xe Pian reserve, summarises the results generated and assesses what has happened to the system now donor support has ended. One critical issue is that of how to ensure sustainability of locally based monitoring systems, even when they have been designed to require minimal resources and to be reliant on locally available expertise and materials.

Site description

Xe Pian NBCA is a 2400 km^2 area in Champasak and Attapeu provinces, southern Laos. Xe Pian is covered with tropical lowland forest and wetlands (53% is semi-evergreen forest, 26% is deciduous dipterocarp forest and 14% is mixed deciduous forest) (FOMACOP 2000). Species of high conservation importance include the threatened tiger (*Panthera tigris*), Asian elephant (*Elephas maximus*), banteng (*Bos javanicus*), giant ibis (*Pseudibis gigantea*) and Siamese crocodile (*Crocodylus siamensis*) (Duckworth et al. 1993, 1999). Old

hunters still remember encountering kouprey (*Bos sauveli*) and rhinoceros (*Rhinoceros sondaicas* or *Dicerorhinus sumatrensis*), which are both now considered to be extirpated from Laos.

National conservation policies relating to Xe Pian are formulated by the Department of Forestry and disseminated to provinces and NBCAs by the Division of Forest Resources Conservation. The Division of Forest Resources Conservation also provides technical assistance to provinces and NBCAs. The main government management agency for Xe Pian is the Management Unit, which forms a part of the Champasak Province Agriculture and Forestry Office (PAFO), with components located in the three relevant District Agriculture and Forestry Offices (DAFO).

Even before the establishment of the Xe Pian reserve, there was great interest in interviewing villagers in order to obtain information on wildlife and habitats. Ninety villages comprising 50,000 people are found inside or within 5 km of the protected area. These people are almost all subsistence rice farmers who depend heavily on resources from the protected area to secure a balanced diet and for building materials. Participatory rural appraisals have shown that the most important resources for the local communities are malva nut fruits from the malva nut tree (*Scaphium macropodum*), fish, wildlife, yang oil (resin from *Dipterocarpus alatus*), rattan and timber. The value of non-timber forest products (NTFPs) consumed annually by the average rural Lao family has been estimated at US$ 280 (Robichaud et al. 2001) and is likely to be higher for people living next to the Xe Pian. As in the rest of the country, most people belong to the Lao Lum ethnic group but some of the villages that are most dependent on the natural resources of the protected area belong to Mon-Khmer ethnic minority groups such as the Brao, Laven and Ta-Oy (FOMACOP 2000; Baird and Bounphasy 2002).

Xe Pian is divided between different village areas that pre-date the protected area. The Land and Forest Allocation Policy was introduced in Lao P.D.R. in the early 1990s as a means of legitimately recognising the customary rights of the local communities to access and use land and forest resources, as well as to manage them (MAF 1996; Fujita and Phanvilay 2004). The village areas in Xe Pian have been allocated and zoned through this land and forest allocation process. The village areas mostly belong to villages situated within or on the boundaries. The 14 villages located within Xe Pian can, in addition to non-timber forest products, use small areas for agriculture or timber extraction for local building. As is the case with land throughout Laos, land within Xe Pian cannot be privately owned or sold. People can only obtain and inherit rights to use the land. Communities situated along the boundaries or outside are not allowed to take timber from within Xe Pian. The rules regarding wildlife are generally the same inside and outside. Only certain species can be hunted and it is illegal to transport or trade wildlife.

Monitoring system

The biodiversity monitoring scheme at Xe Pian was originally developed by R. Steinmetz, who was the ecologist and indigenous knowledge specialist in the earlier Rapid Biodiversity Assessment activities, working with Joint Monitoring Teams (JMTs) in focal villages. A Monitoring Team was established in each of the seven focal villages between October 1998 and January 2000. The first Monitoring Teams commenced noting monitoring data in logbooks in October 1998.

The Wildlife Conservation Society was contracted in 2000 to establish, together with staff and villagers, a biodiversity monitoring system for Xe Pian. This resulted in the production of a monitoring manual (Ling 2000) with methods based primarily on Steinmetz (1997, 2000), Danielsen et al. (2000) and the experiences of the Wildlife Conservation Society from Nam Ha and Xe Pian NBCAs. The methods were tested during 2000 and 2001. Xe Pian received donor funding for the monitoring activities during the first half of 2002. There has been no external funding available since June 2002.

All Xe Pian staff have been trained in both biodiversity monitoring and awareness raising and all can use the main monitoring methods. Xe Pian has 6–14 staff, largely depending on how much donor funding the area receives at any given time. Salaries are paid by GoL but only donor funding enables staff to visit Xe Pian regularly.

Methods

The results presented in this paper are based on monitoring forms and summary reports filed at the Xe Pian Management Unit's office in December 2003 plus regular correspondence between the authors from 2002 to 2004. The monitoring forms and reports provide information on the threats, species and resource uses that have been recorded by different monitoring methods. The forms also provide information as to when, where and by whom monitoring activities were carried out. The forms and reports provide some information on what management initiatives have been suggested and implemented in response to the results of the monitoring activities. The Xe Pian Management Unit has not collected information on management responses to monitoring results in any structured way. The authors also accompanied Xe Pian staff during much of the monitoring field activities and staff have had many opportunities to provide additional information.

