



**Towards A Wildlife Protection Strategy
for the Nam Et Phu Louey NPA**



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**Based on results from a workshop held at
Viengthong District, Lao PDR
12 – 14th May 2006**

Recommendations

1. There is a need for a **detailed wildlife protection strategy** that will dovetail with the management workplan for the Nam Et Phu Louey NPA. The strategy needs to incorporate all aspects of conservation work needed to achieve the stated goals for tiger conservation, with a focus on addressing specific threats identified by this analysis. The strategy needs to be supported with a dedicated budget.
2. **Tiger conservation interventions should focus on dealing with several groups who cause threats to tigers** (the negative stakeholders) either directly or indirectly through other groups.
 - a. The **first priority are the local middlemen** who are linked to all other actors. They support illegal hunting by hiring other groups to hunt, and they facilitate trade in tiger parts by selling illegal wildlife to traders. Reducing or stopping their activities will cause the trade chains to collapse. Their identities are either already known or can be ascertained using local information networks.
 - b. The **second priority are groups who do the hunting, including poor locals, Vietnamese, militia and military**. Reducing or stopping their activities affects the supply of illegal wildlife. Problem villagers are already known to project staff thus allowing activities to be targeted.
 - c. The **third priority are Lao traders who traffick wildlife to urban centres and foreign traders who in turn traffick wildlife to neighbour countries**. Wildlife traders are the most difficult group to deal with since their identities are usually unknown because of the secretive nature of their illegal business and their movements difficult to monitor. Dealing with them will involve cooperation from agencies in neighbour countries and networks such as the recently formed ASEAN Wildlife Enforcement Network.
3. **Conservation interventions needed to reduce the threats will include applying law enforcement and encouraging compliance with laws**. The particular balance will vary among the target groups of negative stakeholders. For example, it might be possible to establish good communication with local people so education and awareness tools can be applied. For local middlemen a combination of education and enforcement tools might be effective, while for traders who we can't easily communicate with, enforcement tools should be more effective.
4. **The Lao Forestry Law clearly states that wildlife trade in local markets and restaurants, and cross-border trade is illegal. However, some groups may not understand the law** because it has not yet been articulated to them or the penalties are unclear.
 - a. Meetings with local business people, village headmen and higher officials should be done to explain the articles relating to wildlife, and related penalty structures, and seek support for adherence to the laws.
 - b. Radio programmes, posters and booklets explaining the laws should be developed in local languages and distributed to people, targeting problem communities inside the reserve in the first instance, and expanding to other communities.
5. **If people understand that there is a chance of being caught and fined for wildlife offences, they will be less inclined to break the law**. Currently, it appears there is an almost complete lack of active wildlife and forestry law enforcement at NEPL and in surrounding communities. As a result people involved perceive no risk and a thriving business in wildlife trade exists involving multiple actors and local transportation and

communication networks in and around NEPL, and this is draining resources including tiger and prey populations.

6. **Encouraging people not to break the law may be possible if people perceive benefits from tiger conservation.** Interviews should be done to ascertain how various groups see benefits from having tigers. In the absence of first-hand information, the following might be possibilities;
 - a. Local middlemen are often involved with multiple business activities. They might be convinced to drop wildlife from their portfolios in exchange for concessions or permits or other assistance with trading legal goods.
 - b. Local people might be provided assistance during times of food shortage so they don't have to hunt.
 - c. Small-scale agricultural development projects would reduce the dependency of local people on timber reserves. Development projects should be located outside of the reserve to encourage villagers to spend more time outside the reserve rather than inside.
 - d. Projects to reduce dependency on hunting/NTFPs could provide alternative employment for locals as guides in nature trekking or kayaking, or tiger monitoring activities.
7. **Enforcement interventions should focus on detecting, arresting and punishing offenders of serious wildlife and environmental crime.**
 - a. A first priority is to control the use of explosives, guns, trapping equipment, and poisons, and stopping livestock baiting, which are used for killing tigers and prey, and also endanger human life.
 - b. A second priority is controlling the impacts on tiger habitat from timber cutting and use of fire, and endanger local economies.
8. **Different kinds of threats will require different suites of interventions.** Some interventions have already been identified in the existing site strategy for tiger conservation at NEPL. We expand and elaborate here on the **kinds of interventions that might be appropriate for reducing critical threats.** This includes threats identified in the site strategy and additional ones considered important;
 - a. **Stop deliberate killing of tigers by imposing strict controls on the use of legal weapons and ammunition.** Awareness presentations and agreements with militia and military commanders will help. Homemade guns and war weapons need to be collected through district wide amnesties followed by annual patrolling to detect and confiscate remaining weapons and ammunition. Individuals found with weapons and ammunition after the amnesties should receive stiff penalties or jail time according to Lao Criminal Law. Prosecuting a few offending individuals will have an immediate impact on the behaviour of people in local communities. Controls on weapons coming into the reserve might be made by monitoring local middlemen and establishing permanent manned substations at critical access points to the reserve. Random checkpoints should be used in conjunction with vehicle searches by mobile patrol teams. **Explosives should be treated the same way as weapons.** Strict controls on road construction companies and irrigation department crews will help reduce the illegal supply to locals and Vietnamese. Traps are brought in from outside the reserve. **Trap use can be reduced by systematic patrolling** to detect and destroy traps combined with monitoring of local middlemen and other outsiders e.g. people who bring farming equipment into the reserve and traders.

