Evaluating Eden Series
Discussion paper No 13

ECOLOGICAL SURVEYS, MONITORING, AND THE INVOLVEMENT OF LOCAL PEOPLE IN PROTECTED AREAS OF LAO P.D.R.

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Abstract

Protected area managers sometimes view villagers solely as a threat to biodiversity and inimical to its conservation. This is reflected in the definition of "local participation" that is applied, and limited role designated for local people in management of the area. Only after research information is analyzed and processed are villagers asked to participate, and then usually in pre-determined ways. This paper describes an alternative approach to assessing and monitoring biodiversity, and illuminating opportunities for its conservation, that has been developed by the WWF/Thailand Programme Office, which is working with the staff and local people of four protected areas in southern Lao People's Democratic Republic. The process begins with a Participatory Biodiversity Assessment (PBA) which focuses on local ecological knowledge and practices, and helps reveal details of wildlife-habitat relationships, the diversity of habitat types, and ecological processes. Subsequent field surveys are informed by, and follow the PBA. Surveys are followed by returning results to local communities using graphic posters and maps, and allowing local interpretations of data to help advance a mutual understanding of conservation issues facing the protected area. This approach facilitates positive relationships with local people while establishing a process for integration of local ecological knowledge, and ecological monitoring of key species of large mammals and birds. Two complementary monitoring methods – village logbooks and joint monitoring teams - are under implementation. These track simple indicators of the population status of focal species. Relating ecological and cultural information may be used to uncover points of intersection, where local interests and existing patterns of land or resource use converge with protected area priorities. This paper argues that the approach establishes a basis for protected area collaborative management in a broader sense by using initial surveys as the starting point from which information emerges that is owned and used jointly by local people and protected area officials in informing management decisions.

1. INTRODUCTION

The concepts of collaborative, or participatory, management although not fully embraced or willingly accepted by some, are on the conservation agenda in many countries. Protected area management theory has evolved to accommodate the idea of participation, partially due to past failures of an ideology predicated on the urban ideal of "wilderness preservation". This trend has joined one of increased awareness of the social, economic, environmental, and cultural costs to local and indigenous peoples who have, in numerous cases, struggled against what amounts to expropriation of their resources in the name of biodiversity conservation. The acceptance of local involvement in protected area management has been assisted by the demise of the "equilibrium paradigm" in ecological science (Meffe *et al.* 1997). This model promoted the idea that natural systems exist in a fragile, static, and carefully balanced state that only the depravations of man could upset. This scientific and popular misconception has hindered an understanding of disturbance processes and change in the maintenance of ecosystems and biodiversity, and has prevented an unbiased perception of the ecological role of humans and their relationship with the landscape (Robinson 1993).

Although it is now generally accepted that conservation planning should account for human presence (Meffe *et al.* 1997), there are sometimes limiting notions among the conservation community regarding the role of local communities. This is reflected in the level of local participation deemed suitable, and the range of activities local people are invited to participate in. Some major elements of protected area (PA) management commonly in use today (e.g. economic incentives and development interventions, community outreach and conservation education) seem to implicitly maintain a largely passive role for local people. Other management actions, such as monitoring and patrolling, and designation of core areas, are seen largely as the responsibility of PA staff, outside the framework of participation. This paper presents a variation to traditional PA management approaches, that incorporates important procedural and technical innovations. This variation, currently being implemented in four PAs in southern Lao People's Democratic Republic (hereafter referred to as Lao PDR), emphasizes a more active role for local people and their knowledge in overall management, as well as in activities usually reserved solely for PA staff and outsiders.

2. BACKGROUND

The Lao protected area system was established in 1993 (Berkmuller *et al*., 1995), and currently there are 20 national PAs (also referred to as National Biodiversity Conservation Areas) under varying degrees of management. The Protected Areas and Conservation Sub-Program of the Forest Management and Conservation Program (FOMACOP), funded by the Global Environment Facility (GEF), was started in 1995 to assist the establishment of management in four PAs in southern Lao PDR: Xe Pian, Dong Phou Vieng, Phou Hin Poun, and Xe Sap (see Figure 1). The WWF/Thailand Programme Office was contracted to survey the social and biological features of those PAs, provide baseline information from which management decisions could be made and establish the framework for a monitoring system.

For South East Asia, the protected areas in Lao PDR are a special case. From the inception of the PA system in 1993, the Lao government has clearly stated that communities must be included in the management of protected areas. Though many Department of Forestry officials believe that their jobs would be easier if they could simply relocate Lao villagers, most accept this option as unethical and impractical. By not declaring local people illegal squatters in newly established PAs, the government opened a path towards more sustainable conservation of both biodiversity and culture.

Experience throughout the region has revealed that in many cases, enabling local people's involvement is arguably the most crucial aspect of PA management (McNeely 1996), and may determine the effectiveness and sustainability of conservation initiatives (Borrini-Feyerabend 1997). That involvement can take different forms, but it still must be based upon a common understanding of the circumstances of a particular PA. The approach presented in this paper presents a way to achieve this common understanding.

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3. A PARTICIPATORY APPROACH

Traditionally, outside researchers and PA staff study the biological values of protected areas and use the results and interpretations to form a foundation for management decisions. Local people are often left out of the more important parts of the process, including decisions on what information is being collected and why, and its interpretation and use. An uneven relationship is established or reinforced, and the potential for incorporation of local knowledge and experience in data collection, interpretation and application is missed.

The participatory approach being tested in the project PAs in Lao PDR intends to avoid these shortcomings. It requires the acceptance of a few simple but crucial premises. The first is the belief that the goal of participatory management can be realized only when it ceases to be seen as the final step in the process of establishing management in the PA, but rather as the mindset from which everything else follows. Participatory management can be seen as starting today, not after a whole range of activities have created it. Observations of the relationship of inhabitants to the PA often reveal that villagers are already acting as *de facto* managers; to ignore this is to set the stage for failure when outsiders attempt to impose their own systems.

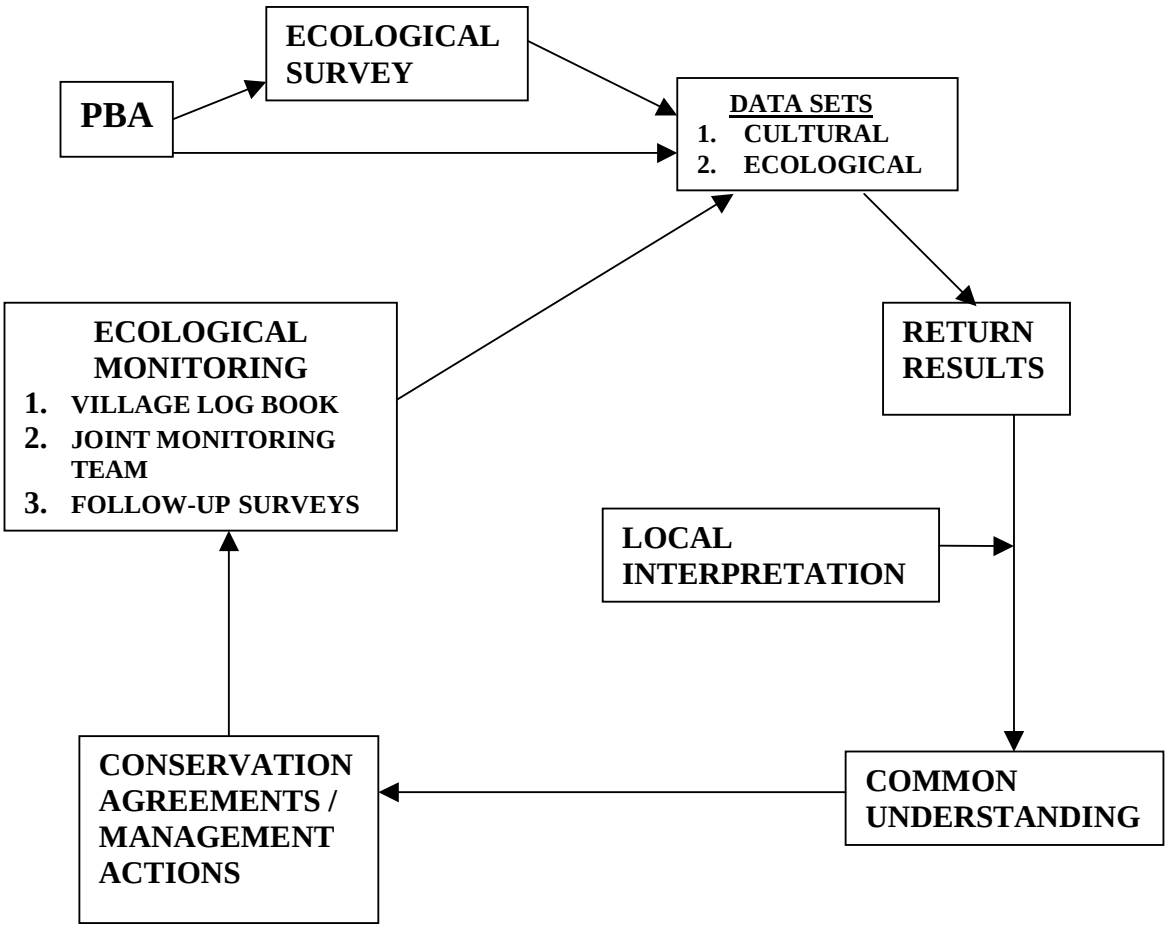
The second premise recognizes that local people are a significant component of the human assets of the PA, upon which the conservation of biodiversity greatly depends. Although some local activities pose threats to biodiversity, local peoples' presence also has beneficial sides, and presents conservation opportunities. Their knowledge of ecology, and historical ecological perspective provide insights into past and ongoing processes in these environments, and are invaluable for interpreting and understanding biological data. Their existing practices, institutions and beliefs may provide a basis for, and help inform conservation initiatives.

The requirement becomes then, not to "create" local people's involvement by writing them into management plans devised by outsiders, but rather to initiate a management process that accommodates both community and PA concerns. This requires that outsiders explore and understand the local social-economic and cultural processes already occurring. Through the process suggested in this paper, one may discover points of intersection, where existing local practices converge with PA priorities. These intersections can be the starting points for co-management action, because they start with what already exists, and build from there, thus following paths of least resistance. In this context, surveys, for example, should not be seen simply as a means to extract information, but rather as the first step in creating a participatory relationship.

