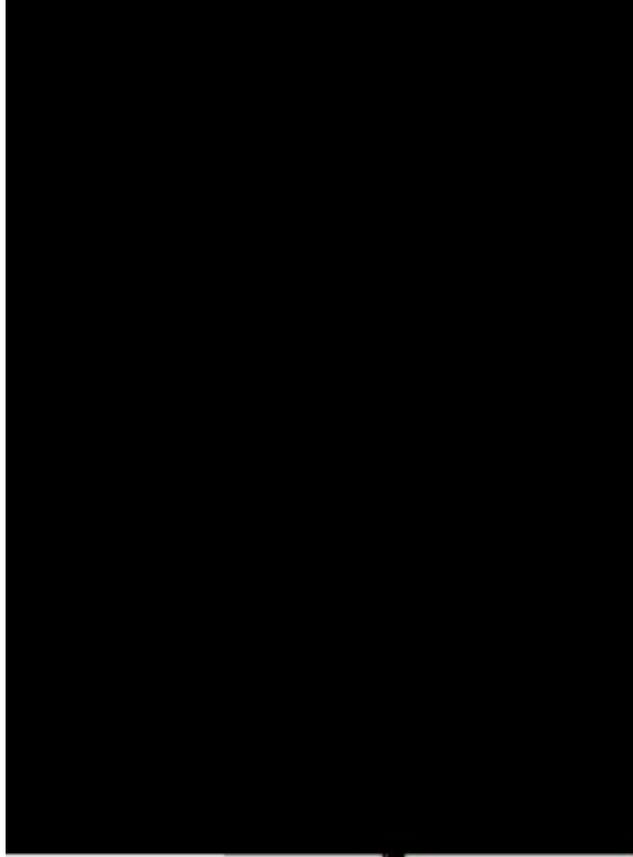


**A Preliminary
Wildlife and Habitat Survey of
Hin Namno National Biodiversity Conservation Area,
Khammoune Province, Lao PDR**



Conducted during December, 1995 and January, 1996

**Final report to the
Centre for Protected Areas and Watershed Management of the
Department of Forestry, Ministry of Agriculture and Forestry,
Lao Peoples' Democratic Republic**

R.J. Timmins and Khamkhoun Khounboline

Vientiane 1996



WILDLIFE CONSERVATION SOCIETY, New York

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ABBREVIATIONS

APR, Action Plan Rating [of turtles listed in IUCN/TFTSG (1991)]

BIMS (1996), Biodiversity Information Management System database, developed by J. MacKinnon/WWF Indochina. Data as of March 1996.

c., approximate[ly]

CPAWM, Centre for Protected Area and Watershed Management (formerly NONC)

DDF, Dry Dipterocarp Forest

EF, Evergreen Forest

GNT, Globally Near-Threatened

GT, Globally Threatened

LSFCP, Lao-Swedish Forestry Cooperation Programme

MDF, Mixed Deciduous Forest

NBCA, National Biodiversity Conservation Area

NHD, National Historical Decline *sensu* Thewlis *et al.* in prep.

NOFIP, National Office of Forest Inventory and Planning

NONC, National Office for Nature Conservation and Watershed Management

PPA, Proposed Protected Area (*sensu* Berkmuller *et al.* 1995)

RAR, species Regionally at Risk (for birds *sensu* Treesucon and Round 1990, for mammals *sensu* Salter 1993)

SEF, Semi-evergreen Forest

WWF, World Wide Fund for nature

Meanings of commonly used Lao words in place names:

Ban, village

Phou, mountain

Pha, limestone karst peak

Xe, large river

Nam, river/stream

Houay, seasonal stream

ACKNOWLEDGEMENTS

The survey was entirely funded by a grant from the MacArthur Foundation. We are particularly grateful to the staff of the Provincial and District Agriculture and Forestry Offices in Thakhek and Boualapha for their assistance in planning of fieldwork.. The staff of the Centre for Protected Areas and Watershed Management, are thanked for their unflagging assistance and advice, in all aspects and stages of the WCS Wildlife and Habitat Inventory Project, particularly Chanthaviphone Inthavong, Vene Vongphet, Saleumsy Phithayaphone, Sivanavong Siwathvong, and Boonhom Sounthala.

Cover Illustration: Francois' Langur *Semnopithecus francoisi* by Karen Phillipps

Executive summary

This report summarizes findings from an initial survey of Hin Namno National Biodiversity Conservation Area (NBCA) between December 1995 and January 1996. Hin Namno NBCA lies along the border with Vietnam between 17° 40' and 17° 15' N, to the south of Nakai-Nam Theun NBCA. The NBCA is approximately 865 sq. km and is predominantly karst limestone, interspersed with other habitat including pockets of tall Evergreen Forest. The limestone is contiguous with a similar area of limestone across the Vietnamese border, which is likely to be designated a conservation area. The survey aimed to make a preliminary baseline assessment of the NBCA's wildlife and habitat, in the context of its national importance and to identify the areas most critical management needs. The aim was not to produce an exhaustive species inventory, which would have required many person weeks of surveying by a larger team. Six areas were visited; four within the NBCA's northerly extent, and two along its southern boundary, each for a period of 1/2 to six days.

Despite the brevity of the survey important populations of several Key Species were found. Of greatest significance are Globally Important populations of Douc Langur *Pygathrix nemaeus* and Francois' Langur *Semnopithecus francoisi*. Encounter rates with five primate species were some of the highest recently found in Lao. Both Large-antlered Muntjac *Megamuntiacus vuquongensis* and Crested Argus *Rheinhardtia ocellata* were found. Both species are Globally Threatened and have very limited ranges, throughout which they are hunted. Crested Argus, a Globally Threatened species, is known in only three other NBCAs or Proposal Protected Areas (PPA) in Lao. Sooty Babbler *Stachyris herberti*, a species endemic to limestone areas of central Lao and central Vietnam, was found commonly at all sites visited. The species is found within only three protected areas in the world, making the population within Hin Namno NBCA Globally Important. Of areas recently surveyed, Lao, Hin Namno NBCA is one of only a few where four species of hornbill have been found. Large hornbills either wreathed *Rhyticeros undulatus* or Great *Buceros bicornis* were recorded almost daily, one of the few areas in Lao where this has occurred recently. Taken together with the presence of big cats and reports of wild cattle, Hin Namno NBCA appears to retain a reasonably intact wildlife community. Other interesting findings included a species of tit *Parus* which is new for Lao and a leaf-warbler *Phylloscopus* species which appears to be restricted to limestone areas of central Lao.

This is only one of two NBCAs in Lao with large areas of limestone, particularly karst formations. Two biogeographical aspects of the wildlife community make the area potentially very important for conservation. Firstly, the limestone is part of a homologous limestone formation stretching across central Indochina. Secondly, it is part of the Annamite mountain range. Both regions are biogeographically distinct and both have several endemic or near-endemic bird and mammal species, several of which have been recorded within Hin Namno NBCA. Such localised endemism suggests that other aspects of the faunal and floral community may be endemic and as both biogeographic regions are relatively small any endemic species are likely to be at a heightened threat globally.

Until recently an ethnic group lived within the limestone, which relied on small scale non-rice cultivation. As a result secondary vegetation probably occurs throughout the area. Currently, habitat clearance appears to be restricted to the periphery of the limestone, and is probably most prevalent in the south, including the southern Vietnamese border area where there is encroachment from Vietnam. Although the threat is only moderate on a national perspective, tall forest within the limestone is limited. Also threatening is the over-exploitation of certain natural resources, in particular rattan and *mai dam*, the fungus-infected heartwood of a species of *Aguilaria*.

Hunting occurs wherever there is human activity. It was not possible to identify critical sites or species at disproportional risk, however given the rarity of Douc Langur *Pygathrix nemaeus*, Francois' Langur *Semnopithecus francoisi*, and Crested Argus *Rheinhardtia ocellata*, any hunting of these species is of high concern.

During the American-Indochinese conflict the Ho Chi Minh trail crossed the Vietnamese border adjacent to both the northern and southern boundaries of Hin Namno NBCA, and wound around its western edge. The effects of the conflict on habitats and wildlife were probably very localised. Long-term degradation of habitat as a result of the conflict is not severe.

Hin Namno NBCA rates highly compared to other NBCAs in terms of its National and Global conservation value. Although not as important as Nakai-Nam Theun NBCA or Xe Pian NBCA, it is certainly more important than Xe Bang Nouan NBCA or Phou Xiang Thong NBCA. Previously, management of the area was considered a low priority compared with other NBCAs. Although the threats facing Hin Namno NBCA are only low to moderate on a national scale, its high conservation importance warrants that its management urgency is at least moderate to high in comparison to other NBCAs or PPAs. The conservation value of the area may be higher, and the threats facing it more serious than survey revealed thus further surveys are of high priority. Water sources and tall Evergreen Forest patches within the limestone deserve high management attention.