The monitoring manual (Ling 2000) describes the six monitoring methods that Xe Pian staff have decided should be used in Xe Pian following consultation with local villagers and foreign advisers. Three main monitoring methods have been proposed for use at least once a month throughout the year in Xe Pian:

(1) *Patrolling* – standardised data collection whilst walking in Xe Pian, focusing on a pre-determined list of priority ('indicator') species and on

legal and illegal human activities. Patrols are conducted by teams of 2–6 persons (Xe Pian staff, district forestry staff and Monitoring Team members or other villagers) and take from 1 day to 1 week. Patrolling takes place throughout the year but most intensely during the dry season. This method was chosen because it provides Xe Pian staff and villagers with data that may reveal species trends over time. Patrolling can also provide an insight into immediate threats. This method also forces staff to visit Xe Pian and obtain a first hand impression of the area.

(2) *Village discussions* – short informal semi-structured interviews in any of the 90 Xe Pian villages with a small group of villagers normally invited by the headman. Discussions follow a format allowing villagers' perceptions of the status and trends for hunted wildlife species, fish and non-timber forest products to be monitored over time. This method was chosen not only because it documents the villagers' perceptions of trends for the natural resources they collect but also because it facilitates contact between Xe Pian staff and villagers and leads to many valuable discussions about Xe Pian management. A village discussion does not have to last more than an hour or two and it is therefore possible to undertake a village discussion whenever Xe Pian staff are visiting a village for other reasons.

(3) *Joint Monitoring Team logbook* – A Joint Monitoring Team is a group of 2–5 villagers with a special interest in wildlife, chosen by the villagers during a village meeting, who join the protected area staff on patrols within their village area and who keep a logbook with monitoring data. The Monitoring Team members are seen as local naturalists always present in Xe Pian. This method was chosen because it can provide monitoring data on the rarest and most threatened wildlife species in Xe Pian. This method also leads staff and villagers to discuss conservation management interventions that may help these species. The logbooks are always kept in the villages.

Other monitoring methods, which are used less frequently, are: (4) *Monitoring of ecologically sensitive sites* – standardised data collection at sites such as salt-licks and permanent wetlands, of special importance for wildlife. Such areas are sometimes reached during patrols. Here, more detailed data on habitats and signs of wildlife are noted on a special form. At first, this method helped Xe Pian staff and villagers identify the most important sites within Xe Pian. Over time it may contribute to monitoring population trends for larger mammals and water birds. (5) *Fishery monitoring* – standardised data collection from motorised canoes on rivers, focusing on fishery activities. This is similar to patrolling but with special attention paid to fishery issues. (6) *Photo points* – photos taken repeatedly by Xe Pian staff of selected forested hillsides to reveal and document change in forest cover. This method was chosen because it is able to provide first-hand documentation of habitat destruction. (7) *Wildlife trade monitoring* – Xe Pian staff record the wildlife present in restaurants along roads close to Xe Pian. This method is not included in the manual as it was later 'invented' by the staff. The idea is that by monitoring instead of

policing, Xe Pian staff get to know more about what is actually happening in terms of illegal hunting and trade and become more successful in stopping these activities by using awareness, persuasion and light threats of law enforcement. (8) *Camera traps* – were placed at ecologically sensitive sites by Monitoring Teams from two villages, who also collected exposed film monthly. The use of camera traps was not planned as a monitoring activity but rather as a one-off survey. This activity was continued at the request of the Monitoring Teams as long as cameras could be borrowed free of charge from the Wildlife Conservation Society. The Xe Pian staff compile and analyse the monitoring data, while the Head of the Management Unit ensures that the monitoring results are presented to other decision-makers, including the provincial and district forestry offices as well as villagers of Xe Pian villages.

As Xe Pian staff combine different tasks when they are in the field, it is not possible to tell exactly how much time they have spent on monitoring. Each date where a monitoring method was used is here counted as a day. In some cases two different methods were used on the same date. This is here counted as one day for each of the activities. The cost of the monitoring is calculated on the basis of the accounts for the projects supporting the monitoring activities plus staff salaries related to time spent on monitoring.

Results

Patrolling

Patrolling was the most time-consuming monitoring method used, with 536 man-days spent on patrolling activities and related transport during March 2000–May 2002. Patrol forms for monitoring were used on 82 days during this period. An additional 43 days were used for travel to or from Xe Pian. The total distance walked during patrolling was nearly 700 km. A total of 992 monitoring records were noted during patrols within Xe Pian. Around half of these records were wildlife records while the other half were records relating to human activities (Figure 1). More than half of all wildlife records (259 of 483) were records of tracks. The most commonly recorded disturbance was camps (101 records) or campfires (90 records). Typical records in the category 'hunting' were of hunting dogs accompanying hunters (30 records), guns carried by hunters (9 records) and snares (7 records). The most common type of record in the category 'fishing' was records of fishing nets (23 records). Disturbances where vegetation had been removed were entered under a separate category of 'habitat loss.' These records mainly related to evidence of trees recently cut down for timber (40 records).