4. PARTICIPATORY BIODIVERSITY ASSESSMENT AND ECOLOGICAL SURVEYING

One of the first tasks in PA management are surveys to develop a knowledge base about two major elements - local people and biodiversity - and where and how these elements interact. Surveys to gather this information in the project PAs were separated into two complementary phases. First, was a Participatory Biodiversity Assessment - this facilitated and informed the second phase - ecological field surveys of habitats and wildlife. Elements of the process are described below, and their relationships depicted in Figure 2.

Process and components of the survey and participatory monitoring approach implemented in Lao PDR



Initial PBA and ecological surveys start the process. Establishing ecological monitoring systems is one initial form of conservation agreement and management action; more refined or species / area specific conservation agreements are more likely after a number of cycles of the process have occurred.

The Participatory Biodiversity Assessment (PBA) involves local people in discussions about habitats, wildlife and ecology, resource and land use, and cultural factors affecting these issues. It involves them in the role of local naturalists and experts, and is the first step for creating positive relationships between PA personnel and community members. The PBA process also serves as on-the-job training for PA staff, as they observe and participate in the use of the requisite social and technical skills. The PBA, although referred to here by a new acronym, is nothing revolutionary. It is not a new formula for engendering participation. Essentially, it simply means taking time to learn from local people, and brings tools together to accomplish this more systematically. Most importantly, the PBA is set within a process designed to build partnerships with local people, spotlight opportunities for conservation initiatives, and maximize cooperation in management decision making.

4.1 PBA goals

- Develop (among PA staff and outsiders) a more complete understanding of ecosystems, including local knowledge of ecological communities, wildlife habitats, and wildlife-habitat relationships. This information helps inform the subsequent ecological surveys, as well as future research and monitoring efforts.
- Develop (among PA staff and outsiders) an understanding of the nature and extent of local resource use and agriculture, local or traditional conservation practices, and spiritual aspects of local involvement with the area.
- Establish a positive, respectful, and participatory relationship between local people, PA staff, government officials and outsiders.
- Training and awareness building for PA staff.

4.2 Information Objectives

The information objectives of the PBA are twofold:

1. *Status / Biodiversity values of the PA* - This is accomplished through observation, habitat inspection with local people, and research into local knowledge on the following topics:

- Structure and composition of ecological communities and wildlife habitats
- Structure and composition of the landscape mosaic comprising the PA
- Presence, absence, and relative abundance of selected wildlife species in and between habitats and regions within the PA
- Abundance and location of critical wildlife resources
- Wildlife-habitat relationships, including effects of season and other factors on wildlife

distribution, abundance and movement patterns
- Trends and changes among the species and communities of the PA
- Ecological processes, disturbance regime and historical ecological perspective
- Local taxonomy and classification of habitats, forest types and animals

2. *Local people / Resource use* - Local interaction with the PA including actual and potential impacts, as well as opportunities for conservation inherent in local beliefs and practices.

- Basic socio-economic data
- Resource use (inventory, intensity, spatial and temporal aspects)
- Community history
- Local resource management
- Forest perceptions, attitudes, spiritual aspects of human-environment relationship
- Beliefs and patterns of behavior related to conservation

4.3 Methodology

The PBA methodology relies on tools of Participatory Rural Appraisal (PRA) (see Poffenberger 1992) that are adapted to focus more on information regarding the biodiversity of the area and local ecological knowledge. The details of PBA tools and their use is not covered in this paper, but the range of techniques are briefly listed below. Their use is not necessarily exclusive from each other; for example semi-structured discussions usually accompany mapping and forest walks. Techniques are listed roughly in chronological order of their use, and by importance. Level I tools form the basis of PBA work, and build an information base which can be augmented and refined through further use of the same tools, or addition of more time-consuming methods of Levels II and III.

Level I
- Participatory mapping, both village area and larger regional scale, which explores landscape level attributes
- Semi-structured discussions with local naturalists, experts, and hunters
- Listing of wildlife types present
- Use of pictures and photos of mammals, birds, and fish
- Listing of habitat types
- Forest walks and habitat investigation with local people
- Observation of village activities and resource use

Level II
- Linguistic interpretation of local languages to elicit information about wildlife, ecology and cultural beliefs. This includes the creation of a glossary of local terms for wildlife, habitats, ecological communities, topographical features and place names. Attention should be given to local language concerning ecology, conservation practices, cultural and spiritual beliefs and perceptions of nature.
- Ranking of wildlife species' relative abundance, done by (largely) taxonomic groups

- Ranking of historical trends in wildlife species abundance

Level III – these require the most time
- Ranking of seasonal habitat-wildlife relationships
- Ranking of fish presence, absence, seasonal occurrence, and migratory patterns (in different watersheds)
- Ranking of village resource use
- Seasonal calendar of resource use
- Resource comparison between economic, subsistence and historical use

4.4 How the PBA supports ecological field surveys

The PBA generates information essential to prepare logistics for subsequent ecological surveys. It identifies knowledgeable and interested villagers (local naturalists) who can join the survey team as guides and consultants. Most importantly the PBA provides a wealth of regional knowledge and better "pre-understanding" of the landscape and ecology of the area. With this information, field survey time can be allocated more efficiently and attention directed to species, habitats or processes previously unconsidered. Ecological field surveys have employed traditional survey techniques including direct observation, recording of animal signs, static watches, and night spot-lighting for nocturnal mammals.

4.5 After the PBA and ecological surveys

The PBA and ecological surveys of the PAs in Lao PDR have generated information about the state of both culture and ecology in the protected area, and relationships between the two. In particular the following pieces of information have started to emerge:

- Status of wildlife species and ecological communities.
- Important areas for wildlife.
- Important areas for local resource use, economy and subsistence.
- Local traditions, beliefs and practices relevant to resource management.
- Villages which are important in terms of management because of their location, local knowledge, activities in the protected area and (possibly) enthusiasm towards an active role in PA management. These are referred to as ‘key villages’.
- Individuals within villages who show aptitude, knowledge and motivation for working together with PA staff and outsiders.

The identification of ecological attributes of the surveyed areas is assisted by the incorporation of local knowledge into the information base of outsiders. “Incorporating” local knowledge of ecology is defined here as the addition or application of this information, *with* awareness of its properties and limitations. The use of local ecological knowledge is discussed in the next section (and also see section 7).

5. LOCAL ECOLOGICAL KNOWLEDGE

Traditional approaches to biological surveying and local participation usually ignore the great potential for incorporating local knowledge. This is because:

- Local ecological knowledge is often considered to be "unscientific," a belief that obstructs or limits the ability of biologists to objectively study it and the ecological interpretations it offers.
- Many biologists do not know or have not learned the tools and skills necessary for exchanging information with, and learning from local people. Some do not appreciate that special skills are even necessary.
- Understanding information gathered from villagers has pitfalls for those unaware of the subtle factors regarding language, history, culture, psychology, cosmology, epistemology, and politics that influence peoples' perceptions, the nature and interpretation of questions asked, and answers provided. These factors impose limitations on the usefulness of local knowledge for outsiders, which can be mitigated through lengthy periods of interaction and study with local people, but probably never overcome completely.

Local inhabitants, through interaction with their landscapes over time, have often developed a refined and detailed understanding of the landscape. Landscape attributes, such as habitat diversity in protected areas, play a crucial role in the regulation of animal populations (MacArther and Wilson 1967; Pickett and White 1985; Saunders *et al*. 1991). Also, community level diversity may be important to the long term stability and functioning of the landscape as a whole (Walker 1992). Details of such components of community and landscape ecology are often a prominent domain in local people's ecological knowledge.

Work in the target PAs has shown that without the input of local people one may be left with only a rough understanding of the existence of different forest types and wildlife habitats present, or perhaps be overconfident that satellite images and existing maps revealed sufficient detail on which to base plans for survey and monitoring work. The example in Box 1, from Xe Pian Protected Area, Champassak and Attapeu Provinces, highlights the importance of integrating local ecological knowledge into survey design.

BOX 1

It was known from existing maps and cursory information gathered from local people, that extensive tracts of Deciduous Dipterocarp Forest dominated the southern portion of the PA. However, only through detailed PBA work was it learned from the local people of local variations in the broader forest mosaic defined as Deciduous Dipterocarp Forest. These variations were clear to many local naturalists, and survey effort was allocated so that the range of vegetation community subtypes identified by them could be included. As it turned out, two of the subtypes, known as *Ba-Dong* and *Song* in local terminology, were extensively interspersed among the broader Deciduous Dipterocarp Forest, with significant differences in structure and composition that affected local migrations of wild cattle and perhaps other large mammals (Steinmetz 1997).

After PBAs and field surveys, initial data have been put to use, and further information added, through continuation of the process described in Figure 2. This phase of the process requires that information first be returned to local communities.

6. RETURNING THE RESULTS

Traditionally, local people are overlooked after surveys are completed - survey information becomes the property of protected area staff and outside advisors who unilaterally use it to inform conservation management and decisions (if not shelved). In contrast, the approach advocated here continues the survey process already started by returning the results to local communities. The benefits for the PA potentially include:

- Better cooperation between local communities and PA staff
- Application of local ecological knowledge to help interpret survey results
- Shared understanding of survey results and their meaning
- Joint decision making based on a common understanding of the situation
- Agreement on conservation priorities and actions
- Raised awareness about biodiversity values (as perceived by outsiders)
- Development within communities of increased sense of ownership, responsibility, and pride in their role as conservation partners

Sustaining conservation initiatives or management actions in the PA depends on reaching agreements with local people, and this can best be accomplished by involving them in analysis of information. Unilateral decisions on either side must be avoided for co-management to succeed.

In the project PAs, ecological survey fieldwork was followed initially by informal meetings in key villages that had taken part, in which initial results and observations were presented by researchers, PA staff *and* local naturalists. This began the involvement of local people in the interpretation and discussion of biological information. After survey reports were written, results were returned more formally through the three steps described below.