The flat lowland forest surrounding the NBCA may be of considerable conservation significance, if relatively undisturbed forest still occurs there. Forest at the headwaters of the Xe Bang Fai and along the Vietnamese border south of Hin Namno NBCA may also be of heightened conservation value. Both areas are also a high priority for survey.

Recommendations

- Focus management priorities on conservation of watersources and tall forest in or surrounding the limestone.
- Determine whether any people still live within the limestone, and stabilize forest clearance by them.
- Determine how much use of the area is made by the Vietnamese, and for what purposes.
- Prevent expansion of cultivation within the limestone area, working particularly with Ban Tasang, Ban Vangngnow and Ban Phasong.
- Assess commercial and semi-commercial non-timber forest product collection within the area, particularly the harvest of rattan.
- Control hunting of primates (particularly Douc and Francois' Langurs), hornbills and pheasants (particularly Crested Argus).
- Propose to the Vietnamese government that the Dong Phong Nha Nature Reserve is extended to protect the limestone along the international border adjacent with Hin Namno NBCA. Initiate discussion to limit encroachment upon Hin Namno NBCA by Vietnamese locals.

Further surveys are required to refine management recommendations. Areas particularly in need of survey are:

The south-eastern end of Hin Namno NBCA, in limestone close to the border.

The Xe Bang Fai river above the cave (to assess possible inclusion in the NBCA). [Areas] in the central southern border region of the NBCA.

Lowland forest to the west of Hin Namno NBCA particularly in the border region of [redacted] The district of Xaibouathong and Boualapha (to assess possible inclusion in the [redacted] NBCA).

The forested border area to the south-east of the Hin Namno NBCA around the headwaters of the Xe Bang Fai to assess possible inclusion in the NBCA).

In addition, visits should be made to other areas not surveyed, primarily to determine whether there are other serious threats which were not found during the current survey and secondarily to determine the status of Key Species there. In particular:

The status of large mammals, particularly big cats, needs to be established.

All significant watersources and saltlicks, if any (?) within the area should be located to help determine important areas for large mammals.

Survey Area

Site Description

Hin Namno NBCA lies along the border with Vietnam to the south of Nakai-Nam Theun NBCA, between 17° 40' and 17° 15' N. . The NBCA is approximately 865 sq. km and lies entirely within the Boualapha district of Khammouan Province. Limestone karst predominates, interspersed with other habitat.

A short wildlife and habitat corridor along the Vietnamese border has been proposed to link Hin Namno NBCA with Nakai-Nam Theun NBCA to the north (Timmins and Evans 1994, Berkmuller *et al.* 1995). Dong Phong Nha Nature Reserve which covers limestone contiguous with that in Hin Namno NBCA lies to the east in Vietnam. It is likely that there will be a proposal to extend the Dillon, WWF Indochina representative, pers. comm. 1996). Currently, the NBCA has no management or even a draft management plan, in part because the area was given low priority by Berkmuller *et al.* (1993).

Geography

Hin Namno NBCA consists of sparsely vegetated limestone karst, and less precipitous forested limestone hills and valleys. The limestone is part of a massive homologous limestone formation that straddles central Indochina, and also forms the Khammouane Limestone NBCA. However, the limestone of Hin Namno is physically separated from Khammouane Limestone NBCA by only extensive areas of cultivated lowlands broken by sporadic limestone karst outcrops. However, the mountain of Hin Namno NBCA extends unbroken over the border into Vietnam. Phou Techeung mountain at the northern end of Hin Namno NBCA, and the ridges bordering the Xe Bang Fai to the south are non-calcareous sedimentary formations. Hin Namno NBCA lies across the Annamite mountain range, forming a low altitude link in the chain of this mountain range.

Hin Namno NBCA forms part of the upper catchment of the Xe Bang Fai river. At one point the river cuts through the limestone in a 5 km cave. The climate of the area follows the typical seasonality of central and southern Lao; a cool dry winter, hot spring and warm wet summer. The Vietnamese border region appears to experience a wetter winter than areas further west due to the north-east winter monsoon, although it does not apparently get the very wet winter characteristic of some border areas further north.

Settlement

The lowlands peripheral to the NBCA boundary (with the exception of the Mountain Vietnamese border) are heavily settled, with a predominance of cultivation and secondary habitats. Until recently the limestone was inhabited by an ethnic group who cultivated small areas (non-rice) and lived in small family units. All people from this ethnic group have apparently now resettled in villages outside of the limestone area, although they still maintain some cultivation within the limestone. Villages to the north and west of the NBCA are essentially dependent on paddy rice cultivation, those in the hills to the south and east have a greater dependence on hill rice cultivation.

Access

All roads within the area are only seasonally accessible, in some cases simply because of the difficulties of river crossings. Route 12 to the south of Nakai-Nam Theun NBCA branches at the northern end of Hin Namno NBCA. One branch (not drivable) crosses the Vietnamese border between the two NBCAs, another goes into Ban the village of Nongnglor in the Nam Ngor valley, while the main branch continues on to Boualapha District town. The road, although in bad condition, continues south from Boualapha with branches south to Vilabouli District of Savannakhet Province, and east to Ban Katok. From Ban Katok a branch of the road in very poor condition goes north and crosses the Vietnamese border. There are several side branches from this road, one of which penetrates the south-eastern end of the NBCA and another which goes to Ban Houayhet. From Ban Katok another branch goes south to Vilabouli. All of these roads were once part of the Ho Chi Minh Trail used by North Vietnamese and Pathet Lao forces during the American-Indochinese conflict. Several other routes were used around the periphery of the area, many of which now serve only as foot trails or have been overgrown.

Numerous small trails enter the limestone area of Hin Namno NBCA. Apparently several of these trails continue over to Vietnam, although none of them appear to be regularly used.

The Xe Ban Fai is navigable only below the cave.

Survey Description

The survey aimed to make a preliminary baseline assessment of the area's wildlife and habitat, in the context of its national importance, and to identify the NBCA's most critical management needs. The aim was not to produce an exhaustive species inventory, which would have required many person-weeks of survey by a larger team. The survey focused on brief assessment of peripheral areas and longer field visits to potentially important areas for wildlife. These latter sites were identified by interpretation of topographic maps and discussions with local people. Field visits were made to six areas for periods between 1/2 and 6 person days. Table 1 gives a break down of effort and dates at each site.

Methodology followed that of other recent WCS surveys. Opportunistic diurnal observation focused on locating and assessing populations of Key Species. A basic assessment was made of habitat condition and notes were taken on human use at all sites.

The survey was brief and only a moderate proportion of the area was surveyed. While results from these limited sites probably reflect the general condition throughout the area, it must be remembered that important aspects of human use, habitat condition and wildlife populations may have been missed.

Satellite spot images compiled from data collected between February 1987 and May 1992, at 1:100,000 scale (kept at the NOFIP) were analysed after the field survey. These provided a basis for a broader assessment of habitat condition and probable wildlife distribution.

The principal surveyors were R.J. Timmins of the Wildlife Conservation Society and Khamkhoun Khounboline of the Center for Protected Areas and Watershed Management, Department of Forestry, Lao PDR.

Table 1: extent of field survey effort and coverage.

Site	Date (1995 and 1996)	Effort	Altitude	Habitat
Nam Ngor and Nam Huck valleys	29 and 30 December, 5, 6 and 9 January	<1 person day	c. 200 m	Mosaic of secondary vegetation with some degraded forest
Houay Clocc	30 December to 5 January	6 person days	400 to 550 m.	Evergreen forest surrounded by precipitous karst
Houay Packha	30 December and 5 January	<1 person day	c. 200m	Mainly secondary vegetation
Houay Talee	6 to 9 January	3 person days	325 to 550 m.	Evergreen forest and karst with some secondary vegetation
Ban Nongma to Vietnamese border	13 January	1/2 person day	560 to 710 m	Secondary Vegetation
Ban San- Houay Pan	14 January	1 person day	580 m	Mosaic of secondary vegetation and degraded forest

Note: notes on habitat condition, human use and opportunistic wildlife observations were taken during travel periods between the sites.

Findings with respect to habitat

Significance of and threats to vegetation

This is only one of two NBCAs in Lao which incorporate large areas of limestone, particularly karst formations. The homologous central Indochinese Limestone which also includes Khammouane Limestone NBCA is an isolated and very specialised habitat, which has several endemic animals, suggesting that aspects of the flora are also likely to be endemic to the same limestone. In addition, Hin Namno NBCA falls across the Annamite mountain range, which also has several endemic or near endemic animals, and once again the same is likely to be true of the flora. Of particular interest within the Annamite range is a forest type which receives regular winter precipitation, a habitat which in Lao appears to be restricted to small pockets of the Lao-Vietnamese border.