Village discussions

A total of 53 village discussions took place during March 2000–May 2002 and an additional five between then and December 2003. In total, a species of

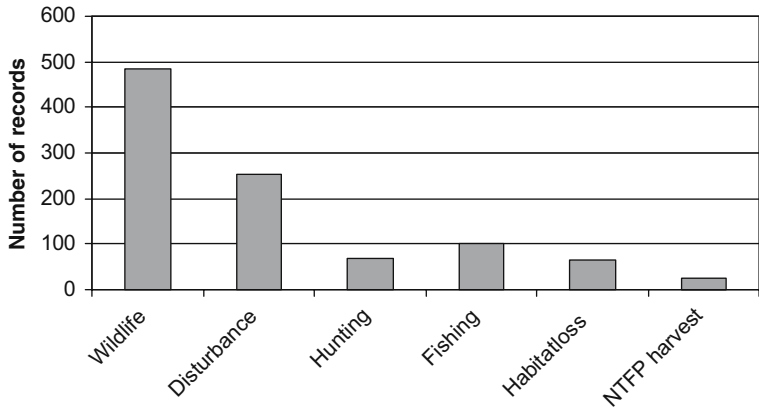

Figure 1. Number of different types of monitoring records during patrols in Xe Pian, Laos. Disturbance here covers human presence that cannot be classified into any of the other categories.

wildlife, fish or NTFP was discussed on 722 occasions during the 43 village discussions for which monitoring forms exist on the files. A total of 52 species of wildlife were discussed, with an average of 7.7 species per village discussion. Similarly, 40 different species of fish and 19 types of NTFP were discussed, with an average of 4.8 species of fish and 4.3 types of NTFP per village discussion. The most discussed species are listed in Table 1. Up to three village discussions were conducted in any one village. A typical village discussion would take place in the house of the village headman. Three Xe Pian/district forestry staff and three to five villagers normally took part in the village discussions. Xe Pian staff would perhaps ask for a woman or a member of one of the poorest families to be present. The discussions sometimes continued for hours and were accompanied by large quantities of alcohol. Each village discussion covered abundance and harvest levels of hunted wildlife species, fish and NTFPs that the villagers wanted to discuss. Possible management interventions would normally be discussed whenever a species was perceived as becoming more difficult to catch or collect.

While Xe Pian staff did not want to simplify the monitoring methods when this was discussed with the foreign advisors, they nevertheless stopped filling in village discussion forms as soon as the last project adviser had left. Wildlife and resource use trends were, however, still discussed with villagers and problems raised during their discussions were still reported in narrative trip reports. These can also be used to generate valuable monitoring data (Table 1).

Joint Monitoring Team logbook

All seven focal villages have made use of their logbooks although some Monitoring Teams did not write any new records in the logbooks for several

Table 1. Species most often discussed during village discussions in Xe Pian, Laos, with indications of perceived trends and harvest levels.

	No. of discussions where the species was discussed	Percentage of discussions where it was perceived as decreasing in abundance/getting harder to catch/collect	Average of perceived harvest levels[a]
Wildlife			
Wild pig (*Sus* sp.[b])	39	5.1	2.9
Barking deer (*Muntiacus muntjak*)	33	9.1	1.9
Bengal monitor (*Varanus bengalensis*)	32	18.8	3.9
Junglefowl (*Gallus gallus*)	30	3.3	2.8
Turtle sp. (*Testudinidae* sp.)	25	16.0	2.3
Siamese fireback (*Lophura diardi*)	20	5.0	2.8
Fish			
Snakehead (*Channa striata*)	37	51.4	4.6
Catfish (*Clarias batrechtus*)	34	52.9	4.1
Pa khao (*Sikulia gudgeri*)	25	56.0	4.5
Pa kheung (*Mystus microphthalmus*)	18	88.9	4.3
Soft-shelled turtle (*Amyda cartilaginea*)[c]	15	46.7	2.8
Non-timber forest products			
Resin	29	69.0	2.9
Mushrooms	28	39.3	3.8
Rattan	23	69.6	2.9
Bamboo shoots	17	41.2	4.2
Malva nuts	14	64.3	3.2
Yang oil	14	64.3	2.5

[a]Villagers gave a rough assessment of harvest levels on a scale from 0 to 5 (0 = none, 5 = high).
[b]Clarification of the identity of the pig species in the area is needed (Duckworth et al. 1999).
[c]Soft-shelled turtles are fish according to traditional Lao taxonomy.

months. Xe Pian staff reported 19 village visits when they met and discussed logbook results with Monitoring Teams. The logbook records were copied on at least 13 occasions. Copies of 137 logbook records had been filed with the Management Unit's office as at December 2003. More records, which have either not been copied or for which the copies have not been filed correctly, are known to exist in the logbooks in the villages. Joint Monitoring Teams noted at least 137 records of key species, including records of tiger, leopard, gaur (*Bos gaurus*), elephant, Siamese crocodile, giant ibis, green peafowl (*Pavo muticus*), white-winged duck (*Cairina scutulata*), lesser adjutant (*Leptoptilos javanicus*) and Oriental darter (*Anhinga melanogaster*). When discussing logbooks with the Monitoring Teams, it became clear that they never noted all key species records from the villagers. There was a clear tendency among the Monitoring Teams not to note the commoner key species when their tracks were encountered, while the rarest species were almost always recorded. An observation record of a tiger would probably always be noted, a tiger track would sometimes be noted, while a gaur track would almost never be noted. No Monitoring Teams ever claimed records of kouprey or Eld's deer (*Cervus eldii*), which are believed to be extirpated from the area. No Monitoring Teams recorded the number of outsiders visiting their village area, even though it had been agreed that they should.