6.1 Preparation of a summary of the survey results

Ecological survey information was “translated” by the staff (with the assistance of the author) into more easily understood and graphic forms, such as posters, lists, and maps. The translation process increased the staff's understanding of the survey results and ecology of the PA, and improved their information analysis capabilities. Survey information returned to local communities has included:

- Species lists with local names
- Habitat type list with local terms
- Relative abundance of different species between sites
- Photographs of survey activities, birds, animals, forest types and local landscapes
- Spatial information for forest and habitat types, wildlife sightings, and important areas for wildlife

One of the primary methods for translating results has been creating posters that display pictures or silhouettes of animals - different numbers of pictures / silhouettes indicating differences in relative abundance between sites.

6.2 Preparation of mounted and laminated maps

In addition to summary survey information, topographic maps of the entire protected area and periphery have been presented to key villages, along with marker pens. The maps have been used for describing spatial details of survey results. They have also been a medium for recording data in subsequent Joint Monitoring Team (see section 8.3) survey and monitoring activities, such as plotting the locations of habitat features, species sightings and signs.

Discussions with local communities have discovered that the existence of the PAs and its boundaries were often unclear or unknown to many local villagers. Using maps of the area assists local people to comprehend the locations of their villages, resource use areas, and territories – in relation to the PA. Existing spatial knowledge regarding the locations of wildlife and their movements is usually localized, but has been expanded regionally through use of maps. For example, villages in southern Xe Pian were familiar with seasonal movements of wild cattle in their region, but knew little about populations in the center of the PA. Discussing survey results and using maps expanded their understanding of the wider picture of the status of these endangered large mammals.

As a tool in the collaborative process recommended here, maps may increase local people's participation by drawing them (literally, on the map) into the larger picture. Observations from returning results in Phou Hin Poun and Xe Pian PAs indicate that the simple act of drawing a brightly colored star where a village is located may initiate a small but seminal sense of pride and ownership. This is one of the intangible social aspects of collaborative protected area management that may support and facilitate tangible conservation objectives later.

6.3 Visit villages and discuss results

The goal of returning results is not simply the transmission of information from staff to villagers, but rather eliciting local people's interpretations about what the information means, and how to use it. They have important interpretations, based on local knowledge and an unmatched historical ecological perspective. PA staff involved in the process should ideally learn at least as much as they transmit.

Discussing results with local communities has also presented an opportunity to raise conservation awareness in some cases by describing the status of different species throughout Lao PDR and the region. When set in the process of returning and discussing results, building awareness about Key Species (those of global, regional or national conservation concern) or other conservation issues becomes more relevant, because the local situation can be compared and contrasted with that of other parts of the PA, the province, nation and region.

7. LOCAL INTERPRETATION AND CONSERVATION BIOLOGY

A previous example from Xe Pian PA (Box 1) demonstrated how local ecological knowledge of habitat subtypes can inform the allocation of survey effort. Great potential for integration of local knowledge lies not only at the beginning of surveys, however, but also after they are completed. Local people, if given the opportunity to discuss survey findings and observations, often provide interpretations and insights that otherwise may have been missed were the results interpreted solely by staff and advisors.

7.1 Providing hypotheses

Local ecological knowledge is especially useful for comprehending seasonal effects on wildlife, as seen in Box 2.

BOX 2

In Phou Hin Poun Protected Area, local people explained how their own pattern of resource use in certain areas, combined with dry season localization of foods for macaques, leads Pig-tailed Macaques (*Macaca nemestrina*) to inhabit a cliff habitat that, in other seasons, would be the domain of the other macaque in the area - Assamese Macaque (*M. assamensis*) (Steinmetz 1998). Dry season surveys had observed this macaque distribution, but the seasonal and historical ecological perspectives of local people provided a hypothesis about what natural and anthropogenic factors might be influencing that distribution.

Could this interpretation be wrong? Possibly, but it pinpoints a question which follow-up surveys can address (through joint monitoring teams – see section 8), and through which common understanding will be advanced. As this example showed Phou Hin Poun staff, when local people are involved as partners, there is much less reticence to honestly assess the complex of factors affecting wildlife, including local people's own activities.

Ecological processes, such as changes in macaque distribution described in Box 2, are often the least understood component of biodiversity (Noss 1990), but largely determine its status and are crucial to its maintenance. One of the most overlooked potentials of local knowledge is its understanding of change in ecological communities and across landscapes over long time periods. Temporally, outsiders usually catch only a glimpse of an area's biology, which is incomplete without seasonal and historical analysis, possibly leading to incorrect conclusions and informing inappropriate decisions. The depth of analysis that local knowledge can add, through these *historical* and *seasonal ecological perspectives*, provides the bridge for linking present day data with past and current ecological processes.

7.2 Informing conservation measures

The incorporation of local knowledge can not only enhance ecological understanding, but also help avoid unnecessary conflicts arising from the unilateral interpretation of survey results by PA management. An example from Xe Pian is detailed in Box 3.

BOX 3

Surveys and local reports both pointed to the importance of a certain mineral lick complex (Bong Kalen) for larger mammals, especially elephants and gaur. PA staff initially sought to declare it a core zone for that reason, off-limits to local people under all circumstances. After encouragement to follow through first with returning of results, PA staff were told by local people that large mammals for which the lick is important concentrate their use in the rainy season. This local interpretation was supported by data from a follow-up survey in the rainy season to explore the question of seasonal use of the licks. Comparison of sightings and tracks of wildlife between the dry and rainy seasons suggested that the most important time for lick use by some mammals was during the rainy season. Most importantly, this season did not overlap with local peoples' use of the area, which was intensive mainly in the dry season.

A core zone centered on the mineral licks would have ignored seasonal movements of the wildlife ostensibly being protected, such as gaur. Gaur populations in Xe Pian may have drastically different patterns of habitat use between seasons (Steinmetz 1997), which would regularly remove them from the protective sphere of any but the largest core zones. In addition, survey results strongly suggested that gaur moved widely between the licks and other distant habitats, such as semi-evergreen + bamboo, even within the rainy season. Based on ecological grounds alone, this annual and same-season variation in gaur distribution renders the core zone approach of limited value as a one-off conservation measure. As the process of involving local people helped clarify, the unilateral establishment of a core zone would be especially inappropriate without regard to spatial and temporal aspects of local resource use.

To have unilaterally declared a core zone - without first returning results, eliciting local interpretation, and seeking mutual understanding through follow-up participatory surveys - may have created an unnecessary conflict with local people, while failing to account for ecological factors which seriously limit the conservation value of the approach itself. In initial stages of co-management, gaur and elephants in Xe Pian may be better protected through species-specific measures, special protection to areas which are not also important for local people (see section 11), and serious attention to outside wildlife trade issues.

In the example in Box 3, restricting local use or visitation at the Bong Kalen mineral licks, such as through designation of the area as some type of core zone, may be appropriate in the future, after staff and local people have developed more experience in addressing conservation issues together. Unilateral decision making leading to imposed conservation measures by staff and outsiders will stifle this development, and may even be unjustified and unrealistic on an ecological basis. Moreover, imposed measures such as these will probably be ineffective anyway: who will ensure that core zones, once designated, are respected as outsiders intend ?

This does not mean that attention should not be given to critical areas like Bong Kalen, but local people must be involved in making decisions about conservation measures, for both reasons of completeness of ecological information, and social sustainability of the decision. In the meantime, action can be taken, but in a different form: jointly monitoring the area (explained in the next section), combined with clearer understanding of how local resource use relates to the specified area, amounts to conservation action. If future core zone status or use restrictions emerge as one conservation measure, they will be much better informed as a result, and more likely to be adhered to by local people who took part in defining them.

Sometimes local knowledge may prove to be inaccurate or mistaken about certain ecological processes or their features. However, through the process of discussion and mutual learning being promoted, deficiencies in local or outsider knowledge will hopefully be adjusted. This process is also more likely to lead to a common understanding of the ecological and socio-economic circumstances from which sustainable solutions to conservation issues can emerge. In the PAs where the project is working, that process of post-survey discussion has led to the next step – ecological monitoring.

8. ECOLOGICAL MONITORING

Monitoring is often seen as a function of protected area staff or outside researchers. This project views it as integral to the collaborative process instead. Local people may not initially assign great importance to systematic monitoring of wildlife populations and their trends, but in fact they naturally perform their own style of qualitative (and sometimes quantitative) monitoring. They perceive changes in the abundance, distribution and diversity of wildlife and habitats, between regions and over time. They accumulate observations about the composition, structure and function of biodiversity from the scale of species and populations, up to communities and landscapes. They transmit this information within their communities and through generations. They form hypotheses to explain what has been observed, and are capable of adjusting these explanations as new information is added, or old information refuted or challenged.

The 'scientific method', typically considered to be an intellectual heritage exclusive to formally trained scientists, is instead actually an innate thought process of humans. With subsistence people it is not necessarily conscious or articulated, however, leading many outsiders to assume it is absent, or at least hopelessly deficient. With the exception of controlled experimentation, which is usually not a part of the epistemology of local people's knowledge of wildlife ecology (although it is very much a part of their agricultural knowledge), local people follow a mental path similar to the 'scientific method' (although it is expressed in different forms) in making sense of their natural world. Following are methods to tap into this source of information, and use it to advance comprehension of the ecological situation in the PA, and inform management decisions.

8.1 What to monitor?

8.1.1 Objectives

Most of the ecological field surveys took place in the dry season. Returning of results to local communities in Lao has elicited interpretations about the information collected, and how the dry season "snapshot" view of wildlife generated by the surveys may change in other seasons. A certain level of mutual agreement and understanding regarding the state of wildlife communities, habitats, and their conservation in the PA has emerged through the discussion of the results with local people. Deciding what species, habitats or locations to monitor, or choosing which biological questions to follow up, should emerge through that foundation. This will help ensure that decisions are made through exchange and collaboration, rather than unilaterally.

What to monitor essentially depends on the objectives of management, the definition of which should be one of the first steps in establishing a monitoring program (Hellawell 1991; Noss 1990). In the Lao case, one management objective of the government, PA staff and donors is to maintain (and/or increase) wildlife populations and their habitats, especially those of endangered birds and mammals, for which Lao protected areas are so important in Indochina.

The objective of monitoring then is to assess the effectiveness of management in maintaining wildlife populations and habitats, and to provide an "early warning system" that allows management to respond and adapt to changing situations early enough to achieve conservation objectives. These management and monitoring objectives are broad, and it is important to choose monitoring indicators which are realistic, and indicative of the stated objective. Direct, quantitative indicators, such as "numbers of sun bears" or "numbers of resident female tigers" might be considered ideally relevant for monitoring management effectiveness, but are unrealistic as there will probably never be enough time or resources to collect the necessary data.