The flat lowland forest surrounding the NBCA may be of considerable conservation significance, if relatively undisturbed areas still occur. Only Xe Pian NBCA, Dong Hua Sao NBCA, Xe Bang Nouan NBCA, Nam Kading NBCA, Xe Khampho PPA and Bolovens Northeast PPA are known to include appreciable flat lowland forest in Lao (as opposed to forest on lowland hills), in the latter five areas these forests are expected or known to be seriously degraded.

Forest clearance for cultivation, probably more prevalent in the south, is at present of low scale, although in the long term it is a potential threat both from Lao and Vietnamese villages. Also threatening is the over-exploitation of certain natural resources in particular rattan and mai dam, the fungus-infected heartwood of a species of *Aguilaria*.

Habitat Description

Figure 3 shows habitat of the Hin Namno NBCA area.

The extensive lowlands to the north and west of Hin Namno NBCA have been heavily degraded by a combination of factors, and now have a high density of villages and cultivation. However, the hill and limestone areas generally retain reasonable forest cover. The area to the south of Hin Namno NBCA, despite being hilly, is more extensively degraded.

The Hin Namno NBCA area covers limestone. Much of the area is limestone karst with a range of vegetation cover from bare rock to shrubby forest. Within the karst flatish valleys and depressions hold pockets of tall closed canopy Evergreen Forest. In some areas limestone hills have a good closed canopy forest cover.

Several of the valleys and depressions within the karst limestone have secondary growth varying from scrub to reasonably old, secondary forest, in most cases this appears to be the result of quite recent habitation and cultivation. The most extensive area of secondary growth found was that in the Houay Packha valley. Satellite images show much of the peripheral areas of the limestone to have secondary vegetation. Images of the central area of limestone are unclear, although it is likely that secondary vegetation occurs throughout.

Characteristically, surface water in the limestone areas is very limited, particularly at the height of the dry season, to larger deeper valleys in the limestone, and areas where beds of non calcareous rock types (within the limestone) are exposed as at the Houay Clocc site. The large streams and rivers in the area all lie outside the main body of the limestone, except where the Xe Bang Fai cuts through the limestone in a five km long cave. Satellite images and field observation suggest that all remaining river or streamside habitat is heavily degraded or secondary in nature. Nonetheless, it may still retain importance for several Key Species.

The few kilometers adjacent to the Vietnamese border area appears to be wetter than areas progressively further west. Heavy low clouds were seen over this region on many of the survey days, clouds which visibly dispersed as they moved west. Fine drizzle fell at the Houay Talee site and over the Vietnamese border region south of Hin Namno NBCA the survey days but not at the Houay Clocc site or in the Nam Ngor or lower Nam Huck valleys. Weather conditions, stream flow and accounts

from local people suggest, however, that the border area is not as wet during the winter months as it is further north in the proposed northern extension of the Nakai-Nam Theun NBCA .

Much of the area to the north and west of the limestone and the high non-calcareous ridges on the west bank of the Xe Bang Fai, are flat lowlands broken by sporadic karst outcrops. Much of this land is now a mosaic of rice paddies, villages and secondary vegetation, but forest remains in several areas, in some cases in relatively large patches. Much of this forest has been degraded, probably in many areas by the removal of the most valuable timber species. Although not properly surveyed, the structure and composition seemed to suggest a mix of tall Mixed Deciduous and Semi-evergreen and perhaps Evergreen Forest. The best lowland habitat remaining in the areas visited was a stretch of degraded Semi-Evergreen Forest along the road between the villages of Ban Khang and Ban Katok (050945 to 090943). Other remaining forest includes small sections of degraded Mixed Deciduous/Semi-Evergreen Forest between Ban Naphoung and Ban Khok (835125 to 870095), between Ban Tapachon and Ban Nammahung (885030 to 890990) and degraded Mixed Deciduous Forest in the upper Nam Ngor valley. These observations are borne out by satellite image interpretation. This suggests that habitat degradation and pressure on wildlife populations has perhaps been higher than would be predicted from the current positions and density of villages. The largest areas of forest with the fewest patches of secondary vegetation appears to surround low hills on the Xaibouathong-Boualapha Districts border. Forest also extends over some of the flat lowlands around these hills.

Findings with respect to wildlife

Significance of and threats to wildlife

Despite the brevity of the survey important populations of several Key Species were found. Of most importance are the populations of primates in particular those of Douc Langur *Pygathrix nemaeus* and Francois' Langur *Semnopithecus francoisi*. Populations of both in Hin Namno NBCA are of High Global Importance. Encounter rates with primates were some of the highest recently found in Lao, and in very few areas have five species of primate been found commonly in such close association, as is the case in Hin Namno NBCA. Both Large-antlered Muntjac *Megamuntiacus vuquongensis* and Crested Argus *Rheinartia ocellata* were found. Both species have very limited world ranges, throughout which they are hunted. The Globally Threatened Crested Argus is known in only three other NBCAs or PPAs in Lao. Sooty Babbler *Stachyris herberti*, a species endemic to limestone areas of central Lao and central Vietnam, is common at all the sites visited. Because the species is found within only three protected areas in the world, the population within Hin Namno NBCA is of high Global Importance. Of areas recently surveyed, Hin Namno NBCA is only one of a few areas where four species of hornbill have been found. Large hornbills in this case, Wreathed *Rhyticeros undulatus* and Great *Buceros bicornis* were recorded almost daily, in very few areas recently surveyed has this been the case. Taken together with the presence of big cats and reports of wild cattle, Hin Namno NBCA appears to retain a reasonably intact wildlife community. Other significant findings include a species of tit *Parus* species which is new for Lao and a leaf-warbler *Phylloscopus* species which appears to be restricted to limestone areas of central Lao, and presumably Vietnam.

Two biogeographical aspects of the wildlife community make the area potentially very important for conservation. Firstly, the limestone is part of a homologous limestone formation stretching across central Indochina. In addition, it is also part of the Annamite mountain range. Both regions are biogeographically distinct and both have several endemic or near-endemic bird and mammal species, several of which have been recorded within Hin Namno NBCA. Such localised endemism, suggests that other components of the faunal community may be endemic. As both biogeographic regions are relatively small any endemic species are likely to be at a heightened threat globally.

The most serious immediate threat to wildlife is hunting, particularly for the large bird and large mammal species. Given the global status of Douc Langur, Francois' Langur and Crested Argus, any hunting of these species is of high concern.

The tolerance of degraded habitat by most of the Key Species found is poorly understood. At present within the limestone could lead to severe reductions in populations of many of the Key Species; tall

forest is likely to be important even for Sooty Babbler and Francois' Langur species specialised to limestone karst.

Table 2: Key Species status, importance and potential threats to populations

										Potential threat			
Lesser Fish-eagle	GNT						P	low?	?		mid/hgih	mid?	prevent hunting
Pied Falconet	GNT						P	?	?		mid?	low?	survey Xe Bangfai prevent hunting
Bar-backed Partridge	RAR	C			C	P		low	low/mid	low/mid	low?		control hunting
Sitver Pheasant	RAR	P						low	?		low/mid	low	control hunting
	GT			P				?	mod+	mid	low/mid?		control hunting
Grey Peacock Pheasant	RAR	P	P	C	P			low	low/mid	low/mid	low/mid		control hunting
Crested Argus	GT		P					?	mid+	mid/high	low/mid?		prevent hunting
Yellow-vented Pegeon	GNT				P			?	mid?	low?	?		control hunting
Brown Hornbill	GNT	C?						?		low/mid	low/mid		prevent hunting
Wrealted Hornbill	RAR	P					P	low/mid	?		mid/high	low/mid	prevent hunting
Great Hornbill	RAR	P			P			?	mid+	mid/high	low/mid		prevent hunting
Blue-rumped Pitta	GNT	P						?	?		low	low	control hunting
White-winged Magpie	GNT				P			?	?		low	low	control hunting
Sooty Babbler	GT		C		C			high	High	low		low/mid	protect tall forest
Mountain Fulvetta (Form A/B)	RAR					C		?	?		low	low	protect forest
Assamese Macaque	RAR		P		P			?	mid	mid	low	mid?	stop hunting
Stump-tailed Macaque	RAR	P			P	P		?	mid	mid	low	mid?	stop hunting
Francois' Langur	GT	P			P	P		high	high	mid	low/mid	mid	stop hunting protect
Doc Langur	GT	P			P			high?	High	mid	low/mid	mid	stop hunting protect
White/Yellow-cheeked Gibbon	GT		P		P			?	low/mid	mid	low/mid	mid	stop hunting protect
Black Giant Squirrel	RAR				P			?	low/mid	mid	low/mid	mid	stop hunting protect
Cambodian Striped Squirrel	RAR		C			C	C	low	low	low		low/mid	protect tall forest
Bear sp.	GT		P					?	?		mid/high	low/mid	prevent hunting
Big cat sp.	GT/RAR	P		P	P			?	?		mid/high	mid?	prevent hunting prote
Large-antlered Muntjac 1	GT							?	?				control hunting prote
Wild Cattle 2	GT							?	?		mid/high	low/mid	prevent hunting prote
Serow 3	RAR	[P]						?	?		?	?	control/prevent hunti

Notes

1. Trophy antlers seen in several villages.
2. Reports from forest in the interior.
3. Trophy horns seen in several villages

Key Species accounts

Lesser Fish-eagle (Globally Threatened)

One flew over the Xe Bang Fai on 12 January at the point where the road from Ban Katok to the Vietnamese border crosses the river. This stretch of the river is heavily degraded.