Additional monitoring methods

Forms for monitoring ecologically sensitive sites were used once at 10 different sites during April 2000–November 2001. These sites were considered by Monitoring Teams and Xe Pian staff to be the most important sites for wildlife within Xe Pian. Fisheries monitoring was carried out from canoes over 5 days (October 2000 and July 2001), allowing data collection at least once on most river stretches where this method could be used. The establishment of photo points was an activity on three dates and just two photo points in total were established and later repeated.

Monitoring of ecologically sensitive sites, fisheries monitoring and photo points were only applied by Xe Pian staff when working together with project staff. Monitoring forms were used in two salt-lick areas and eight wetland areas. Fisheries monitoring from canoes over 5 days on the Xe Pian and Xe Kong rivers resulted in substantial datasets with 716 records, primarily of fishery activities (including more than 200 records of canoes) and of river birds such as kingfisher species and river lapwing (*Vanellus duvaucelii*). Data collection has not yet been repeated on the same rivers during the same season.

Awareness campaigns to try and stop wildlife trade were initiated when restaurants and shops along roads near Xe Pian were visited and the wild animals present were recorded. Four camera traps placed by Monitoring Team members during April 2000–March 2001 were successful in taking 109 wildlife photographs including photographs of elephant, gaur and dhole (*Cuon alpinus*).

Activity level

Patrols, village discussions and other monitoring activities, from the time of the first monitoring activities (excluding earlier logbook activities), are summarised from March 2000 to the end of 2003 (Figure 2). Foreign advisers and other project staff were present until the end of December 2001. Patrol and monitoring activities were continued for a further 6 months, until mid-2002, although the Xe Pian Management received only modest external support. This external funding finally ended in June 2002. Patrols and village discussions came to a virtual standstill when external funding terminated (Figure 2). Monitoring Teams have since continued to note villagers' records of key species in their logbooks.

Monitoring forms and reports were filed in ring binders at the Xe Pian Management Unit's office. Part of the field allowances were paid to the staff once the monitoring forms had been filled in and filed correctly. The files were almost complete when checked in December 2003. It is estimated that around 40 man-days have been spend on preparing field trips and writing reports after returning from field trips.

Xe Pian staff have noted that, during village discussions, villagers normally show great interest in discussing Xe Pian monitoring and management. This is in line with what the authors have experienced. The establishment of Xe Pian as a protected area has been positive for the people living in the focal villages. None of the management interventions decided for Xe Pian have been against the wishes of the villagers. Xe Pian staff and villagers agree that most of the

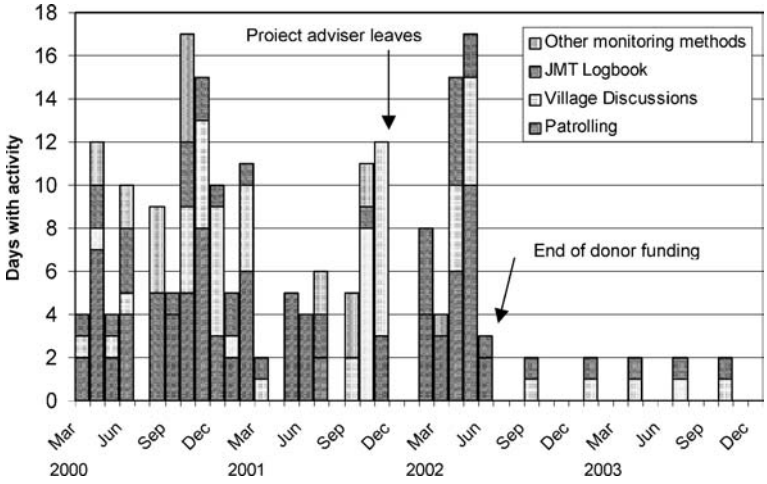

Figure 2. Number of days with monitoring activities by Xe Pian staff per month over the period March 2000–December 2003. The arrows indicate when the external adviser left and when external funding ended. A village discussion or a meeting with a Monitoring Team is here counted as a full day. The exact dates for 2003 activities are not recorded.

threats to the area come from outsiders, people or companies, and that the staff and villagers have to work together to keep them out. Xe Pian staff will often help the village leaders communicate their problems to the outside world and Xe Pian staff have also been involved in implementing several small-scale development projects in all focal villages.

The motivation of the Xe Pian staff to carry out the monitoring was partly related to the pleasure of doing a good job. More important, however, is that they can keep some of their daily allowances. Staff normally saved half of the US$ 5 a day they received when the Xe Pian was receiving Danish Government (Danida) funding. This was enough to ensure that there were always staff interested in participating in the field work. The field allowances were at times so small that Xe Pian staff were economically worse off if they participated in the field work.

Management response to monitoring results

Village meetings to discuss Xe Pian, with the involvement of Xe Pian staff, have been held approximately yearly in each of the seven focal villages. These meetings are normally held in the village temple, with people sitting on the floor. They are usually well attended. A short introduction by the village leaders and Xe Pian staff is followed by a lengthy free debate with the enthusiastic participation of many villagers. Both men and women will speak. The women will, however, often be distracted as they are also expected to look after the children during the meetings. Small and large management interventions are proposed, discussed and agreed upon during these village meetings.