Fortunately, for most protected area management purposes, quantitative wildlife population or density data are less important than information on presence, absence, distribution, and relative population abundance and its trends (Caughly 1977; Duckworth & Hedges 1998; Karanth 1987; Rodgers 1991; Sale & Berkmuller 1988; Van Lavieren 1982). These are the types of data which the previous ecological surveys have already begun collecting (in limited areas of each PA), and which have served as a partial baseline. The monitoring program described in this paper relies on indicators particular to these sets of data, which are within the capabilities of staff and local people to access, build on previous survey data and ecological knowledge, and provide feedback towards management effectiveness.

It is important to keep in mind that the strategy of surveying and monitoring being promoted is meant to facilitate co-management by involving local people in the process. As discussed previously, monitoring is therefore seen as a means to an end that includes more than just data and management decisions that the data inform.

8.1.2 Focal species

Experience from Xe Pian and Phou Hin Poun PAs has shown that key species (those at risk globally, regionally or nationally) of each PA often figure prominently in the discussion of results and choice of focal species for monitoring. These have included: tiger (*Panthera tigris*), elephant (*Elephas maximus*), gaur (*Bos gaurus*), banteng (*Bos javanicus*), serow (*Naemorhedus sumatraensis*), bears (*Ursus* spp.) Francois' langur (*Semnopithecus francoisi*), gibbon (*Hylobates* spp.), green peafowl (*Pavo muticus*), giant and white-shouldered ibis (*Pseudibis* spp.) and sarus crane (*Grus antigone*), among others depending on the wildlife community particular to the PA. By reaching agreement about the species on which to focus initially, local people have become involved in decision making, however seemingly small that decision. Initially, what to monitor is, in many ways, less important than the degree of local involvement and the process in which monitoring is set.

It is envisaged that the list of focal or target species can be amended or expanded as practice and experience is gained in monitoring. For example, tiger has been chosen as a focal species in every village where monitoring has been established, but in the future its prey species may be added (in two villages they already are) to better understand the tiger's status.

8.1.3 Habitats

The monitoring program under implementation focuses on populations of particular species of larger birds and mammals. This is partly because of the relative ease in identification of these species and their signs by PA staff and local people. Also, the focal species are among the most familiar and most endangered larger animals in the PAs. A final reason is that in general, past and present changes to the ecological status of the project PAs have been most severe at the level of wildlife species populations. Some of that change is due to past human land use practices which have affected wildlife habitats or compromised the ability of wildlife to inhabitat them, but presently, within the project PAs, habitat change is much less of a threat to the health of wildlife populations, and is therefore a relatively minimal management concern.

Although monitoring *habitat change* is not yet a feature of the system described here, studying *habitat types*, their structure, composition, distribution and abundance, is considered a vital aspect of the work, which needs to run concurrently or precede wildlife monitoring. Making sense of survey and monitoring information about wildlife will be impossible without this information. Building comprehension of the baseline status of landscape ecology – the composition of different vegetation communities, their spatial pattern, and processes occurring among and between them – was started through previous surveys, and will need continued attention, especially in the first few years of the program. As will be seen in the next section, early joint monitoring activities (and those planned for the future) have taken the task to document and map different habitat types and critical wildlife resources (such as waterholes).

Additionally, as the programme develops, it is anticipated that habitat parameters may be added to the list of what is monitored, particularly as they relate to aspects of life-history requirements of the focal species. For example, the relative abundance of favored seasonal foods in different survey blocks and between different habitats may be noted.

8.1.4 Human-environment interaction

Besides understanding habitat and landscape variables, assessing ecological change through monitoring requires comprehension of human relationships with the area. The present program focuses almost exclusively on non-human ecological factors, a point which may admittedly be seen as a weakness. That ecological monitoring requires the linkage of ecological and socio-economic data, especially in a spatial context, has not been ignored, however. Two approaches to linking these data, ways to address potential conflicts between resource use areas and important locations for wildlife, and ideas to illuminate and build upon existing positive aspects of local presence are presented in section 11 on *Co-management Opportunities.*

It is accepted that continual attention must be given to understanding, documenting and mapping local peoples' land use practices and resource use patterns. The example of the Bong Kalen mineral licks, in section 7.2, demonstrates the necessity of correlating such information with ecological data, in order to properly inform conservation measures.

Keep in mind that the survey and monitoring programme, if firmly set within the process described in Figure 2, is also intended to build trust and common understanding between outsiders and local people, a foundation on which the potentially contentious issue of human impacts can more smoothly be addressed.

8.1.5 MONITORING METHODS

How to collect data on the distribution and relative abundance of the focal species, and the distribution, abundance, and features of different habitat types they depend on, is being addressed through two complementary methods – village logbooks and joint monitoring teams (JMTs), each with different limitations and assumptions. Certain suggested indicators, such as 'presence / absence of a species at particular locations', can be similarly monitored by both methods, while others are specific to either logbook or JMT monitoring. Suggested indicators to be used with logbook monitoring are presented in Table 1, those for JMT field monitoring in Table 2. Details of the two methods, their underlying assumptions, applications, and limitations are discussed in the following sections.

8.2 Village logbooks and opportunistic information

Local people mentally note sightings or signs of wildlife and other ecological information which they observe in their daily activities. A wealth of opportunistic information is generated over time, and if recorded systematically in a simple format, would constitute an important form of monitoring in itself. This is the rationale for introducing a village logbook for key villages to record information that can be assessed periodically with PA staff. The logbook information is a focal point for discussion as well, between staff and local people.

Logbook records as envisioned here are essentially a form of 'checklist', an important but under-used tool for the inventory and monitoring of animals, in which locations are chosen by the observer rather than a statistical sampling framework (Droege *et al.* 1998). In this case, the observers are local people going about their daily and seasonal activities, and the observations are opportunistic. In some western countries, checklist data are gathered by amateur or professional naturalists, for example during bird-watching trips or outdoor recreational activities (see Baillie 1991). Although the observers' motives may be different, the data sets from logbook monitoring and checklists contain the same core information (species, observer, location, environmental and habitat variables) that Droege *et al*. (1998) cite as necessary for the effectiveness of the method as a monitoring tool.

After results were returned to key villages in Xe Pian and Phou Hin Poun, a limited number of species were chosen for logbook monitoring. These have included from four to ten larger birds and mammals (focal species). Information to be recorded about the species includes: species, location, habitat, number of animals if sighted, estimate of numbers of animals if signs seen, observer, date, and notes on sex and age of individuals if known. These data categories were chosen through discussion between staff, local people and the author in the villages. A table was drawn into a bound book by staff and local people together. Some villages suggested adding additional table headings to more precisely document animal sign.

Recent actual examples were recorded immediately so that everyone understood how to use the table.

Members of the JMT, if one exists in that village, may or may not be involved in recording information, but it is best if one person or a small group maintain responsibility for the book. In villages in Xe Pian and Phou Hin Poun, it was decided that the recorder(s) would simply note down villagers' observations of the focal species once per month, at monthly village meetings. This requires a minimum of additional work or effort for local people.

8.2.1 Assumptions, limitations and possibilities of logbook monitoring

The major assumptions with this method are that local people are capable of identifying and mentally noting the species in question, remember the details of the record, remember to report it to the logbook recorders, and that no factors predispose them to manipulate their findings.

Limitations regarding monitoring include the fact that numerous observers may report records, thereby potentially injecting a large degree of bias into the data arising from wide variability in local peoples' experience with wildlife and identification skill. This is less of a problem for actual sightings (such as large water birds), but will be significant for species usually recorded by signs (such as wild cattle and tigers). Until individual observers' identification skills are evaluated (such as through joint field surveys), it may be necessary to simply record target groups, such as "ibis", or "wild cattle", for those species that are not readily differentiated.

Difficulty with sign identification is related to the second major limitation of logbooks: differences between habitat types, substrate, and subsequent variability in encountering or detecting wildlife and their signs. For example, a record of a species in one location but not in another may be an artifact of differential ability to see the species or its sign due to different habitat visibility and substrate conditions. However, logbook records will be most valuable for monitoring temporal trends, so this factor is less important provided the same areas and seasons are compared.

To address these limitations, the information in the logbooks should undergo three filters, in a periodical assessment process (every three months for example) which should be the function of the JMT and protected area staff. The first filter is that of the reliability of individual observers, each of whose names are recorded next to each record. The JMT members, being the most experienced with wildlife, can assess the reliability of each record through personal knowledge of the observer's skill and credibility.

The second filter should be an interpretation of how habitat might affect the accumulation of records for different species in different locations. For example, does the lack of records for banteng in location X indicate their absence, or is it known (through local knowledge,

previous ecological surveys, and subsequent JMT surveys) that habitat types and substrates there simply make detection of their signs difficult.

The third filter relates to the observer's activity when the sighting was made. After recent analysis of logbook information in one village, the author realized the necessity of adding this information, which was not considered during the initial design of the logbook data categories. 'Observer activity' should be an additional column in the logbook data table, because it influences the probability of what species are seen and when. For example, fishing activity along certain streams in the dry season may facilitate observations of giant ibis, while rattan collection in the cool season in locations distant from mineral licks might fail to notice sambar concentrations. Observer activity can also be related to time spent in a particular location – another factor bearing on encounter probability.

The fact that logbook information includes the animal's location and habitat, and the observer's activity (to be added), will increase the usefulness of records for monitoring (Roberts 1991), and will assist interpretation by the JMT and staff in their periodic analysis of the logbooks. Another positive aspect of logbook data is that it can be correlated with the maps that accompany the logbooks and remain the property of key villages. This will need to become a consistent feature of data analysis, and will become easier as locally named locations and habitat blocks are mapped through JMT surveys (see next section), a process that has started in one village in Xe Pian. Data in map form will improve their potential value and usefulness because records may be related retrospectively to variables affecting species distribution and abundance not yet discerned at the time of their documentation (Roberts 1991). Such variables might include environmental change, wildlife-habitat relationships, aspects of reproductive ecology, dispersal and migration, land and resource use practices, and outsider disturbance.