- b. **Stop retribution killing of tigers and killing of tigers using livestock as bait** by issuing and enforcing directives for the strict protection of critical tiger areas, including removal of and relocation of human settlements. Education programs to teach farmers correct practices for grazing and managing their livestock will help.
 - c. **Stop illegal trade in tigers and tiger parts.** This will involve restricting or preventing access to the reserve for local middlemen, surveillance of houses and villages where middlemen operate, and monitoring of vehicular traffic into and out of the reserve along road routes (via substations and random checkpoints) to detect traders and traffickers. Training for customs and border officials in detecting illegal wildlife will be important for stopping cross-border trade.
 - d. **Stop illegal hunting of protected species (Gaur, Serow and Sambar) and reduce illegal hunting of managed species (Muntjac spp. and wild pig)** using interventions for controlling weapons and traps (see a) above). Law awareness broadcasts and literature distribution to locals focussing on villages with families engaged in hunting and trade.
 - e. **Reduce illegal trade in wild meat.** This will necessitate monitoring of local markets and restaurants in Viengthong and Viengkham Districts, and campaigns and incentive programmes to change attitudes of higher officials, and the owners and operators of outlets that sell wildlife. Law awareness broadcasts and literature distribution to locals focussing on villages with families engaged in hunting and trade.
 - f. **Habitat loss and degradation can be reduced** by better landuse planning and education of people living inside the reserve, combined with field patrols to ensure compliance.
 - g. It may be possible to encourage villagers involved in hunting and NTFP collecting to stop illegal activities and participate in small-scale community development projects outside the reserve (e.g involving NTFP farming) or nature tourism inside the reserve (e.g. trekking, wildlife watching, rock-climbing and kayaking).
 - h. A key intervention which may help reduce all critical threats will be **an experimental Participatory Landuse Planning (PLUP) project.** PLUP might be introduced in one or two problem villages inside the reserve between tiger core zones. If successful it might be replicated in other places.
9. **Infrastructure must be created including permanent ranger substations at 8-10 entry/exit points on the reserve boundary.** Locations will include strategic road entry and exit points along the main road from Luang Prabang (2), entry points from Xam Nuea (2), river access points in the far NE (1), and road entry points N of Sone Nuea near the Vietnam border and NW (Viengkham District) (2), and in the S from Viengthong District (1)
 10. A radio communications system will facilitate coordination of enforcement operations among the guard stations and the reserve HQ in Viengthong Town.
 11. **Substations will be manned by permanent paid staff** (1 policeman and 1 forestry official) and 3 volunteer community rangers whose families receive benefits from the conservation project.
 12. **At least one mobile patrol team of 7 staff will respond to reports of illegal trade and transportation of wildlife,** and establish temporary checkpoints along roads and footpath access points. A team already exists but it currently has no workplan to guide its activities.

13. At least 1 4WD vehicle should be assigned to the mobile patrol team, with permanent enforcement duties, along with 1 motorcycle for each of the ranger substations.
14. **Rangers and mobile patrol staff should undergo rigorous training** in subjects relevant to environmental law enforcement. A training curriculum being developed by WCS for use in Asia might be adapted for use. If possible tactical training could be done in Thailand by Thai border police trainers and WCS staff who speak Lao or Thai language.
15. **All enforcement operations will be under the direction of an enforcement supervisor** who will lead the protection programme, manage and direct enforcement operations and staff. Finding the right person for this job will be key to the success of the protection programme.
16. **A site visit to the Seima Biodiversity Conservation Area, Mondulkiri, Cambodia** would help the reserve manager and the enforcement supervisor understand how systematic field enforcement can lead to improved protection of wildlife.
17. **A network of village informants will be developed by the enforcement supervisor.** To ensure confidentiality and safety, informants will be known only to senior police, some village heads, and reserve staff.
18. **Staff training in practical techniques of enforcement and negotiating methods for working with local communities** should be provided to the ranger substation staff and mobile patrol team staff. This should be a regular programme of training combined with assessment of staff performance rather than a one-off training.
19. **Tiger core zone and lands in the geographic centre of the reserve between tiger core zones are subject to the full range of threats to tigers.** These three areas should be a special focus of future law enforcement monitoring efforts.
20. **Areas in the north of NEPL adjacent to and near the Vietnam border and in the southwest lack information on direct threats to tigers.** Once patrolling efforts are made systematic, coverage should be extended to these areas.