Lao forestry staff are used to writing reports to their superiors when they have been in the field. These narrative reports are often written in addition to the forms and summary reports required by the monitoring system. They may include recommendations for further action in response to issues that have come up during the monitoring work. It is these issues and suggested actions, included in the narrative reports, that are primarily acted upon. Following a monitoring activity, such reports will typically refer to the monthly work plan, list the Xe Pian staff, villagers and others involved in the activities, describe the duration and location of the activity, list the main findings, including wildlife and disturbances, and give management proposals from Xe Pian staff and villagers.

It was the intention of project advisers and staff that monitoring data should be analysed and used for annual monitoring reports. It has now become clear that the Xe Pian Management Unit does not have the capacity to produce such an annual report. Table 2 gives examples of problems for Xe Pian's biodiversity that were revealed, at least partly, by using the monitoring system. This list is not exhaustive. As there have been no agreed procedures for recording what management interventions have been proposed as a result of the monitoring,

Table 2. Examples of issues revealed by the different monitoring methods used in Xe Pian, Laos, and the actions taken.

Issue	Method revealing issue	Action taken
Poorest villages hunt and collect NTFPs beyond sustainable levels because they lack rice[a], as they always owe most of their rice harvest	Village discussions, use of monitoring forms during patrolling	Establish rice banks[b] (one with project support and one by villagers alone). Establish 'buffalo bank' (one with project support)
Guns still used in the Xe Pian. Gun collection repeatedly mentioned as reason for increasing abundance of wildlife	Village discussions, use of monitoring forms during patrolling	Gun collection campaign repeated with police visiting all villages during 2003 to confiscate guns
Many fish populations are declining	Village discussions	Villagers establish fish conservation zones
Too heavy burning of trees when extracting yang oil in boundary area between two village areas	Use of monitoring forms during patrolling	Discussions with village leaders in concerned villages and agreement on changed practices
New house and rice field inside Xe Pian	Use of monitoring forms during patrolling	Agree that village leaders will help offenders to get land outside Xe Pian
Selective logging of highly valuable trees by villagers for specific external sawmill	Use of monitoring forms during patrolling	Discussions with village leaders, reporting incidents to superiors
Fishing in river using poison in area with several logbook records of Giant Ibis	JMT logbook, patrolling and information from villagers during joint patrolling/monitoring	Village headman talks to offenders at request of Xe Pian staff
Cutting of trees and branches to get malva nuts	Village discussions	Rules for rights and restrictions concerning malva nut harvest were agreed upon
Shooting of a gaur (wild cow)	JMT logbook and patrolling forms (status of gaur), village discussions (incident)	Meetings with village leaders, interrogations of villagers, arrest of offender

[a] Xe Pian villagers will always eat rice for every meal. When a family have eaten all their own harvest, they will normally buy rice by paying with their labour or with forest products.
[b]A rice bank is a communal rice store from where rice can be borrowed if a slightly larger quantity of rice is returned after next harvest.

it is not possible to quantify the management decisions that may have been taken in response to monitoring information.

Discussion

We have shown that Xe Pian villagers and staff can take on much of the responsibility for monitoring and managing Xe Pian. The management interventions that followed the monitoring activities were a reaction to immediate threats or perceived trends in biodiversity rather than to trends revealed by analyses of the collected data (see also Uychiaoco et al. 2005 (this issue)). Both protected area monitoring and co-management efforts came to a virtual standstill when external funding ended. This happened because there was insufficient capacity at the local level and particularly weak national policies supporting monitoring and therefore a lack of institutionalisation of the monitoring within the job descriptions of the staff.

Strengths and weaknesses of the monitoring methods

The experience from Xe Pian is that collecting monitoring data during patrols is a useful approach that can lead to more and better informed management interventions. Patrols will often try to cover as many different areas as possible to look for immediate threats to the protected area. Monitoring data, however, best reveals trends if collected repeatedly under the same conditions (same route, same walking speed, same time of day, same time of year, same weather conditions, etc.). It is too early to say if it will ever be possible to show statistically significant abundance trends based on patrolling data from Xe Pian.

The monitoring method 'patrolling' can be conducted at almost no extra cost if patrolling is already an activity for protected area staff. The method is based on the assumption that patrolling is always one of the regular activities for protected area staff. However, there have never been any regular activities for Xe Pian staff and it is apparently uncommon for staff to walk patrols within any of the NBCAs in Laos. This is partly because NBCA staff lack job descriptions specifying patrolling duties and partly because there are no budgets for patrolling.

Village discussions proved an effective way of collecting information on wildlife species and human activities within Xe Pian. Village discussions are also an opportunity for villagers and staff to discuss protected area management, and this has proved very important in the co-management of Xe Pian. Village discussions can be conducted at almost no extra cost if villages are already visited regularly by the protected area staff. This method is crucial to understanding what benefits the local communities obtain from living within the protected area. Generally, the villagers in Xe Pian claimed that wildlife abundance was increasing while it was getting harder to catch fish and collect

NTFP (Table 1). The quality of data can vary greatly and villagers may have reasons for not always telling the truth. There has, however, been no reason to doubt that the villagers told their true perceptions and these may well reflect what is really happening. The other monitoring methods may help understanding if the village discussions give a reasonable picture of actual changes.

The logbook does not cover the natural resources of most importance to the villagers. The Monitoring Team members have, from the start, been elected from among the people who know most about the rare and threatened species and the focus has been entirely on these species. The logbook used by the Monitoring Teams in the focal villages costs almost nothing and the Monitoring Teams do not need to spend much time collecting the monitoring data. The method can therefore continue even if the Management Unit is not functioning for long periods of time. This method plays a lesser role in directing management action than the other two main methods. It is possible that the Monitoring Teams could become even more important to monitoring and managing Xe Pian if they also collected data on more abundant species and resource use.