8.2.2 "Traditional" vs. "community" monitoring

Some readers may argue that the methods proposed above are less than adequate because: (a) allowing local interpretations and priorities to influence decisions may not address PA priorities, and (b) the monitoring approach lacks scientific rigor. These arguments will be briefly addressed in turn.

In the initial stages of PA management in Lao PDR, it is more important that a framework for monitoring be established, one that includes those who may be affected by the findings of that monitoring – local people. If local people can be meaningfully included, and positive reinforcement gained through success of initially simple methods, then both sides may move forward in addressing more difficult or contentious issues. The approach recommended here is intended as much to build trust and understanding, as it is to monitor wildlife. Having that foundation established will help advance PA priorities.

Experiments in Xe Pian PA by the author (Steinmetz, in prep.) indicate that establishing a repeatable sign index, with sufficient statistical precision to track trends, requires more kilometers of 'transect distance' than staff or local people can realistically be expected to walk. This is not to say that a sign index, or other replicable monitoring method which can generate precise data, is not worth the effort [see section on Joint Monitoring Teams below,

for suggested possibilities] - simply that a less structured approach is more appropriate initially. Despite these statistical challenges, the community monitoring approach outlined here can provide data sets which are comparable over time and between areas (depending on habitat similarity and other qualifying factors). Comparison between years will be the main strength of the program; comparisons between different seasons and different areas is more problematic due to the limitations described above in section 8.2.1.

Theoretically, village activities in any one time period represent many hundreds of kilometers of "transect distance" walked, although it would be unrealistic to try to measure this. However, if surveys are used to determine presence/absence or relative abundance, but not absolute numbers or population densities, then transect distance is simply a denominator of search effort, which could be substituted by other measures of search effort as long as they are replicable. The method suggested here relies on a broad measure of survey effort in units of time, and can be used in two indicators, presented in Table 1.

8.2.3 Logbook monitoring indicators

First, the continued presence or absence of focal species, in different locations and over time, can be monitored. Second, by combining numbers of observations and a measure of survey effort such as 'seasons' or 'one month periods of (typical) villager activity', an index of relative abundance might be tracked. This is similar to one of the indicators recommended by Wangwacharakul *et al*. (1996): "Changes in number of sightings of designated species in specified locations for a constant number of informants." Obviously, comparisons must be made with qualifications of how much villager activity took place in an area in a certain month. As many village activities are seasonal, however, same months in different years should often be comparable. Relative to the scarcity of monitoring systems of any kind in the region, that are actually in place in the field, such data would be a significant start.

Table 1. Indicators and methods in a community logbook monitoring system

Indicator	Method	Monitoring protocol
Presence/absence of focal species at a particular location, in defined time periods	Village reports of signs/sightings recorded in log book	Over time – same month, season, or village activity period, in successive years
Relative abundance of focal species in defined time periods	Village reports of signs/sightings, and search effort, recorded in log book	Over time – same month, season, or village activity period, in successive years

Given the low density of many of the focal species in Lao protected areas, a large survey and sampling effort is required to monitor their distribution and status. Logbook monitoring taps into local "survey effort" already deployed in the field. Failure to systematically collect local observations would amount to a lost monitoring opportunity, and furthermore, it ignores the potential benefits towards co-management which the overall process can promote. Therefore, despite the limitations of the method, it is better to acknowledge them, address their influence on the validity and usefulness of the data, and work towards refining the method, such as through use of the data filters suggested, to mitigate or diminish those limitations.

8.3 Joint Monitoring Teams (JMTs)

Among the local people living around the PAs are local naturalists i.e. local people knowledgeable about the biodiversity of the area. Through the ecological and PBA surveys, capable and interested individuals who fit this description have been identified in the key villages. These people have formed the core of small Joint Monitoring Teams (JMT's) to act with PA staff and (at least initially) outside assistance in the field implementation of simple monitoring programs.

In Xe Pian PA, local villages chose two or three people, often the same local naturalists who accompanied the surveys, to form the JMT. One village decided to rotate the membership in order to spread the experience to more people [but see next section regarding the undesirability of JMT member rotation]. The role of the JMT is to accompany PA staff in mutually agreed upon follow-up surveys, and eventually field monitoring work, which might take place once or twice per year.

So far JMT surveys have occurred with three villages, all in Xe Pian. The process in Nongkhe village was typical of the sequence of activities. After returning of results in Nongkhe, discussion focussed on areas that surveys had not previously reached, but that villagers thought were important to large mammals and endangered water birds. To gather additional information from those areas and coordinate the documentation of local sightings of wildlife and their signs, the JMT idea was proposed. A JMT was formed and its first task was to survey the selected area, gathering information about habitat diversity, distribution of gaur and banteng, the status of large carnivores and locations of waterholes and mineral licks. They also surveyed the locations of previously unmapped waterholes. Discussions with the village headman and other community members followed, continuing the process of returning results and refining mutual understanding of the local ecosystem.

The other JMT surveys in Xe Pian to date, with Taong and Phonvisai villages, returned, in the rainy season, to areas previously surveyed in the dry season.

In the future, the JMT's may also help perform more "traditional" enforcement oriented activities, such as patrolling.

In all cases, the JMT members should be paid for their *time* in the field, not simply for their role as a JMT member. Payment for data and information should be strictly avoided in collaborative management.

8.3.1 Assumptions, limitations, and possibilities with JMT's

This method is based on the establishment of a group of local naturalists, who participate in field surveys and monitoring with PA staff on a consistent basis as determined by monitoring objectives and time available. First, it assumes that select local people, together with PA staff

have the capability to add to baseline information, and collect data useful for monitoring of wildlife and habitats. Second, it assumes that staff will have or make time to visit key villages where JMT's are established and undertake fieldwork with them.

The second assumption is validated somewhat by the work plans of the staff for Xe Pian and Phou Hin Poun, which dedicate up to three separate village JMT surveys in the coming dry season, to map critical habitat features and explore regions not visited by previous surveys.

The first assumption can be divided into (a) capability to undertake further baseline surveys, and (b) capability to implement and follow through with a field based (as opposed to logbook based) monitoring system. Both of these, but especially field based monitoring, will require outside technical assistance for at least a year, which exists in both Xe Pian and Phou Hin Poun.

So far, JMT fieldwork has essentially been in the form of additional surveys to augment existing baseline information. In the case of Nongkhe village the intention was to explore regions still not surveyed (but regions with which local people are familiar nonetheless) to map critical habitat features such as waterholes, note the presence and distribution of different forest types, and record the presence of large mammals and water birds. For Phonvisai and Taong villages, the JMT's re-visited study areas in a different season from the initial ecological survey, to assess seasonal differences in large mammal distribution and relative abundance. In all three JMT surveys, wildlife abundance was assessed with the same sign-based method used in preceding ecological surveys by the author (in which sign encounter rates are used to assign a qualitative relative abundance class to each mammal species). The information therefore complements existing relative abundance data, and helps to complete a picture of the status of the wildlife community over an annual cycle.

The JMT work so far has not approached actual monitoring: The Nongkhe JMT performed an additional survey (i.e. they explored a new area), while Taong and Phonvisai JMT's undertook surveillance (i.e. they returned to previously surveyed areas in a different season), defined as a series of surveys to ascertain the range of situations that might be encountered over time (Hellawell 1991). Additional surveys and surveillance are necessary prior to implementing field based monitoring mainly because the previous ecological surveys have been spatially limited relative to the large sizes of the protected areas (Xe Pian – 2600 km^2 and Phou Hin Poun – 1600 km^2), and temporally limited mainly to the dry season.

Regarding species distribution then, existing information for many of the focal species represents a reasonable baseline from which to assess change in indicators related to continued presence. It is not assumed that existing observations are representative of the ecological status of the wildlife community in areas still unexplored. It is uncertain to what extent existing data is representative of other indicators of population status, such as relative abundance, because in most cases, surveys have been done in just one season of one year. Another year of JMT surveys and possibly seasonal surveillance, to better define the baseline status of wildlife and habitats, has been planned before systematic field monitoring will proceed.

The ‘completeness’ of baseline information is of course a relative term, but here is defined as the point at which surveys have spatially covered the range of habitats and critical resource areas in which the focal species exist, in sufficient detail to clarify their presence / absence and relative abundance in each of those areas. Seasonal surveillance (i.e. outside of the dry season) may be a less important precondition for the start of field based monitoring, because dry season results from different years can be compared without knowledge of the rainy season status of the species, although such information will eventually be desirable for management.

8.3.2 JMT methods

Once baseline presence / absence information is relatively complete, there are two possibilities for the structure of future field-based monitoring.

(1) *Repeat surveys*: With the acceptance that monitoring can be defined as surveying over time to detect changes (Hellawell 1991; Roberts 1991), JMT work might entail returning to the same campsites in the same and different seasons, and employing the same methodology as used by the initial field surveys (see Steinmetz 1998). This methodology relates numbers of observations of animals and their signs to survey effort (measured as number of days per site), in order to assign species to one of five relative abundance classes, depending on the frequency with which it (and its signs) was detected. Changes could thus be monitored against the established baseline abundance classes where they have already been assigned for different species.

Problems with interpretation of perceived changes in abundance classes include the fact that the baseline data was generated mostly through fieldwork of the author himself, and future JMT repeat surveys may use different observers with different levels of skill, and possibly varying degrees of enthusiasm to perform the same physically demanding, spatially extensive foot surveying. However, with attention to re-visiting the same locations at each site (such as particular waterholes, mineral licks, and watercourses), repeat surveys can track continued presence of a species, and at least provide a rough indication of its abundance relative to previous field work.

(2) *Sign transect surveys*: This method relies on using animal signs to indicate relative abundance and population trends, and is more rigorous because bias is minimized, and precision enhanced, through strict standardization of (a) survey effort - which is measured in numbers of kilometers, and (b) survey area - which is along permanent transects.

Two important elements of bias that exist when interpreting animal signs include (a) variation in individual observers skills, and the related problem of (b) difficulty in assigning groups of multiple signs to numbers of individual animals. Sign transects provide the possibility to minimize these sources of bias, such as by subdividing transects into segments (perhaps 100m each) and counting the frequency of segments with sign of different animals, rather than attempting to count each individual sign (Duckworth & Hedges 1998; Karanth, 1999).