Populations of this species are now fragmented over the least intensively used rivers of Lao. Pairs require long lengths of river for breeding and thus population size on any river is small (Thewlis *et al* in prep.).

Bar-backed Partridge (Regionally at Risk)

The species was probably common at the Houay Clocc site, with two groups seen on the 1 January and one heard on the 4 January. One to two groups were recorded daily at the Houay Talee site. Two were heard from the degraded forest and secondary west of Ban San. Calling is perhaps less frequent at this time of year than later in the year.

Silver Pheasant (Regionally at Risk)

Feathers from a female of this species were found in the forested upper valley of the Houay Packha.

Siamese Fireback (Globally Threatened)

Feathers of a recently caught male of this species were seen in the village of Ban Tasang. The bird was reportedly snared in degraded forest close to the village. Feathers of a female were found along a trail in the same area. Two males were flushed from the dry streambed of the Houay Packha and feathers from a female were found in the same area of secondary habitat.

Grey Peacock-Pheasant (Regionally at Risk)

One to two were heard daily at the Houay Clocc and Houay Talee sites; single birds were also heard in the degraded secondary forest of the Nam Ngor (30 December and 5 January) and Nam Huck (6 January) valleys. A single was heard from the degraded forest and secondary west of Ban San.

The number of calling birds heard is low compared to other areas recently surveyed. However as with other calling species, calling rates may be depressed at this time of year (Thewlis *et al.* in prep.).

Crested Argus (Globally Threatened)

The only confirmed record of this species was of feathers found on the 30 December in the forested higher Houay Packha valley. However, locals from Ban Tasang, Ban Vangngnow, Ban Katok, Ban Nongma, Ban San all described this species and reported them as occurring in the forests close to the Vietnamese border.

This species is restricted to the Annamite mountains, and mountains in Peninsula Malaysia. It has only recently been found in three other NBCAs or PPAs in Lao, in only one of which was it found to be

Yellow-vented Pigeon (Globally Near-Threatened)

One of three or more green-pigeons, in a small tree on the 6 January, at the Houay Talee site was identified as this species. The birds were on a small forested ridge at 500 m between two valleys.

This species has been found only at a small number of sites in Lao, all essentially part of the Annamite range (Thewlis *et al.* in prep.).

Brown Hornbill (Globally Near-Threatened)

This species was recorded daily at the Houay Clocc site, the only site at which it was found. Records all probably came from one mobile and sometimes fragmented group of at least 13 (though probably several more).

Wreathed Hornbill (Regionally at Risk)

A pair was seen in a fruiting strangler fig at the Houay Clocc site on the 1 January. At the southern end of Hin Namno NBCA a single male flew over the heavily degraded border area into Vietnam towards forested hills in the south-east.

This partly nomadic species requires large areas for population viability; it is also the target of hunting.

Great Hornbill (Regionally at Risk)

Two, probably the same birds in each case, were seen on 30 December and, 3 and 4 January at the Houay Clocc site. On two of these occasions they were in a fruiting strangler fig (the same tree in which Wreathed was also seen); on one of these occasions Brown *Ptilolaemus tickelli* and Oriental Pied Hornbills *Anthracoceros albirostris* were also present. The species was also recorded on the 7 and 8 January at the Houay Talee site.

This partly nomadic species requires large areas for population viability; it is also the target of hunting. At no site in Lao has this species been found recently to be common (Thewlis *et al.* in prep).

Blue-rumped Pitta (Globally Near-Threatened)

One bird was seen on 1 January and a second probable bird on the 31 December, both at the Houay Clocc site.

White-winged Magpie (Globally Near-Threatened)

Probably the same group of at least five White-winged Magpies was seen on successive days at the Houay Talee site.

This is only the third NBCA or PPA where this species has been found in Lao (Thewlis *et al.* in prep).

Tit sp. *Parus* sp.

Birds of the genus *Parus* were seen on two occasions. They most resembled Green-backed Tit *Parus monticolus* a species not previously recorded from Lao, but differed in a number of respects from the descriptions of this species in King *et al.* (1975) and Ali, Ripley and Dick (1983). The first sighting was of a single bird flitting between vegetation and protruding rock formations on a sheer karst face at the Houay Clocc site. The second was of two or more birds moving around in shrubby vegetation, in loose association with a mixed species bird flock, on a karst face to the west of Ban San. Birds on the latter occasion had greenish mantles and wing coverts lacking prominent pale wingbars, the breast was yellow with a black stripe down the center which expanded into a blackish grey vent and under tail coverts, the yellow of the breast became noticeably duller on the belly and graded into the blackish grey of the vent. They appeared to have pale tips to the outer tail feathers, but a pale outer fringer was not noticed. A pale nape area was also not prominent. They appeared somewhat longer tailed than British Great Tits *Parus major major*.

Sooty Babbler (Globally Threatened)

Flocks of this species were found daily at the Houay Clocc and Houay Talee sites, making it one of the commonest bird species recorded at these sites. Almost all flocks were associated with areas with visible limestone rocks, be it scattered boulders beneath tall closed canopy forest or more sparsely vegetated karst.

This species is endemic to the homologous limestone of central Indochina. It is known only from three protected areas; Hin Namno NBCA, Khammouane Limestone NBCA, and Dong Phong Nha Nature Reserve in Vietnam. They may also be present in the proposed Nadee Limestone extension of Nam Kading NBCA.

Mountain Fulvetta *Alcippe peracensis* (provisional)

The birds seen correspond to fulvettas found in southern Lao previously referred to as Type A (Timmins *et al.* 1993a and b). Groups of this species were commonly recorded at the southern end of Hin Namno NBCA, in the mosaic of secondary and degraded forest. The few birds seen reasonably well showed indistinct eyerings, the grey of the face not extending to the end of the black subcoronal stripe, brownish washed underparts, pale bills of a brownish-horn color, and greyish appearing legs, all

features of *Fulvetta* type A. This fulvetta was known previously from Phou Xang He NBCA and areas further south. Fulvettas were conspicuously absent from the northern end of Hin Namno NBCA. Just north of this area on Sayphou Ak another fulvetta, Grey-cheeked Fulvetta *Alcippe morisonia* (Type C, Timmins and Evans 1994), is common.

Leaf warbler sp. *Phylloscopus* sp.

A distinctive leaf warbler species previously found in the Nadee and Lak Sao Limestone areas of Bolikhamxai Province (WCS 1995) was found commonly at all sites visited. They were almost always associated with mixed species flocks.

This species first found in May 1995 in the Nadee and Lak Sao Limestone areas of Bolikhamxai Province (WCS 1995), is thought to be a new taxon. The species appears to be resident in and endemic to the homologous limestone of central Indochina, although it has only so far been found in Lao.

Assamese Macaque (Regionally at Risk)

Macaques provisionally identified as this species were first recorded on 1 January at the Houay Clocc site. The species was again seen on the 3 January in close association with a group of Douc Langurs, probably within 500 m of the previous sighting. They have a distinctive loud call perhaps given as an alarm signal, from which the local name of *Khang* derives. On 4 January this call was heard 2 km further down the valley. A group of macaques probably of this species were seen on the 5 January in the secondary growth of the Houay Paekha valley. Calls probably from this species were heard on the morning of the 8 January at the Houay Talee site, in close proximity to a group of Douc Langurs. Probably the same group of Assamese Macaques were seen in the late afternoon of the same day a few hundred metres away from the morning locality.

Stump-tailed Macaque (Globally Threatened)

Groups of this species were seen on the 4 January at c. 250 m in the forested upper Houay Paekha valley, on 8 January in secondary growth in the limestone north of the Houay Talee and once on 14 January on a karst outcrop in the degraded forest and secondary growth west of Ban San. The latter group was seen dusk making their way up on to the top of a fairly sheer karst face just before .