Other benefits

The use of the monitoring system has resulted in frequent and positive contact between staff and local communities. Some strong friendships have even developed, judging by the emotions shown when entering or leaving a village. Increased trust between staff and villagers is fundamental to the successful co-management of Xe Pian.

The monitoring activities have also raised awareness around Xe Pian and its conservation objectives among staff and local communities. Tests used during an awareness raising campaign for schoolchildren in Xe Pian villages showed that children in focal villages were better than children from other villages at answering questions about conservation and wildlife. This may be partly explained by the longer and more frequent contact these villages have had with Xe Pian staff and project staff and partly by these villages' greater dependence on the natural resources of Xe Pian.

Motivation

A monitoring system cannot be expected to be sustained if the people involved in the monitoring work do not benefit in some way from their involvement (see also Hockley et al. 2005; Topp-Jørgensen et al. 2005 (this issue)). The current incentives for the Monitoring Team members are related to the prestige of knowing about rare and charismatic species and being consulted by staff and visiting foreigners. Following advice from foreign experts, the Monitoring Team members are not paid for their participation in the monitoring activities.

The authors, however, would like to see this approach reconsidered. If funds are small, it is almost certain that the best results can be achieved if these funds are used primarily to compensate Monitoring Team members. It is not easy to argue that poor villagers should work for free to monitor globally threatened wildlife that the outside world wants them to help conserve.

Clear policies regarding NBCA management and monitoring could help improve the motivation of staff within the districts, provinces and within the Department of Forestry. Job descriptions for Xe Pian staff and other forestry staff involved in managing the NBCA, followed up by compliance monitoring, could help increase their motivation. Rewarding dedicated Xe Pian staff with career opportunities could also contribute to increasing their motivation.

Balance between approaches

The choice of methods and balance between methods used in Xe Pian is largely a result of the extremely low funding and staffing that can be expected for NBCA management in Laos. Participatory monitoring has been chosen because it can lead to local ownership and understanding and thereby develop empowerment and responsibility among the people of the local communities and poorly educated staff. Their opinion on the topic results in discussions and decisions around natural resource management and conservation issues, with consequent management interventions.

Monitoring data that has been collected during patrols and stored properly can always be compared with more recent data, even if there have been long periods without patrolling due to lack of budget. At times when staff rarely visit villages, village discussions should be part of any village visit and the logbook should be discussed whenever a focal village is visited. The two methods 'Patrolling' and 'JMT logbook' in particular collect data that may help to understand long-term trends for biodiversity and for rare and threatened species in particular. However, it is still uncertain if it will be possible to clearly recognise such trends by analysing the monitoring data.

The quality of data gathered by monitoring during patrolling could be checked against more precisely targeted methods providing higher quality data from a scientific perspective. This can only happen if stronger political and financial support of Xe Pian monitoring and management is secured in the long term. The use of conventional scientific monitoring methods for a few years while project advisers and funding is available does not solve the underlying problems of sustainability.

The reliability of trends shown by monitoring

The only biodiversity trends the monitoring has shown are those perceived by villagers (Table 1). The trends the monitoring system may provide in the future

would be those revealed by analysing larger datasets from logbooks or monitoring forms used during patrols. While none of these trends can be considered very reliable as there are too many possible biases involved, it is unlikely that more accurate information on trends would do much to improve management decisions taken locally by villagers and protected area staff (see also Danielsen et al. 2005 (this issue)).

Skills in identifying wildlife and their signs differ greatly among villagers and staff. The results of methods that require experienced hunters or trained staff for species identification will potentially highlight observer skills rather than population trends. While villagers are often better at recognising footprints than the protected area staff, they tend to be less critical of their own identification skills.

The use of cameras is becoming ever more affordable and photographs could, in the future, be used to document the identity of species recorded. This could be done either by photos of tracks and other signs left by wildlife or by using camera trapping. Such photographs could be used if higher authorities were to try to cast doubts on the reliability of monitoring records and overrule the consequent management decisions. The reason why the photo point monitoring method was little used is largely related to the staff's difficulties in getting the expensive GPS receiver, cameras, batteries and film ready before field trips. Other methods using expensive equipment may face the same problems.

What results are used for decision-making?

It takes many years before trends in wildlife abundance can be recognised, even if large datasets are collected regularly (e.g., Brashares and Sam 2005 (this issue)). This alone may explain why there is no example of management response to trends revealed by analyses of series of monitoring data from Xe Pian. It is, however, unlikely that such responses will ever become commonplace. Conventional monitoring by highly-paid external advisers using the villagers and staff as assistants may be better at showing long-term trends but will do little to improve understanding among the local people or to improve management practices. No matter how scientifically credible the resulting data is, the people on the ground do not give much importance to such data. It is much more likely that the managers (communities and forestry officials) will respond to problems they can see and understand (see Table 2). Well-documented declines in globally-threatened species may, however, help to attract donor support to Xe Pian and may eventually lead to relevant changes in the national legislation.