Further training and supervision is required for either method (repeat or sign transect surveys), along with the creation of field tested Lao-language data forms. The reliability of both methods for monitoring can be improved by using the same observers each time (JMT member rotation should thus be avoided), standardizing the locations and survey effort (whether in time or distance), and repeating the surveys in the same seasons during similar weather conditions.

Each of the methods has different limitations and provides different opportunities which make one or the other more suitable depending on the target wildlife species. For wide-ranging herbivores like wild cattle (gaur and banteng), the repeat survey approach will be more appropriate, with survey locations and effort partially directed and informed by the accumulated logbook records (an example of how logbook monitoring and JMT activities complement each other). For tigers and their prey, transect monitoring along streams, trails, and possibly ridges is more appropriate (Karanth 1987). Ideally both methods could be used in conjunction, but this may be too complicated, at least initially because two forms of data are produced.

8.3.3 JMT monitoring indicators

Five indicators to be tracked through JMT monitoring are suggested in Table 2. The first – 'presence/absence of species at particular locations' – is also the basic indicator used with logbook monitoring. Theoretically, logbook monitoring could stand alone, but JMT field work in conjunction can increase the accuracy and detail of coarse logbook data. Because the two methods are independent, one could observe the degree to which they support the same conclusions about the status of wildlife, representing a cross-check to test data accuracy.

Indicators 1, 2, and 3 in Table 2 are considered in this discussion to be 'basic indicators', in that, relative to indicators 4 and 5, they:
(a) require the least complicated analysis (and provide the least detailed information)
(b) include little mathematics in their calculation or interpretation
(c) are accessed through simpler documentation

For these reasons they will probably be easier to begin with as JMT field monitoring commences.

Indicators 1 and 2 are very similar because they are assessed through the same data set: whether an animal is or is not found at a site. They have been separated to emphasize different ways of looking at the presence / absence information which inform them.

The indicator 'changes in spatial distribution' is especially relevant for monitoring the status of low density large carnivores like bears (Servheen *et al*. 1999) and tigers (Karanth 1987). It can be defined as changes in number or percentage of surveyed sites at which an animal is found. Changes in the spatial distribution of a species are expected to indicate the expansion or contraction of a population as it responds to management, not just spatially, but also in

numerical terms. For example, if found at a location from where it was previously absent, this may indicate a population's recovery. As discussed previously, quantitatively measuring population size and changes to it may be prohibitively difficult. Data for this indicator are more realistically gathered than population numbers, but even so, the rarity of many of the focal species in Lao PDR will probably necessitate a high survey effort before sufficient data were available.

Data to measure the third basic indicator – 'the proportion of available high quality habitat occupied by a species' – are also accessible through JMT methods (especially when combined with logbook records). This indicator similarly depends on determining whether a species is present or absent, but requires additional ecological understanding of what constitutes high quality habitat for that species. Another consideration with this indicator, pointed out by Duckworth & Hedges (1998), is that for many animals, high quality or optimal habitat can be more a function of relative freedom from humans than other perceived ecological features.

Indicators 4 and 5 are quantitative expressions of relative changes that occur in species population status. Their use will require more training and supervision before staff and local people (and indeed outside advisors) will be able to perform the accompanying methods, analyze the data, and assess their meaning.

Table 2. Indicators and methods in JMT monitoring

Indicator	Method	Monitoring Protocol
1. Presence / absence of species at particular locations	Repeat surveys	Each dry season (same month and weather conditions)
2. Change in spatial distribution of species	Repeat surveys	Each dry season (same month and weather conditions)
3. Proportion of high quality habitat occupied by species	Repeat surveys	Each dry season (same month and weather conditions)
4. Change in frequency of transect segments with signs of species	Sign transects [survey effort in distance]	Each dry season (same month and weather conditions)
5. Change in encounter frequency of signs/sightings of species	Repeat surveys [survey effort in time]	Each dry season (same month and weather conditions)

The monitoring protocol in Table 2 indicates the dry season as the preferred time period for field activity. This is a reflection of the author's observations of seasonal differences in the willingness and enthusiasm towards fieldwork displayed by PA staff and local people, rather than limitations imposed by the agricultural calendar or other causes. Although true that logistical difficulties are sometimes quite severe, the rainy season should not be ignored if possible because it presents unique monitoring opportunities, especially for the repeat survey method. For example, gaur may be more easily observed at that time due to their concentration at mineral licks, bamboo feeding areas, and grasslands (depending on the month), and because they may be less nocturnal (personal observations and unpublished data).

8.4 Putting logbook monitoring and JMT monitoring together

As mentioned above, logbooks and JMT's are complementary, such as when logbook data is used to direct and inform survey effort and survey sites. Logbook records, besides providing a form of monitoring, also represent additions to baseline data, filling in gaps regarding presence of wildlife in different areas.

Changes in the array of suggested indicators (Tables 1 and 2) may indicate responses of a wildlife population to changes in, or effects from, one or a combination of: (a) environmental factors, (b) species-specific density-dependent factors, (c) degree or type of direct human threats, (d) resource and land use practices of local people, and (e) management actions. It is important for a monitoring program to be able to discern the cause of changes once detected, such as by combining information on relationships of wildlife with different habitat types and the land use practices which influence those habitats. This ability will be enhanced as locally defined spatial regions, habitat blocks, and local peoples' activity patterns continue to become more evident with the accumulation of logbook records and JMT mapping. It will also be enhanced through continued attention to, and inclusion of local knowledge as previously described. This in turn requires that the process in Figure 2 continue to be followed. Results from each phase of logbook assessments, and data from JMT repeat surveys or sign transects, must be returned to the communities to elicit local interpretations and refine a mutual understanding of the status of the focal species and larger ecological community, and reasons for change where it has occurred.

9. THE CURRENT SITUATION

Having started in one village in Xe Pian, the process of returning results, and the establishment of logbook monitoring, JMT's, or both has now been initiated in five key villages in Xe Pian, and five in Phou Hin Poun. The author held a field-based training workshop in January, 1999 for three staff each of Phou Hin Poun and Xe Pian, plus two additional PAs, Dong Phou Vieng and Xe Sap, in which PBA's and ecological surveying had been completed or were scheduled. Field application of the methods was practiced using actual Phou Hin Poun data (the workshop was held at the Phou Hin Poun headquarters), which was then returned to five key villages in the PA. Xe Pian staff who had previously practiced returning results and establishing community monitoring in their PA helped facilitate the workshop, and shared their experiences in implementing the methods. A broader cross-section of staff have thereby gained an understanding of the reasoning, approach and methods behind the process in Figure 2.

The author helped Xe Pian staff to facilitate the establishment of monitoring with the first three villages in which the system was initiated. Following the training workshop referred to above, however, the staff have worked without outside assistance with two additional key villages to start log-book monitoring and establish JMT's. In Phou Hin Poun, community monitoring was begun in five villages as part of the training workshop held there.

Although its origins are recent, a look at how the process has been evolving since the training workshop has identified current and potential constraints to its acceptance and application, as well as ingredients for success. Discussions with the staff of Phou Hin Poun and Xe Pian were held in July 1999, seven months after initiation of activities in Phou Hin Poun, and over a year after the first JMT was established in Xe Pian, in order to address these points. Details of the data from village logbooks were also assessed with staff. Phonvisai village in Xe Pian was visited to assess logbook data directly with local people, and discuss aspects of its collection and application.

The staff of both PAs consider the maintenance of logbooks, and future surveys by JMT's, to be important elements of management of the areas. This is manifested in their workplans for the future which now include significant components devoted to:

a) expansion of the system to include additional villages (in Phou Hin Poun only)
b) follow up visits to key villages for logbook data analysis and refinement with local people
c) JMT field surveys

While the plans being developed by PA staff are notable for the importance they ascribe to continuation of the process, it is important to begin to assess the realities of the monitoring systems in the villages where they currently exist. Questions which need attention include:

a) *Social issues* - How does the social context in which the monitoring systems are inevitably set determine their sustainability and the maintenance of local / PA staff interest? For

example, are development interventions, concurrent in some key villages, affecting the success or failure of local participation in monitoring? How much of a burden for local people is maintaining the logbooks? How often should staff make follow up visits to key villages? To what degree is there a danger of data falsification by local people?

b) *Scientific issues* – How useful are the logbook data for monitoring presence and absence, and trends? How useful are the data for raising ecological questions, informing hypotheses, and directing future JMT field surveys? How can the data and its collection be refined and improved to provide more useful information for management?

These questions are directly or indirectly related to the degree of collaboration in management that is attained, and the value for management of ecological monitoring and the data it generates. Although too early to answer all the questions above, it is useful to try and gauge each one's importance and bearing on constraints and opportunities which staff and local people face in undertaking the approach described in this paper.

10. SOCIAL AND INSTITUTIONAL CONSTRAINTS, AND OPPORTUNITIES

10.1 Follow up by protected area staff

The level of attention that PA staff give to following up logbook monitoring with local people will be a factor determining the long-term success of the system. So far, Phou Hin Poun and Xe Pian staff have returned to visit key villages infrequently, at which time information in the logbooks has been a focal point for discussion with local people. Frequent visits are precluded by the remoteness of most of these villages, and the workload of the staff which includes training courses, moving into new field stations, and implementing the Lao government priority project of "land and forest allocation".

10.2 Perceived importance of monitoring

Recent interviews with staff showed that they perceive both the immediate and potential importance of logbook data, another factor that will influence the consistency and frequency of their visits to key villages. For example, Phou Hin Poun staff regard the importance of logbook data in terms of its clarity and more systematic structure, as opposed to verbal accounts of wildlife records which lose detail and accuracy. They also noted the potential of logbook monitoring to reveal trends in wildlife status, information they would find with difficulty on their own. One reason that staff relate positively to logbook monitoring is that they are accustomed to discussing anecdotal information about wildlife with local people and already acknowledge the importance of this source of information. Seeing the same information written down in a format that they helped devise has seemed to accentuate the importance of village data. However, they are still not clear about how it is to be used, as witnessed by their inattention to recording any of the information in their own notebooks for discussion back at their field stations.