Phayre's Langur (Regionally at Risk)

Reports of a blackish langur with white on the lips or chin are probably referable to this species. They are said to inhabit the non calcareous Phou Tcheung and the Sayphou Ak escarpment.

Francois' Langur (Globally Threatened)

The local name *Cung* of this species derives from a loud distinctive call given by the species. These calls were heard commonly from both the Houay Clocc and Houay Talee sites. Calls were also heard from the Houay Paekha valley and the upper Nam Ngor valley. The acoustics of karst limestone areas make it difficult to determine the origin of calls, making an assessment of spatial distribution at either site difficult. However, the encounter frequency suggests that densities are high and that the species spends a considerable time in tall forest within valleys in the limestone. Groups were encountered on 31 December, 2 and 4 January at the Houay Clocc site and 7 and 8 January at the Houay Talee site. On 31 December at least two and probably three, groups were encountered. The group on 4 January was almost certainly a different group from these, making probably at least 4 groups within the surveyed area (the two encounters at the Houay Talee site were also almost certainly of different groups). The group on 2 January was in close proximity to a group of Douc Langurs.

The pelage of all those seen was completely black except for a small bare whitish patch in the anal region (possibly restricted to females). Such a color morph was not previously known from Lao. The only previous records of Francois' Langur from Lao are from the Khammouane Limestone NBCA and Nam Kading NBCA, involving a different subspecies, *Trachypithecus francoisi laotum*, which has a distinctive white band around the head. Another subspecies *T. f. hatinhensis* (which also has white on the head) is known from across the border in Vietnam.

The species is also reported by villages to occur on the escarpment of Sayphou Ak which has bare rock faces (non calcareous) in several places.

The species is endemic to limestone and other rock faces within Indochina and south-eastern China. The population in Vietnam, which includes four sub-species all different from those in Lao, has recently been estimated to be very small and presumably under considerable threat (Nadler 1996).

Douc Langur (Globally Threatened)

Encounter frequencies with this species were similarly high to those of Francois' Langur. At the Houay Clocc site there were the following records: 30 December one encounter/group, 31 December two encounters/groups, 2 January three encounters (two groups), 3 January one encounter/group and 4 January two encounters/groups, while at the Houay Talee site there was one encounter on the 8 January. Encounters consistently came from at least four different areas at the Houay Clocc site, suggesting a particularly high density.

The species is restricted to Indochina, with the most important populations of this species being found in Lao. The Hin Namno NBCA population is Nationally Important and most likely Globally Important.

Gibbon (Globally Threatened)

At the Houay Clocc site gibbons were heard distantly on 2 January, and two animals were seen later in the same day, and again heard distantly on the 3 January. Two groups were heard on the 9 January from the Houay Talee site.

The apparent scarcity of this species is rather surprising given the commonness of other primate species, however it is possible that calling levels were reduced due to unfavourable weather conditions, (ie., cloudy and often windy).

Black Giant Squirrel (Regionally at Risk)

The only records of this species were singles on the 7 and 9 January at the Houay Talee site. The lack of records of this species is surprising considering the abundance of primate species which at other sites have often mirrored this species in abundance. The season and weather conditions may have reduced calling levels, the main method of detection. However, another genus of squirrel, *Callosciurus*, was much less common at the Houay Clocc site than would have been expected based on recent findings. The explanation for this anomaly is unclear.

Cambodian Striped Squirrel (Regionally at Risk)

This small squirrel was found commonly at all the forest sites visited, though not as abundantly as it has been found at sites further south such as Phou Xang He NBCA, Xe Pian NBCA and Dong Hua Sao NBCA.

The species is widespread and common in central and southern Lao, and is of low conservation concern.

Bears (Globally Threatened)

The only evidence of bears was of old scratch marks found at the Houay Clocc site.

The paucity of evidence for bears is not surprising, as in very few areas recently surveyed have bear signs been found commonly.

Large Cats (Rare/Globally Threatened)

Recent tracks were seen along the dry river bed in the heavily degraded center of the Houay Packha valley on 30 December. A domestic dog was killed by a cat in the upper forested Houay Packha valley between 3 and 4 January. Old tracks, an old scat and a recent scrape were found at separate points in the Houay Clocc area. Around the northern-most area visited, old tracks were found along the Houay Huck, recent tracks were found along a dry gully close to Ban Phasong on the 8 January, and older tracks in a small stream valley within the Limestone, north of the Houay Talee. All were probably from Tiger. A single old set of medium to large cat tracks were seen along the Houay Pan to the west of Ban San.

The number of signs found is encouraging, although it may only represent a small number of animals. In March 1994 tracks of probably Tiger were found in the Nam Hue valley (Timmins and Evans 1994).

Tiger are the cat species of highest conservation priority in Lao. At present Hin Namno NBCA animals are still contiguous with those in the Nakai-Nam Theun NBCA.

Elephant (Globally Threatened)

Elephants are probably not present within Hin Namno NBCA. There were no village reports of this species. They are reported to be present further south of Hin Namno NBCA in forest on the border of Xaibouathong and Boualapha Districts (grid reference 750030).

Large-antlered Muntjac (Globally Threatened)

Two trophies of this species were found in Ban Katok along with three Common Muntjac *Muntiacus muntjak* trophies. In Ban Nongma two Large-antlered Muntjac trophies were found along with five Common Muntjac trophies.

The population of this species within Hin Namno NBCA is difficult to assess. This recently discovered large mammal is only known from the Annamite mountains of Lao and Vietnam. Very little is known of its ecology, including habitat preferences. It is hunted throughout its range.

Saola (Globally Threatened)

Despite extensive questioning, no reports or other evidence of this species were received. There is, however, an old although speculative report from Ban Houayhet (Timmins and Evans 1994) presumably from the forests at the headwaters of the Xe Bang Fai.

Wild cattle (Globally Threatened)

Residents of several villages reported the presence of wild cattle, probably Gaur, within the NBCA. However, no direct evidence for their presence was found in the areas surveyed, most of which were perhaps unsuitable because of their proximity to villages or the lack of accessible water. The most convincing recent reports came from the residents of Ban Tasang and Ban Vangngnow, who reported a few encounters within the last three years in the less accessible, more extensively forested areas of the limestone which have accessible water.

The precipitous topography of Hin Namno NBCA probably makes most of the NBCA unsuitable for wild cattle, and it is unlikely it could ever have supported a very large population.

Serow (Regionally at Risk)

Tracks, dropping presumed to be from this species were found at the Houay Clocc site; trophy horns were seen in Ban Phasong, Ban Katok and Ban Nongma.

Although apparently widespread in Lao the species is poorly understood.

Findings with respect to Human Use

The Hin Namno NBCA, is used by locals in a variety of ways. The most serious for conservation include commercial and local extraction of rattan, *mai dam* collection and hunting. Cultivation and habitation has in the past degraded areas within the limestone. Apparently most if not all habitation has now ceased, but a small amount of recent cultivation remains.

Natural Resource Use

Mai dam (resinous heartwood formed by fungal infested *Aquilaria* sp.) collection according to local reports has been widespread as it has been in other Lao NBCAs (Timmins and Evans 1994). The severity as in other areas is however hard to judge. Perhaps after the threat of over-exploitation of *Aquilaria*, the greatest threat from this practice is the indirect pressure put on Key Species through hunting for subsistence while collectors are in the forest.

Rattan extraction is of concern in the southern area. Concessions to harvest rattan have been granted to a Vietnamese company. At the time of the survey a Vietnamese team comprising cutters and three lorries at Ban Nongma successfully negotiated a new concession area to the east of Ban Houayhet. Areas around Ban San, including areas within the NBCA boundary, had already been exhausted of

commercially valuable rattan. Rattan extraction in these areas has resulted in new road access to certain areas.

Local small-scale logging seems mainly to be restricted to the already degraded lowland forests surrounding the limestone. Whether it is a serious threat to any area or habitat is unknown. There is apparently no commercial logging occurring within Boualapha district.

Hunting probably occurs in all areas where humans are present as it does elsewhere in Lao. Patterns probably reflect the general situation within Lao, with opportunistic hunting concentrated close to villages, easily accessible sites and sites with high human activity for other reasons. The usual common signs of hunting were seen throughout: remains of animals in villages and in the field, men with guns in the field and shots heard. Snaring of small animals was confirmed to occur at the Houay Clocc site, although being one of the basic Lao hunting techniques it is likely to occur widely within the area. It was not determined whether there were areas or species critically threatened by hunting, although all large Key Species should be considered at risk.