Costs and sustainability after the donor has gone

A field trip of 3 days' patrolling or four to five village visits takes a week, including writing and filing of reports and costs about US$ 100, mostly for fuel,

vehicle repairs, staff salaries and field allowances. Xe Pian staff often have to travel several 100 km when on field trips. Fuel and running costs for motorbikes form a considerable proportion of the budget. Field allowances of at least US$ 5 a day are needed to compensate staff during fieldwork. The Xe Pian Management Unit can, with its current staffing, provide about 40 weeks of monitoring work in the field annually. This is if the US$ 4000 needed to fund these activities, including Monitoring Teams members and district staff participation, is available. This comprises 20 weeks per year visiting all Xe Pian villages and 20 patrol trips of one week each. The village visits and patrols where the monitoring work is carried out are expected to require 600 man-days each year from Xe Pian staff and other district forestry staff. Preparation and reporting is expected to require another 40 man-days each year. The cost of running this monitoring system is US$ 0.0167/ha of protected area.

The monitoring effort dropped to very low levels as soon as the donor funding ended, even though the cheapest and most cost-effective monitoring methods had been selected in the hope that the monitoring could be sustained with local funding alone. The total yearly GoL funding for Xe Pian is less than US$ 5000, with more than half being devoted to salaries for nine staff members and about US$ 1000 being for field activities. GoL funding for management activities is small and irregular and is given on a case-by-case basis. The continued presence of staff and the headquarters may indicate that some concern is being given to NBCA management but it is likely that a great deal of further donor support will be needed before GoL is able to take greater responsibility for biodiversity monitoring. Capacity building around monitoring at protected area level needs to be supplemented by policy-level dialogue to ensure that the monitoring becomes institutionalised. The Division of Forest Resources Conservation has shown an interest in keeping the monitoring and other management activities alive in Xe Pian. The Division of Forest Resources Conservation is, however, too small and weak to have any real impact at provincial level. The principal constraint to management progress at *some* local levels is not a shortage of funds, staff or management expertise. It is a lack of understanding of the reasons why the NBCAs have been established, and their importance to the nation (Robichaud et al. 2001).

One possible way of helping to secure regular funding would be for Xe Pian to obtain its own income. An eco-tourism project in Kiatngong village has a three-way profit-sharing agreement with the district and the Xe Pian Management Unit. The Management Unit has received a few 100 dollars in this way, and this kind of arrangement may help to secure funding for management in the future. Money from eco-tourism alone is unlikely to provide much income to the villagers and the Management Unit. Income from natural resource fees may be able to contribute further. Income from malva nuts collected within Xe Pian may be able to contribute substantially to the management of the reserve. In years of high malva nut harvest, it is estimated that tens of thousands of people come from outside Xe Pian to collect the nuts. Official figures from Pathoumphone district reveal that in 2002 alone, 80.3 tonnes of malva nut fruits

were traded throughout the district (Baird and Bounphasy 2002). A large part of these would have been collected within Xe Pian. The market price in Pakse was approximately US$ 2.5/kg in 2001. District authorities and representatives from Xe Pian villages have met and agreed on rules and restrictions on the collection of malva nut fruits and how profits should be shared. The system has, however, not yet been implemented and it is uncertain as to whether or when this will happen. In conclusion, Xe Pian, like the other NBCAs in Laos, will need the government or foreigners to subsidise monitoring and management far into the future.

Acknowledgements

This paper is an expanded version of a presentation we were invited to make at a symposium on locally-based monitoring in Denmark in April 2004 (www.monitoringmatters.org). The symposium was organized by the Nordic Agency for Development and Ecology (NORDECO, Denmark) and the Zoology Department of Cambridge University (UK). We highly appreciate the funding and other support for Xe Pian management received from the government, Swedish International Development Assistance through the Lao–Swedish Forestry Project, the IUCN, the Kouprey Conservation Trust, the Wildlife Conservation Society, the World Bank/Global Environmental Facility through the Forest Management and Conservation Program, WWF-Thailand, the Danish International Development Assistance (Danida) and NORDECO. We are grateful to I. Baird, K. Berkmuller, S. Chanthakoumane, S. Chanthavong, S. Chitvongsak, F. Danielsen, R. Dechaineux, J. Foppes, B. Jefferies, A. Jørgensen, P. Ladouanglerd, M. Linddal, S. Ling, L. Manolak, G. Marris, T. Nilavan, H. Nøhr, Onkeo, Padith, T. Panxayyasak, B. Phanthanousy, B. Phanthavong, I. Phavanhnasouk, P. Phiapalath, S. Phimmasone, S. Phommachan, V. Phommasak, W. Robichaud, X. Samountry, B. Saphangthong, P. Sayyapasert, S. Sawathvong, A. Sittiya, S. Shen, Sountone, S. Southammakoth, R. Steinmetz, Thongphoun, P. Vanalathsamee, V. Vannalath and the Xe Pian villagers for participating in discussions on biodiversity monitoring in Xe Pian. We would also like to thank R. Boonratana, N. Burgess, F. Danielsen, W. Duckworth, M. Funder, S. Ling, E. Topp-Jørgensen and an anonymous referee for comments on the manuscript.

References

Baird I.G. and Bounphasy S. 2002. Non-timber Forest Product Use, Management and Tenure in Pathoumphone District, Champasak Province, Southern Laos. Global Association for People and the Environment, Pakse, Lao P.D.R.

Brashares J.S. and Sam M.K. 2005. How much is enough? Estimating the minimum sampling required for effective monitoring of African reserves. Biodivers. Conserv. (this issue).