10.3 Putting data to use

As discussed previously, involving local people in data collection and surveys for monitoring purposes is intended to help establish and maintain positive relationships, and enable management decisions to be made through common understanding and collaboration. In the initial stages, these benefits are still more or less intangible. Actual application of the data that emerge through logbook records and JMT field surveys will probably make them evident, however, and may be important for sustaining the system. Xe Pian staff intend to undertake JMT field surveys, informed and directed by logbook data, to map important waterholes for large water birds, whose presence or absence at different locations is becoming clearer through assessment of village logbooks. This is one example of how logbook data may be used in actual field work. The combination of logbook monitoring and JMT surveys in the process depicted in Figure 2 may eventually inform species or location-specific protection measures, which would be another tangible output of the monitoring system and its data. Monitoring the effectiveness of those future conservation measures will also be an important function of the system.

10.4 Local interest and ownership

One question sometimes raised about local involvement in monitoring is: Why should local people participate? This is obviously a crucial consideration as it affects the degree of co-management which will be possible – if local people are a part of the monitoring activities simply because they are told to be, then there is no ownership of the information and a minimal sense of pride or responsibility in being a part of the protected area. Theoretically, monitoring could focus on wildlife species or areas that are economically important for subsistence. This would support the argument, for example, that maintenance of a source of game, for the long-term benefit of local people, is one of the benefits of their participation. Species to be monitored in the future may include more game animals like barking deer (*Muntiacus* spp.), and already do in two villages in Phou Hin Poun. In most cases, however, the focal species chosen in each village include primarily large mammals and birds which are not directly important in local livelihoods.

So why are local people interested or willing to participate? The answer is partially found in the veil of power relations which inevitably exists between protected area staff – as government officials – and local people. This veil is present despite even the most sincere efforts to diminish it, and local people's participation will, at least initially, be influenced by their uncertainty of the intentions of outsiders, and a desire to minimize what they perceive as potential risks to their livelihoods. For that reason, they are inclined to participate in monitoring activities, and choose focal species that they already know (through protected area conservation education and extension activities, and a long-term and widespread protected species poster campaign in Lao PDR) staff and outsiders will be interested in. It will be important to consistently work to peel layers from this veil of power relations, a process further advanced in Lao PDR than many countries in the region (which have been adding layers) because of the recent creation of protected areas, the Lao government's professed intention to include local people in management, and the adherence on the part of the field level staff to that policy.

10.5 Stakeholder relations

In many cases, protected area staff in Xe Pian and Phou Hin Poun are *friends* with local people, a management asset that is being further advanced through local involvement in the survey and monitoring process. The staff feel that maintaining interest of local people in monitoring or other activities can be assisted sometimes simply through keeping up friendly relations, even spending time in traditional Lao drinking sessions with liquor purchased by the staff. Experience with more highly developed community wildlife monitoring and management systems in Africa has shown that their viability partly depends on reducing suspicion which local people may feel towards state authorities (Marks 1994). The positive interaction which the author has often witnessed between villagers and PA staff in Lao PDR erodes or obviates suspicion and hostility and is therefore believed to be an important ingredient for long-term success.

10.6 Material benefits for local people

Still, local people's involvement does not depend on psychological factors alone, a fact of which the protected area staff are well aware, and have started considering. They feel that small gifts, to acknowledge the participation of logbook recorders and JMT members, should be given. The staff think this will help sustain interest of local people with tangible benefits. These should be useful articles, such as ponchos, rubber shoes, or shirts, which would contribute to the very field surveys of which they are given in recognition and appreciation. Protected area staff are strikingly careful to identify the potential negative effects of fomenting favoritism or dependence and distinguish how types of things given, and the way in which they are presented to local people, can affect their relationship with villagers. Obviously these issues can also affect the motive behind local people's participation as well, but so far this appears to be less clearly considered by staff members.

10.7 Development interventions

The monitoring activities with local people which this paper documents have not occurred in a vacuum; in many of the key villages in Xe Pian small scale development initiatives, supported by the larger FOMACOP project, have been started or their possibility discussed. These have included water pumps, building materials for schools, and linking villages with sources of improved fruit trees and health care. It has never been the intention to explicitly link participation in monitoring with provision of development assistance, but it is possible that in local peoples' eyes, the good relationship which has been developed with protected area staff and outside advisors (who local people associate with government officials), together with the physical benefits that these outsiders help support, is an incentive to participation as well.

Will the sustainability and success of participatory monitoring be dependent on development support? This remains to be seen, however the initial positive response to the establishment of logbook and JMT systems, even where development interventions had not yet been alluded to, suggests that the acceptance of monitoring by local people as a collaborative activity is supported by means other than solely anticipation of material benefits. Logbook monitoring in Phou Hin Poun was established in villages without reference to future development projects or monetary awards. Follow up visits four months later to two key villages showed over 50 logbook data entries for the focal species, indicating that enthusiasm and interest of the local people (at least in the early stages) can be sparked given the existence of good relations, and perhaps other factors not yet realized.

10.8 Obviating and resolving conflicts

As the cycle of participatory monitoring proceeds, conservation agreements may emerge, which are based on common understanding of why they are necessary, what form they should take (i.e. modifying behavior, protected zones, seasonal limits), and how they should be applied (by correlating ecological and resource use information). The *way* that conservation agreements are generated – through partnership in surveying and monitoring – will elevate the importance of that process as its power to obviate potential conflicts becomes more apparent.

For example, JMT monitoring data together with a clearer understanding of local peoples resource use patterns, may indicate that the collection of Dipterocarpus tree resin by villagers does not endanger giant ibis nesting activity because nesting (rainy season) and resin collection (dry season) occur in different seasons. In this case, the potential conflict resulting from a PA decision to prohibit resin collection would be avoided. It is also expected that conflicts which do develop will more likely be resolved through the collaborative process as well.

In the longer-term then, the participatory monitoring program is expected to intrinsically generate and maintain the interest of local people and PA staff, as its role in obviating and resolving conflict becomes more obvious. This will only become reality with the commitment of time and energy by staff and outsiders with local people, especially in the early stages of implementation. This ingredient, referred to above, is crucial for the success of participatory monitoring as being implemented in Lao PDR: without it, interest may wither before the usefulness and benefits of monitoring become apparent.

10.9 The role of government

It must be recognized that the opportunity to initiate the approach presented here has been made possible largely due to an enabling policy environment. In addition, important legal issues, such as secure land tenure, which Lao policy does not ensure for local people in PAs are not discussed in this paper. Ultimately, the legal instruments that finally emerge in Lao PDR could have great influence on the amount or quality of participation by local people. There must be efforts at the national level to establish positive and realistic conservation policies which advance participatory approaches to protected area management, without which co-management is unlikely to succeed (Renard 1997).

Additionally, there must be national, and especially provincial and district level government commitment to the philosophy of participation, and support for the practice and application of co-management. Failure by the government to provide or maintain these foundations in the future poses incipient threats to the success of initiatives such as the one documented in this paper. Although at present there is political space to pursue participatory agendas in Lao protected areas, the degree and forms of local participation which ultimately evolve, and the limits to be imposed upon it by government, are still open questions in Lao PDR.

11. CO-MANAGEMENT OPPORTUNITIES

The survey work and subsequent participatory monitoring activities described so far have been under implementation for little over one year. They have not reached the point of informing voluntary conservation agreements such as species or area protection measures. In Xe Pian PA the process has been in place longest, however, and further work by PA staff, following up closely with key villages, could potentially see the formation of basic agreements about species and area protection in the near future. It should be kept in mind that follow up surveys and logbook monitoring activities which have been initiated are considered to be an initial form of co-management agreement between PAs and local people. More refined agreements pertaining to individual species, specific locations critical to wildlife, or local resource use practices are more likely to emerge after two or more cycles of the process depicted in Figure 2.

The initiation of co-management described so far has relied upon the use and refinement of information through the process of returning results, eliciting local interpretation, and establishing simple monitoring procedures. As the cultural and ecological data sets become more complete, other types of conservation opportunities may become apparent, through comparison of ecological and cultural information. This section describes possibilities for using these two types of information in the search for co-management opportunities, with examples from the project PAs. These possibilities have been recommended to Lao PA staff for follow up study, but to date have not been taken past theoretical application.

The combination of ecological surveying and PBA work produces two main sets of information. One set is ecological, pertaining to wildlife species and their habitats. The other is related to cultural aspects of local peoples' presence - or human ecology. The PBA starts to uncover traditional resource management systems, rules and restrictions, cultural values, spiritual beliefs, or anything else linked to conservation. The use of this cultural and human ecology information, and its potential link with ecological information will be examined next.

11.1 Indigenous conservation

Even though local people may not invoke the term "conservation" verbally, they often maintain traditions, practices, and beliefs related to resource management in which the concept is inherent. Through such existing practices or traditions, linkages may be made to PA conservation priorities. Local resource management practices may originate from:

- Consciously stipulated regulations
- Traditional norms of behavior
- Spiritual practices or beliefs

Whatever their origin, indigenous conservation practices are important to understand because they provide potential opportunities for collaboration between protected area staff and local people. When compared with ecological data, potential *points of intersection* may be uncovered, whereby local practices converge with PA priorities. If cultural information is overlooked, or relegated to the "social" sphere of management, potential opportunities for

collaboration which build on existing practices and simultaneously satisfy both local and PA priorities will be missed.

Table 3 presents information about local conservation practices and beliefs that emerged from PBA work with villages around Phou Hin Poun PA. These are examples of existing conservation practices, and may provoke ideas for discussion with local people about how existing practices can be linked to species or habitat protection.

For example, in Phou Hin Poun Protected Area, traditional conservation forests have been established in strips of semi-evergreen forest along bases of cliffs, to protect the habitat of villagers' betel (*Piper betel*) vines, the leaves of which are sold and represent an important source of cash income. Ecological survey information has revealed that these areas often overlap with the habitats of serow (*Naemorhedus sumatraensis*) and at least three species of primates. This example shows a point of intersection, where local practices, although not ostensibly related to wildlife conservation, converge with PA priorities which include protection of the habitats of endangered primates and serow.