Habitat clearance and cultivation

Until recently the limestone area (on both sides of the international border) was inhabited by a unique ethnic group who lived in small family units within the karst. These people (at least on the Lao side) have now been resettled in permanent villages (which include Ban Tasang, Ban Vangngnow and Ban Phasong) in the surrounding lowlands. Cultivation has occurred in many places within the limestone, and most appears to have been abandoned principally as a result of the resettlement of the forest living ethnic group. Villagers from Ban Phasong and Ban Vangngnow cultivate areas in the fringing limestone at the Houay Talee site. In the southern Hin Namno NBCA several recent clearings were seen to the west of Ban San and on the hills along the Vietnamese border just south of the current NBCA boundary. Just across the border in Vietnam habitat clearance was much more prevalent and was encroaching on the southern tip of Hin Namno NBCA. From satellite image interpretation and field observation, the general habitat condition in and to the south of Hin Namno NBCA and around the headwaters of the Xe Bang Fai suggest that shifting cultivation is much more widespread and intensive than in the northern Hin Namno NBCA area.

Vietnamese incursion

Vietnamese reportedly hunt and collect natural resources throughout the area, possibly even more intensively than local Lao people villages report. A number of skirmishes between Vietnamese and Lao military personnel over natural resource exploitation were reported in the limestone area to the east of Ban Vangngnow. Lao villagers in this area were hesitant to enter the limestone for fear of confrontation with armed Vietnamese. In other areas there was little fear of the Vietnamese. Several signs of Vietnamese use of the area, in the form of graffiti, were seen at the Houay Clocc and Houay Talee sites. There are apparently several routes across the limestone to Vietnam. Although none of these are used regularly, people from the recently resettled ethnic group from Ban Tasang, Ban Vangngnow and Ban Phasong are most familiar with such routes as many have relatives living in Vietnam. In Ban Nongma local Vietnamese nationals claimed that there was much easier access to the limestone areas of southern Hin Namno NBCA through Vietnam than through Lao.

Effects of the American-Indochinese conflict

Part of the Ho Chi Minh Trail crossed the Vietnamese border adjacent to both the southern and northern borders of Hin Namno NBCA. The karst of Hin Namno NBCA presumably formed an inaccessible obstacle to the trail, which wound around its western edge. The conflict probably had only a minor impact on wildlife and habitat in the region compared to the effects of local hunting, agricultural practices, and commercial logging. Intensive bombing appears to have been very localised to the routes used by troops and vehicles during the conflict, which in turn were localised to traversible lowland areas. Irrespective of the conflict, these areas have been and probably would have been the focus of intensive human landuse (cultivation, habitation or roads). The region surrounding the Ho Chi Minh Trail where it crosses the Vietnamese border to the south of Hin Namno NBCA shows perhaps the most extensive signs of degradation, with extensive areas of secondary growth present. However even within this area it is not clear whether all degraded habitats are a result of the conflict; many hill areas unlikely to have been part of the Ho Chi Minh Trail are very degraded suggesting agricultural clearance perhaps before the conflict, while in other places hills on either side of what was evidently the trail retain forest. The most likely areas degraded by the conflict, where habitat might

otherwise have retained a reasonable forest structure, are a few sq. km on the Vietnamese border and parts of the Xe Bang Fai valley. Both have extensive low secondary growth with large areas dominated by tall grass. The grass areas may have resulted from the use of defoliants during the conflict. Taking into account the probability that defoliants were used, the Xe Bang Fai river and valley were probably the worst affected by the conflict of any natural habitat within the Hin Namno NBCA region.

Discussion: Hin Namno NBCA in a national perspective

The area has considerable importance for the conservation of several Key Species, (especially primates) as well as for habitat. The importance of the NBCA is further enhanced from a biogeographical viewpoint, as it lies in two biogeographic zones which are pockets of localised species endemism: the central Indochinese limestone and the Annamite mountain region. Such localised endemism is particularly important for the conservation of the worlds biodiversity, and gives the Hin Namno NBCA a much greater importance than a similar area within a larger biogeographic zone with a more widespread faunal community. Taken together, these factors allow an overall assessment of the areas conservation value to be made. Hin Namno NBCA rates highly against other NBCAs in terms of its National and Global conservation value, although not as high as Nakai-Nam Theun NBCA or Xe Pian NBCA, it is certainly higher, for example, than Xe Bang Nouan NBCA or Phou Xiang Thong NBCA.

Although much of the habitat is probably safe from major degradation in the near future, there is likely to be continued clearance and cultivation of small areas throughout. At present the rate of habitat clearance is only of a moderate to low scale on national NBCA basis. There is, however, at least a potential threat from commercial extraction of some non-timber forest products, particularly rattan. Hunting similarly is probably only of a moderate to low scale compared to other NBCAs in the country. However there should be further investigation of human use, as the brevity of survey makes it likely that threatening activities were missed or underestimated.

One of the most important considerations for the Hin Namno NBCA area is the urgency of it's management. This requires an evaluation of the areas conservation value against the intensity of threats facing it. Although threats are only low to moderate, its high conservation importance warrants that its management urgency is at least moderate to high in comparison to other NBCAs or PPAs. Futher surveys may well show that the conservation value of the area may be higher, and the threats facing it more serious, than so far assessed. Such survyes are a high priority..

Due to the brevity of survey cover it has not been possible to recommend areas of high conservation value or sites and species disproportionately threatened by human activity. More fieldwork is required to identify such sites. The first two sites visited, Houay Clocc and Houay Talee, certainly have high conservation value and require protection, but this situation is likely to be true of other areas throughout the NBCA. Water sources in particular are probably a limiting resource, especially to large mammals, and such areas are a higher priority for the focus of management. Tall Evergreen Forest patches within the Limestone also deserves high management attention; many of the Key Species depend in part on tall forest, which is in turn at a higher level of threat because of its easier access and smaller area in comparison to other karst habitat.

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ANNEXES

ANNEX 1: MAPS AND PLACE NAMES

The following map sheets were used during the fieldwork:

RDP Lao Service Geographique d'Etat, 1: 100 000 (1986); E-48- 92, 93, 104, 105, 116 and 117.

Topographic features shown were broadly accurate, including the boundaries of major land-cover types. Several village names in local use differed from those mapped. Many of the natural features on the maps are unnamed or have names differing from those in local usage. Names used in the text are those in local use, related to the 1:100,000 topographic maps by Table 3 and Figure 2.

Table 3: localities of the Hin Namno NBCA area which are mentioned in the text and differ from those on the RDP Lao Service Geographique d'Etat, 1: 100 000 maps.

Local Usage	Topographic Maps	Grid reference
Ban Phasong	Ban Xon	882468
Ban Vangngnow	Ban Louk	897437
Ban Mai	none	824404
Ban Nongnglor	Ban Nongno-Tai	861392
Ban Dou	Ban Xam Tai (Ban Don marked elsewhere)	871390
Ban Tasang	none	c. 910358
Ban Boualapha	none	816141
Ban Nammahung	none	c. 890980
Ban Khang	Ban Khe?	30949
Ban Xaibouathong	Ban Phahoudona	451009
Ban San	none (marked elsewhere)	223097
Ban Phaak	Ban Bounggna lao	244083
Ban Nongma	Ban San	238077
Ban Phachha	*(can you find this for me, i scribbled the name out on my map?)	234038
Ban Labouy	Ban Bounggnalao-Tai	209046
Ban Vilabouli	?	?
Pou Tcheang	Pou Etva / Pou Chuang	850460
Nam Ngor	Nam Ngo	777397-920340
Houay Talee	none	896451
Nam Huck	Nam Tang	895415
Houay Packha	none	935315-970287
Houay Clocc	none	976280
Houay Pun	none	200095
Nam Lalut	none	60240
Ban Xam Kang	none (marked elsewhere)	890415
Ban Xam Thai	none (marked elsewhere)	885407
Abandoned	Ban Xam Nua	871421
none	Ban Tou	221099
none	Ban Paak	216085
none	Nong Gapoa	195080

Grid references are given to the nearest 0.1 km, with eastings first.

ANNEX 2: TERMINOLOGY AND CONVENTIONS

2.1 KEY SPECIES

Key Species are species considered to be of conservation concern and are thought to be threatened in some way, either globally or regionally.

Key bird Species are those listed in any of the following three sources:

1. The highest priority species are those listed as Globally Threatened (GT) in Collar *et al.* (1994).
2. Globally Near-Threatened (GNT) species are listed in the same book and are thought likely to move into the Globally Threatened class soon, unless action is taken.
3. Treesucon and Round (1990) list species which are at risk in Thailand (RAR), which may therefore be threatened or vulnerable in Laos (there is no comparable list for Laos or Indochina).
4. Thewlis *et al.* (in prep.) lists species which have shown a documented decline in Lao, greater than the sum loss of their habitat; these species are considered to be Threatened in Lao and are listed as NHD 'National Historical Decline'.