Cox, R., Laurie, A. and Woodford, M. 1992. Report of the results of four field surveys for Kouprey (*Bos sauveli*) in Vietnam and Lao. P.D.R. Unpublished report, Kouprey Conservation Trust.

Danielsen F., Balete D.S., Poulsen M.K., Enghoff M., Nozawa C.M. and Jensen A.E. 2000. A simple system for monitoring biodiversity in protected areas of a developing country. Biodivers. Conserv. 9: 1671–1705.

Danielsen F., Burgess N. and Balmford A. 2005. Monitoring matters: examining the potential of locally-based approaches. Biodivers. Conserv. 14: 2507–2542.

Duckworth J.W. 1997. Small carnivores in Laos: a status review with notes on ecology, behaviour and conservation. Small Carnivore Conserv. 16: 1–21.

Duckworth W., Evans T. and Timmins R. 1993. A wildlife and habitat survey of Xe Piane proposed protected area, Champassak, Laos. Lao–Swedish Forestry Cooperation Programme, IUCN.

Duckworth J.W., Timmins R.J., Thewlis R.C.M., Evans T.D. and Anderson G.Q.A. 1994. Field observations of mammals in Laos, 1992–1993. Nat. Hist. Bull. Siam Soc. 42: 177–205.

Duckworth J.W., Timmins R.J., Anderson G.Q.A., Thewlis R.M., Nemeth E., Evans T.D., Dvorak M. and Cozza K.E.A. 1995. Notes on the status and conservation of the gibbon *Hylobates (Nomascus) gabriellae* in Laos. Trop. Biodivers. 3: 15–27.

Duckworth J.W., Salter R.E. and Khounboline K. 1999. Wildlife in Lao P.D.R. 1999 Status Report. IUCN, Vientiane, Lao P.D.R.

FOMACOP. 2000. Xe Pian National Biodiversity Conservation Area Management Plan. Forest Management and Conservation Program, Vientiane, Lao P.D.R.

Fujita Y. and Phanvilay K. 2004. Land and Forest Allocation and Its Implication on Forest Management and Household Livelihoods: Comparison of Case Studies from CBNRM Research in Central Laos. Instituto de Investigaciones Sociales, Universidad Nacional Autónoma de México, Oaxaca, México. www.iascp2004.org.mx/downloads/paper_105b.pdf.

Hockley N.J., Jones J.P.G., Andriahajaina F.B., Manica A., Ranambitsoa E.H. and Randriamboahary J.A. 2005. When should communities and conservationists monitor exploited resources? Biodivers. Conserv. 14: 2795–2806.

Ling S. 2000. NBCA Biodiversity Monitoring, Part One: Monitoring Manual and Part Two: Trainers Notes. WCS, Vientiane, Lao P.D.R.

MAF. 1996. Instructions on Land and Forest Allocation. Ministry of Agriculture and Forestry (MAF), No.0822/MAF. Vientiane, Lao P.D.R.

MAF. 2001. Regulations Concerning NBCAs, Wetlands and Wildlife (unofficial translation). Ministry of Agriculture and Forestry (MAF), No.0524/2001. Vientiane, Lao P.D.R.

Robichaud, W., Marsh, C., Southammakoth, S., Khounthikoummane S. 2001. Review of the National Protected Area System in Lao PDK. Ministry of Agriculture and Forestry/Department of Forestry/National Agriculture and Forestry Research Institute, Vientiane.

Salter R.E., Phantavong B., Sawathong S., Souliyakan S. and Luanglath K. 1990. An Assessment of the Current Status of Kouprey and Other Wild Cattle in Southern Laos. Forest Resources Conservation Project, Lao–Swedish Forestry Cooperation Programme, Vientiane, Lao P.D.R.

Steinmetz R. 1997. A Survey of Mammals and Habitats in Xe Piane National Biodiversity Conservation Area, Lao P.D.R. WWF-Thailand Project Office, Bangkok, Thailand.

Steinmetz R. 2000. Ecological Surveys, Monitoring, and the Involvement of Local People in Protected Areas of Lao P.D.R. International Institute for Environment and Development, London, UK.

Thewlis R.M., Duckworth J.W., Anderson G.Q.A., Dvorak M., Evans T.D., Nemeth E., Timmins R.J. and Wilkinson R.J. 1996 (for 1995). Ornithological records from Laos 1992–1993. Forktail 11: 47–100.

Timmins R.J. and Duckworth J.W. 1999. Status and conservation of Douc Langurs (*Pygathrix nemaeus*) in Laos. Int. J. Primatol. 20: 469–489.

Topp-Jørgensen E., Poulsen M.K., Lund J.F. and Massao J.F. 2005. Community-based monitoring of natural resource use and forest quality in montane forests and miombo woodlands in Iringa District, Tanzania. Biodivers. Conserv. 14: 2653–2677.

Uychiaoco A.J., Arceo H.O., Green S.J., De la Cruz M.T., Gaite P.A. and Aliño P.M. 2005. Monitoring and evaluation of reef protected areas by local fishers in the Philippines: tTightening the aAdaptive mManagement cCycle. Biodivers. Conserv. 14: 2775–2794.

WWF. 1997. Rapid and Participatory Biodiversity Assessments (BIORAP) in Xe Piane NBCA – Final Report. WWF-Thailand/Burapha, Bangkok, Thailand.