Table 3. Examples of local conservation practices and beliefs: potential co-management opportunities in Phou Hin Poun Protected Area

VILLAGE	CONSERVATION PRACTICE / BELIEF
Phin	• **Spirit Protectors** in limestone areas
Nakhu	• **Community Forests** established to ensure wood supply and wildlife habitat. "Dong Houay Dua" – established 20 years ago. "Dong Tham Pha" established 10 years. Hunting and forest product collection allowed. Timber cutting restricted.
Sanak	• Long tradition (over 100 years) of conservation of semi-evergreen forest (SEF) along limestone cliffs. This **"betel-leaf forest"** (called Dong Tin Pha Nak") used mainly to provide habitat for betel-leaf vines (*Piper betel*) which require moisture and shade for optimal health and productivity. The SEF provides these conditions. Leaves sold in market. • **Sacred Spirit Forest**, about 10 ha., where village Protector Spirit resides. • Two **sacred caves** with restrictions on behavior and resource use in their vicinity. • **Buddhist days** twice per month – no fishing, no killing of other animals allowed.
Bouamlou	• **Sacred Spirit Forest** exists • **Betel-leaf Protected Forest** along bases of cliffs – similar to Sanak above.
Houana	• **Betel-leaf Protected Forest**
Na Heub	• **Sacred Spirit Forest** to south of village, called "Pa Nam Tieng," about three km^2. No agriculture allowed; other uses allowed. Unclear about hunting restrictions. • **Buddhist day restrictions** on digging, hunting, tree cutting.
Nathan	• Village initiated community **Conservation Forest** four-five years ago, inside Kouan Nong limestone area. • **Spirit Forest**
Nabon	• Village initiated **Conservation Forest** (complete with sign) four-five years ago, about 4 ha. Restrictions on tree cutting; timber use must be approved by village leaders. • **Spirit Forest** – no cutting or clearing. Other uses allowed.
Xong	• **Spirit and Conservation Forest** area in Kouan Khum, follows cultural traditions. Cutting must be approved by village leaders, and livestock sacrifice required. Hunting and collection allowed. Some village rituals conducted here.
Vieng	• Two village initiated **Conservation Forests** in Kouan Houay Sai, and Kouan Paew Kom, roughly estimated at 600 ha. Protected status now for 10 years. Timber use must be approved by village leaders. Hunting and other uses allowed. Reasons given for protection: (a) "preserve forest for future generations" (b) "protect wood supply" (c) "protect wildlife habitat"

	• **Spirit Forest** exists which contains **sacred cave** called "Tham Sao". All activities and disturbance in area prohibited. Cave is home to protected fish population said to be very large, and only caught when cave waters overflow in the rainy season.

Source: Steinmetz (1998)

By starting with existing practices and focussing on the positive aspects of local peoples' presence and opportunities they provide, the level of importance of local people in PA conservation efforts is elevated. This approach is more likely to foster a positive foundation for cooperation between local people and the PA.

Besides their immediate conservation value, existing concepts and customs of local conservation forests could be expanded to protect more areas and additional wildlife species. For example, many villages in Phou Hin Poun maintain conservation forests for resource or spiritual reasons. Ban Vieng in particular also maintains a protected cave which in turn preserves the dry season habitat and breeding population of economically important fish. The *concepts* inherent in these local practices – protection of habitat and wildlife populations - could potentially be expanded to include locations or species not presently covered. The important point is that some underlying conservation concepts exist already and are being applied; these are conditions that will enhance their relevance to future conservation priorities.

11.2 Paths of least resistance

As seen in the examples above, combining ecological and cultural information may help direct management efforts by providing windows of opportunity in which existing practices converge with national and global priorities in relation to wildlife or habitat protection.

Another way to look at points of intersection between these two sets of information is to find where they specifically *do not* converge. This may be an important approach in situations where local resource use patterns are seen as a threat to wildlife or habitats. Opportunities to initiate management actions may exist in those zones where wildlife values are high, but importance to the local economy or subsistence is low. Instead of focussing on locations of obvious importance to both wildlife and people, the approach suggested here starts with "easier" areas, where establishing voluntary agreements or other forms of management action may be less contentious. The intention is not to ignore conservation urgency in other, more "difficult" areas, but simply to initiate positive collaboration upon which the management of difficult areas can follow more smoothly in the future.

Table 4 compares the importance of different zones in Xe Pian PA to wildlife and local people. It appears that initial conservation actions in "easy" areas, such as the Bong Gaderll mineral lick complex (Location D), where wildlife values are high but its importance to local people is minimal, may develop positive examples of collaboration. Returning of results and discussion of voluntary agreements about protection measures in these "easy" areas, may be a smoother option than simply attempting to curtail local resource use in sites that are important to communities. Voluntary agreements limiting hunting in Bong Gaderll would be one management option for PA staff and local people to discuss. The possibility of extending such agreements to areas more important for local hunters, such as Bong Kalen (a more "difficult"

area) in Table 4, will be more likely when positive examples are already in place, such as for Bong Gaderll.

This approach may also provide a more neutral forum for developing local appreciation of national and global conservation values, as local people participate in decisions to conserve species with relatively minimal efforts on their part. Convincing or coercing people to change resource use habits or forgo opportunities in "difficult" areas will permit them little psychological space to begin understanding national / global concerns, especially regarding wildlife that they perceive as locally or relatively abundant.

The success and sustainability of altering resource use patterns, where required, will be more certain if a cooperative framework has been established, and practice in *doing* participatory management has been gained. More "difficult" areas or topics may initially be addressed through additional JMT surveys on habitats, species or resource use (see section 7.2), so as to allow more time and information to foster the growth of a common perception. Even where common conclusions do not emerge, the trust built will enable compromises to be more easily reached and implemented.

Table 4. Priority conservation areas and associated human activities in Xe Pian Protected Area. Conservation difficulty ranks potential difficulty of initiating conservation agreements as easy, moderate, or difficult, depending on relative importance of location to humans and wildlife. DDF=Deciduous Dipterocarp Forest, MDF=Mixed Deciduous Forest, SEF=Semi-evergreen Forest.

Location	Habitat	Wildlife Values	Human Activities	Conservation difficulty
A. North of Huay Kaliang	DDF mosaic with MDF, SEF, and Savanna-SEF island habitat	**High**: Wild cattle abundant. Important large carnivore community (tiger, leopard, dhole).	**Moderate to high**: Eastern part of area regularly used by Ban Xot in dry season for fishing, reptile capture and some deer hunting.	**MODERATE**
B. Ridge area between Xe Kong Plains and Main Block.	MDF-DDF mosaic; SEF with bamboo on ridge and base of ridge	**Moderate to high**: Important for wild cattle: "staging area" between DDF grass resources and mineral licks.	**Low to moderate**: Low level of use by Nongkhe village, but exact activities still uncertain. Villagers interested in conservation here	**EASY – MODERATE**
C. Bong Kalen mineral licks. Main Block.	SEF with wetlands, bamboo and grass patches. Mineral lick complex.	**High**: Heavy seasonal use by elephants, wild cattle, sambar, pigs. Tiger present.	**Moderate:** Limited hunting of certain primates, deer by Nongkhe and Taong villagers. Cool season trapping of ground birds. Forest product collection.	**MODERATE - DIFFICULT**
D. Bong Garderll mineral lick complex. Main Block.	SEF with mineral lick complex, bamboo patches	**High:** As above	**Low:** Little human activity believed to exist. Very remote from all villages.	**EASY**
E. Huay Jieng Hieng stream	SEF with many streams, and scattered, small	**High:** These licks important especially for sambar,	**Low:** Remote from all habitation. Taong and other villages visit	**EASY**

watershed.	mineral licks.	barking deer, pigs. Good habitat for otters, Asiatic black bear, and probably sun bear.	for fishing in dry season. Limited hunting during dry season.	

Source: Steinmetz (1997)

Tables 3 provides examples of local conservation practices and beliefs, while Table 4 gives a qualitative, preliminary review of the degree to which human resource use and wildlife habitats overlap. This information is intended to provide preparatory ideas for PA staff to explore further with local people, and highlight potential starting points for initiating collaboration. The intricacies of human ecology, however, are far from fully documented in any of the project PAs. It is imperative that PBA work continues with local communities to elaborate and refine an understanding of resource use and what influences it. This is a time-consuming job, but, as seen in examples above (Box 3), will be integral to the success of future area and species-specific conservation agreements.

12. CONCLUSION

The WWF-Thailand Programme Office, in its ongoing work in Lao PDR, has elaborated the importance of incorporating local people and their knowledge in the assessment of biodiversity and its management. By striving to involve communities in all stages of information collection and analysis, the approach and methods foster a relationship of trust and respect among outsiders, local people, and government staff, while building the social and scientific foundation on which sustainable conservation agreements and management decisions will depend.

Participatory Biodiversity Assessments together with ecological field surveys represent the first stages of collaborative management, and serve to initiate a process of information-sharing which has led to joint management actions like ecological monitoring. The use of village logbooks and joint monitoring teams to monitor focal species is still experimental, but with attention to identified constraints and ingredients for success, can prove to be a sustainable co-management initiative.

The focus on both cultural and ecological data helps to illuminate points of intersection, or the behavioral, physical and psychological domains where existing local practices of resource use or belief come together with protected area priorities.

Starting points towards collaboration such as these may seem inadequate given the urgency and scale of conservation priorities. However, the process described does not necessarily operate in isolation from other protected area management functions, which may be addressed simultaneously. These include land-use planning, mapping and documenting resource management practices, appropriate local development activities, conservation education, provincial ecosystem planning, and outside wildlife trade suppression.

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ACKNOWLEDGEMENTS

Thanks are due to the staff and local people of Xe Pian, Dong Phou Vieng, Khammouan Limestone, and Xe Sap protected areas, who are engaged in the difficult and complex process of working towards conservation of the natural and cultural values that their protected areas contain. The partnership of Ian Baird on the initial participatory biodiversity assessments was important for helping develop the methods and their application; and his practical experience and foresight regarding technical, scientific, and social aspects of working with local people have been a source of insights and ideas for the author throughout this project. The work presented has been facilitated by the Forest Management and Conservation Project (FOMACOP), under the direction of Bouahong Phantanousy (National Project Director), Bouaphan Phantavong (Assistant Project Director), and Bruce Jefferies (Technical Assistant). Ian Baird, Gordon Claridge, Will Duckworth, Guy Marris, Robert Mather, and Sejal Worah took time to thoroughly read earlier drafts of the paper; their extensive and insightful comments helped greatly to improve its contents. Thanks to Monowar Kamal at WWF for producing the map.