Key mammal Species are those listed in the following sources:

1. The highest priority species are those listed as Globally Threatened (GT) by Groombridge (1993).
2. Species considered to be possibly regionally threatened (RAR) are listed in Salter (1993).

Key reptile Species are those listed in the following sources:

1. The highest priority species are those listed as Globally Threatened (GT) by Groombridge (1993).
2. Further turtle and tortoise species are those listed in IUCN/TFTSG (1991) with the following action plan ratings (APR):
 - (APR 1) Known threatened species.
 - (APR 2) Restricted range species requiring status assessment but thought to be threatened.
 - (APR 3) Widespread species which are probably in need of conservation action.

2.2 NOMENCLATURE AND SYSTEMATICS

Bird nomenclature and systematics

Nomenclature for birds follow Boonsong Lekagul and Round (1991), with King *et al.* (1975) used for systematic order and species not found in Thailand.

Mammal nomenclature and systematics

Nowak (1991) is generally followed, with exceptions where noted.

Testudine nomenclature and systematics

Ernst and Barbour (1989) is followed throughout.

ANNEX 3: STATUS OF BIRD SPECIES RECORDED DURING THE SURVEY

Bird status was assessed subjectively using the following criteria:

overall encounter frequency (the number of records): this baseline is considered in the light of the following factors, to assess how the encounter rate reflects the species's abundance.

shyness: skulking or shy species are recorded much less frequently than extrovert ones.

activity level: active birds are recorded more frequently than sluggish or inactive species.

area of detection: species of dense vegetation are visible only within close proximity while many open-country species can be noticed from hundreds of meters.

main vegetation storey inhabited: forest-canopy species can be more difficult to observe than those of the mid-storey or under-storey.

aerial species: these can seem disproportionately common in open areas but conversely they are seen only rarely from within forest.

calling frequency: birds calling nearly continuously are found more often than those giving only occasional calls or songs. Calls may be strongly clustered around certain times of the day or year, and the overlap of observations with the bird's chief calling periods should be considered.

distinctiveness of calls: a diagnostic call is more readily noticed than an anonymous-sounding call.

volume of call: loud, strident calls carry further than quiet ones.

whether common calls of the species are known: when no call is known, the assessment is necessarily less accurate than when calls are known; the abundance is probably usually underestimated. Table 4 indicates those species where calls had an important influence on assessment.

flocking behaviour: a handful of records of large flocks do not equate to many records of single birds. Unusual birds can be seen in large numbers through chance encounters of occasional large flocks. The number of records and dispersion of individual birds is therefore accorded more weight than simply the number of individuals.

carrying capacity for the bird of its chosen habitat: big birds generally have much larger home ranges than small birds; thus, what is a high absolute density for the former (in terms of birds per unit area, or birds found per day) would be low for the latter.

seasonality of occurrence: many species are migrants, whose abundance changes throughout the year.

Where possible the abundance of each bird species in each habitat was assessed subjectively on a three-point scale whereby the number of records was assessed in the light of various features of detectability in order to arrive at the bird's true abundance.

The three bands of abundance can be loosely defined as follows, for a medium-sized bird of average detectability:

Common: seen daily, often in large numbers, in favoured habitat

Frequent: seen on most days favoured habitat is visited, but not usually in large numbers

Occasional: seen only occasionally, on fewer than half the days

All breeding indications and other interesting ecological observations were recorded.

Table 4: Bird species recorded during the survey.

Species	Sites						
	North			South			
Little Heron		P					<i>Butorides striatus</i>
pond-heron sp. 1		P					<i>Ardeola</i>
Lesser Fish-eagle						P	<i>ichthyophaga humilis</i>
Crested Serpent-eagle	V	P					<i>Spilornis cheela</i>
Pied Falconet						P	<i>Microhierax melanoleucos</i>
Bar-backed Partridge	V	C		C	P		<i>Arborophila brunneopectus</i>
Scaly-breasted Partridge	V	C	P				<i>Arborophila chloropus</i>
Silver Pheasant		P					<i>Lophura nycthemera</i>
Siamese Fireback			P				<i>Lophura diardi</i>
Grey Peacock-Pheasant	V	C	P	C	P		<i>Polyplectron bicalcaratum</i>
Crested Argus		P					<i>Rheinardia ocellata</i>
Yellow-legged Buttonquail						P	<i>Furnix tanki</i>
green-pigeon type A 2						P	<i>Amaurornis phoenicurus</i>
green pigeon sp.3				P			<i>Treron</i>
Barred Cuckoo-Dove	V	F					<i>Treron</i>
Spotted Dove				C	P		<i>Macropygia unchall</i>
Vernal Hanging-Parrot	V	P					<i>Loriculus vernalis</i>
Asian Emerald Cuckoo			P				<i>Chrysococcyx maculatus</i>
Greater Coucal	V	C		C	P		<i>Phaenicophaeus tristis</i>
swiflet sp.				P			<i>Centropus sinensis</i>
trogon spp.4	V	P	P	P			<i>Otus lempiji</i>
	V		P				<i>Glaucidium brodiei</i>
	V			P			<i>Glaucidium cuculoides</i>
	V	C			P		<i>Aerodramus</i>
	V	C					<i>Harpactes erythrocephalus</i>
			P				<i>Harpactes</i>
	V	C		P			
		C	P	C	P		
Blue-bearded Bee-eater	V			P	P		<i>Nyctornis athertoni</i>
Brown Hornbill	V	C?					<i>Ptilolaemus tickelli</i>
Wreathed Hornbill		P				P	<i>Rhyticeros undulatus</i>
Oriental Pied Hornbill	V	P		[P]			<i>Anthraceros albirostris</i>
Great Hornbill		P		P			<i>Buceros bicornis</i>
Red-vented Barbet	V	P		P			<i>Megalaima lagrandieri</i>
Green-eared Barbet	V			P			<i>Megalaima faiostricta</i>
Moustached Barbet	V	P			P		<i>Megalaima incognita</i>
Blue-eared Barbet	V	P					<i>Megalaima australis</i>
Greater Yellownappe		F		P			<i>Picus flavinucha</i>
Lesser Yellownappe		P					<i>Picus chlorolophus</i>
Great Slaty Woodpecker	V	C	P	C	P		<i>P. flavinucha / P. chlorolophus</i>
Heart-spotted Woodpecker	V			LC			<i>Mulleripicus pulverulentus</i>
Heart-spotted/Black-and-Buff WP. 4		P					<i>Hemicircus canente</i>
Bay Woodpecker		P					<i>M. jugularis / H. canente</i>
Greater Flameback	V	C		C	P		<i>Blythipicus pyrrhotis</i>
flameback sp. 4		P		P			<i>Chrysocolaptes lucidus</i>
Silver-breasted Broadbill	V	C	P	P			<i>D. javense / C. lucidus</i>
		P					<i>Serilophus lunatus</i>
		P					<i>Pitta soror</i>

Species	Sites						
		North			South		
Eared Pitta		C					<i>Pitta phayrei</i>
Blue/Eared Pitta 4	V			P	P		<i>P. cyanea / P. phayrei</i>
Red-rumped Swallow/Striated Swallow 5			P				<i>Hirundo daurica/H. striolata</i>
Bar-winged Flycatcher-shrike		C	P	C			<i>Hemipus picatus</i>
Large Cuckoo-shrike	V					P	<i>Coracina macei</i>
Black-winged Cuckoo-shrike 6		P					<i>Coracina melaschista</i>
Great Iora	V	C		C	P		<i>Pericrocotus flammeus</i>
Blue-winged Leafbird		P	P				<i>Aegithina lafresnayei</i>
Black-crested Bulbul				P			<i>Chloropsis cochinchinensis</i>
Stripe-throated Bulbul		P					<i>Pycnonotus melanicterus</i>
Puff-throated Bulbul			P				<i>Pycnonotus finlaysoni</i>
Grey-eyed Bulbul	V	C		C	C		<i>Criniger pallidus</i>
	V	C	P	C	P		<i>Hypsipetes propinquus</i>
Black Bulbul	V	F/O					<i>Hypsipetes madagascariensis</i>
Black Drongo						P	<i>Dicrurus macrocercus</i>
Bronzed Drongo		P	P	C	P		<i>Dicrurus aeneus</i>
Lesser Racket-tailed Drongo		C	P	C			<i>Dicrurus remifer</i>
Greater Racket-tailed Drongo		C	P	C			<i>Dicrurus paradiseus</i>
Black-hooded Oriole			P				<i>Oriolus xanthornus</i>
Asian Fairy-Bluebird	V	P	P	C			<i>Irena puella</i>
White-winged Magpie	V	P		P			<i>Cissa</i>
Racket-tailed Treepie	V			P			<i>Urocissa whiteheadi</i>
Ratchet-tailed Treepie			P				<i>Crypsirina temia</i>
tit sp. 7	V	C	P	P			<i>Temnurus temnurus</i>
		P			P		<i>Parus</i>
Velvet-fronted Nuthatch	V	C		C	P		<i>Melanochlora sultanea</i>
Puff-throated Babbler		F		C			<i>Sitta frontalis</i>
Buff-breasted Babbler	V		P				<i>Pellorneum ruficeps</i>
	V	C			C		<i>Trichostoma tickelli</i>
	V	C			P		<i>Malacopteron cinereum</i>
Large Scimitar-Babbler	V	C	P	C	C		<i>Pomatorhinus hypoleucos</i>
Streaked Wren-Babbler	V	C		C			<i>Napothera brevicaudata</i>
Eyebrowed Wren-Babbler	V	C					<i>Napothera epilepidota</i>
Rufous-fronted/Rufous-capped Babbler							<i>Stachyris herberti</i>
Sooty Babbler		C		C			
Grey-throated Babbler	V	LC					<i>Stachyris nigriceps</i>
		LF					<i>Stachyris striolata</i>
Striped Tit-Babbler	V	C		C	C		<i>Macronous gularis</i>
White-crested Laughingthrush		F/C	P				<i>Garrulax leucolophus</i>
Lesser Necklaced Laughingthrush	V			F/C	P		<i>Garrulax</i>
Fulvetta Form A/B		F	P		[P]		<i>Garrulax monileger</i>
Striated Yuhina					C		<i>Alcippe cf. A. peracensis</i>
White-bellied Yuhina		F	P		P		<i>Yuhina castaneiceps</i>
White-rumped Shama	V	C		C	P		<i>Yuhina zantholeuca</i>
Slaty-backed Forktail		C					<i>Luscinia sibilans</i>
White-crowned Forktail	V		P		P		<i>Copsychus malabaricus</i>
		LP					<i>Enicurus schistaceus</i>
		LP		[P]	P		<i>Enicurus leschenaulti</i>

Species	Sites							
		North			South			
Blue Rock-thrush					P			<i>Monticola solitarius</i>
Blue-Whistling Thrush	V	P	P					<i>Myiophonus caeruleus</i>
Golden-spectacled Warbler			P					<i>Turdus merula</i>
					P			<i>Seicercus burkii</i>
Yellow-bellied Warbler	V	LC			C			<i>Abroscopus superciliaris</i>
Inornate Warbler	V	C	C	C	C	P		<i>Phylloscopus inornatus</i>
Blyth's Leaf-Warbler		P	P	C				<i>Phylloscopus reguloides</i>
Common Tailorbird		C	P	C	C			<i>Phylloscopus</i>
	V				P			<i>Orthotomus sutorius</i>
	V	P			C			<i>Orthotomus atrogularis</i>
Stub-tailed Bush-Warbler	V	C	P		P			<i>Cettia squameiceps</i>
Verditer Flycatcher				P				<i>Eumyias thalassina</i>
Fukien/Rufous-bellied Niltava			P	P				<i>Niltava davidi</i> / <i>N. sundara</i>
White-tailed Flycatcher	V	LC			P			<i>Cyornis concreta</i>
HillBlue Flycatcher					P			<i>Cyornis banyumas</i>
Hill/Tickell's Blue Flycatcher 4	V		P					<i>Cyornis banyumas</i> / <i>C. tickelliae</i>
Grey-headed Flycatcher	V	C	C	C	P			<i>Culicicapa ceylonensis</i>
Black-naped Monarch	V	C	P	C	P			<i>Hypothymis azurea</i>
Grey Wagtail	V		P					<i>Motacilla cinerea</i>
Olive-backed Pipit			P					<i>Anthus hodgsoni</i>
Crested Myna						P		<i>Acridotheres cristatus</i>
Purple-naped Sunbird	V	p		P	P			<i>Hypogramma hypogrammicum</i>
Black-throated Sunbird				P				<i>Aethopyga christinae</i>
Little Spiderhunter				P				<i>Aethopyga saturata</i>
Streaked Spiderhunter					P			<i>Arachnothera longirostra</i>
Eurasian Tree-Sparrow				P	P			<i>Arachnothera magna</i>
			P					<i>Passer montanus</i>
Coverage		Good/mid	Poor	Mid	Poor	Poor		

Species notes:

1. Excludes birds identified to species.
2. Lekagul and Round (1991) treat Striated Swallow *Hirundo striolata* as conspecific with Red-rumped Swallow *Hirundo daurica*.
3. This row includes all records of Cuckooshrikes, most of which showed features of Black-winged *Coracina melaschista* and none of which was strongly suspected to be Indochinese *Coracina polioptera*.
4. A distinctive but unidentified species of *Parus* tit; see text for further details.
5. A distinctive but unidentified species of *Phylloscopus* warbler; see text for further details.

Key:

Abundance codes: C = common; F = frequent; O = occasional; F/O = present but not common; P = present but abundance unknown; L (prefix) = local; d = remains found in village; [] = provisional identification.

Other: I = species' identification provisional; V = knowledge of the species's vocalisations greatly helped status assessment; W = species strongly associated with water, including when in other listed habitats.

ANNEX 4: STATUS OF MAMMAL SPECIES RECORDED OR REPORTED DURING THE SURVEY

Table 5: Mammal species recorded or reported during the survey.

Species		Identification	Evidence	H. Clocc	N. degraded	H. Talee H	Pan S.	degraded
<i>Tupaia glis</i>	Common Treeshrew	Conf	x				P	
<i>Dendrogale murina</i>	Small Smooth-tailed Treeshrew	Prov	x				P	
<i>Macaca assamensis</i>	Assamese Macaque	Conf	x	P		P		
<i>Macaca arctoides</i>	Phayre's Langur 1	Conf	x	P		P	P	
<i>Trachypithecus phayrei</i>	Francois' Langur	Prov	r					
<i>Trachypithecus francoisi</i>	Douc Langur	Conf	x	P		P	P	
<i>Pygathrix nemaeus</i>	gibbon sp.	Conf	x	P		P		
<i>Hylobates</i>	Burmese Hare 1	Conf	x	P		P		
<i>Lepus peguensis</i>	Black Giant Squirrel	Prov	s, r		[P]			
<i>Ratufa bicolor</i>		Conf	x			P		
<i>Callosciurus erythraeus</i>		Conf	x	F/C		C	P	
<i>Tamias rodolphi</i>	Cambodian Striped Tree Squirrel	Conf	x	C		C	C	
<i>Tamias maritimus</i>		Prov	x			P		
<i>Dremomys rufigenis</i>	Red-Cheeked Squirrel	Conf	x	F/C		F/C		
<i>Ursus</i>	Bear sp.	Conf	s, r	P				
<i>Paradoxurus hermaphroditus</i>	Common Palm Civet	Conf	x				P	
<i>Neofelis/Panthera</i>	Big cat sp.	Conf	s, r	P	P	P	P	
<i>Elephas maximus</i>	Elephant 1	Prov	r					
<i>Sus scrofa</i>	Eurasian Wild Pig	Conf	s, dv			P	P	P
<i>Muntiacus muntjak</i>	Indian Muntjac 2	Conf	dv					
<i>Megamuntiacus vuquangensis</i>	Large-antlered Muntjac 2	Conf	dv					
<i>Muntiacus/Megamuntiacus</i>	Muntjac spp.	Conf	s, x	P			P	
<i>Bos gaurus</i>	Gaur	Prov	r					
<i>Capricornis sumatraensis</i>	Serow 2	Conf	s, dv	[P]				

Order and scientific nomenclature follow Nowak (1991). As mammals are difficult to detect, absence of a symbol should not be taken to suggest absence of a species from that habitat. Identification of tracks followed van Strien (1983) and the personal experience of observers. The best evidence for a species' presence is given for each sector. The estimate of coverage is only for diurnal observation.

Abbreviations:

Identification: conf = confirmed; prov = provisional. Use of a classification other than that of Nowak (1991) may result in a species changing from confirmed to provisional or vice-versa.

Evidence: x = identifiable field records; s = signs (including vocalisations of muntjacs); d = remains (v = those in village); r = reports. Evidence is given in order of importance in making status assessments. The best evidence for a species presence and abundance is given for each habitat.

Abundance codes: C = common or abundant (equivalent to the C category for diurnal birds, Annex 4 and only used for diurnal mammals); F = frequent; F/O = present but not common; P = present but not possible to assess abundance.

Notes:

1. Species reported only
2. Remains seen in village