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Introduction

The Tiger (*Panthera tigris*) is threatened across its global range and future conservation efforts will need to focus on recovering populations in key sites and landscapes (WCS/WWF/SI, 2006). One of the key sites in Southeast Asia is Nam Et Phou Louey National Biodiversity Conservation Area (NBCA) in Lao PDR. This site lies in the northern Annamite Mountains, an important area for wildlife in the country (Duckworth *et al.*, 1999) and for biodiversity conservation in the region (Wikramanayake *et al.*, 2002). Surveys during March 2003 – May 2004 (Johnson *et al.*, in press) confirmed the presence of a low density (<1 tiger/100km²) population of tigers numbering 7 – 23 individuals in a 952 – 3,548km² sampling area. The tiger population is threatened by various human impacts the most serious of which appears to be direct hunting for market trade and retribution killing due to livestock depredation (Johnson *et al.*, in press). As part of a strategy to recover tiger populations at the site, a meeting was held with government officials to define the nature of threats to tigers, identify causes of threats and relevant stakeholders, and explore possible conservation interventions to reduce or mitigate the threats. Efforts to save tigers at this site are a part of a national strategy to recover the species in Lao PDR (Venevongphet & Johnson, 2006).

Purpose

To bring together relevant officials concerned with tiger conservation to discuss problems facing tigers at Nam Et Phou Louey NPA (hereafter referred to as NEPL) and define conservation solutions as a prelude to developing a comprehensive recovery strategy for tigers.

Goals

1. Increase tiger populations by a minimum of 50% in 10 years at NEPL.
2. Increase large ungulate prey populations to levels sufficient for supporting the increased tiger population.

Objectives

1. Improve our understanding of the threats to tiger and prey by developing relationship chain diagrams for tigers and their prey (gaur, sambar, serow, wild pig, and muntjac) at NEPL.
2. Compare the relationship chain diagrams for tigers and their prey to the current wildlife protection strategy for NEPL.
3. Evaluate and make recommendations for improvement of the NEPL wildlife protection strategy based on the workshop results.

Methods

Critical threats to tigers at NEPL have been defined in general terms (Venevongphet & Johnson, 2006). The purpose of this participatory exercise was to verify who is involved in causing the threats, where threats occur, and where interventions should be made to reduce or eliminate the threats. The approach adopted was similar to that used at the Seima Biodiversity Conservation Area (SBCA), an important conservation landscape in Monduliri, Cambodia (Lynam & Soriyun, 2004), and is described here;

Step 1. Confirm objectives.

We confirmed with workshop participants that tigers are a threatened species at Nam Et Phu Louey, and should be a focal species for conservation efforts. Tiger conservation is publicly promoted through the use of highly visible signposts along road access routes into the reserve from Luang Prabang. Forestry officials clearly understood that conserving tigers was a purpose of the reserve.

Step 2. Examples from other sites and landscapes.

The project desires to develop a wildlife protection strategy focussing on tigers and large ungulates. Examples of wildlife protection strategies from other sites in Southeast Asia were presented with an illustrated lecture. The specific examples were from neighbour countries to Laos; the Seima Biodiversity Conservation Project, in Mondulkiri Province, Cambodia, and the Hukaung Tiger Reserve, Kachin State, Myanmar. In both cases, tiger conservation is one component of wildlife/natural resource protection efforts. Similar threats and settings e.g. reserves which share parts of their borders with wildlife consuming countries, made the examples useful because participants were able to relate similarities to their own situation, and see how interventions have been used to deal with specific threats and challenges. In particular was the example from Cambodia which we returned to a number of times during the course of discussions.

Step 3. Define a target condition for tigers.

The target condition is a state that we desire to influence through a set of conservation activities or interventions (Margoulis & Salafsky, 1998).

The target condition for tigers in NEPL, also an objective of the project is

- Increase tiger populations by a minimum of 50% in 10 years

Assuming the current estimated population of tigers in the reserve is 20 tigers (V. pers. comm.), this implies a target of 30 tigers for 2016. Other target conditions that might be considered are

- Achieve year-round use of the project core area by tigers
- No less than 10 adult female tigers protected in the reserve

Supporting factors allow the target condition to be achieved. One supporting factor that has been defined relates to prey populations

- Increase tiger prey populations by a minimum of 50% in 10 years

A possible problem with this is that prey levels required to support 30 tigers may be more or less than that achieved by increasing prey populations by 50%. In fact, we don't yet know the baseline levels of prey, nor the precise levels of prey required to support a 50% increase in tigers, so it might be safer to define a target condition for prey in a slightly different way, for example

- Increase levels of key prey species to support 30 tigers
- Achieve, year-round use of the project core zones by gaur, sambar, serow, wild pig and muntjac

Another target condition relates to habitat and might be defined as

- Maintain a minimum area of core habitat for 30 tigers, effectively patrolled and protected from human disturbance

Step 4. Define geographic divisions in the study area.

Using maps of NEPL, participants identified natural or management divisions/sectors in the reserve, including core zones, areas outside core zones, and areas that might be important that currently lie outside the official reserve boundaries. Seven divisions were identified (Fig. 1) and were drawn onto a topographic map of the reserve which was posted on the wall at the front of the meeting room, and referred to in our discussions. Also identified were 11 problem village clusters in and adjacent to the reserve.

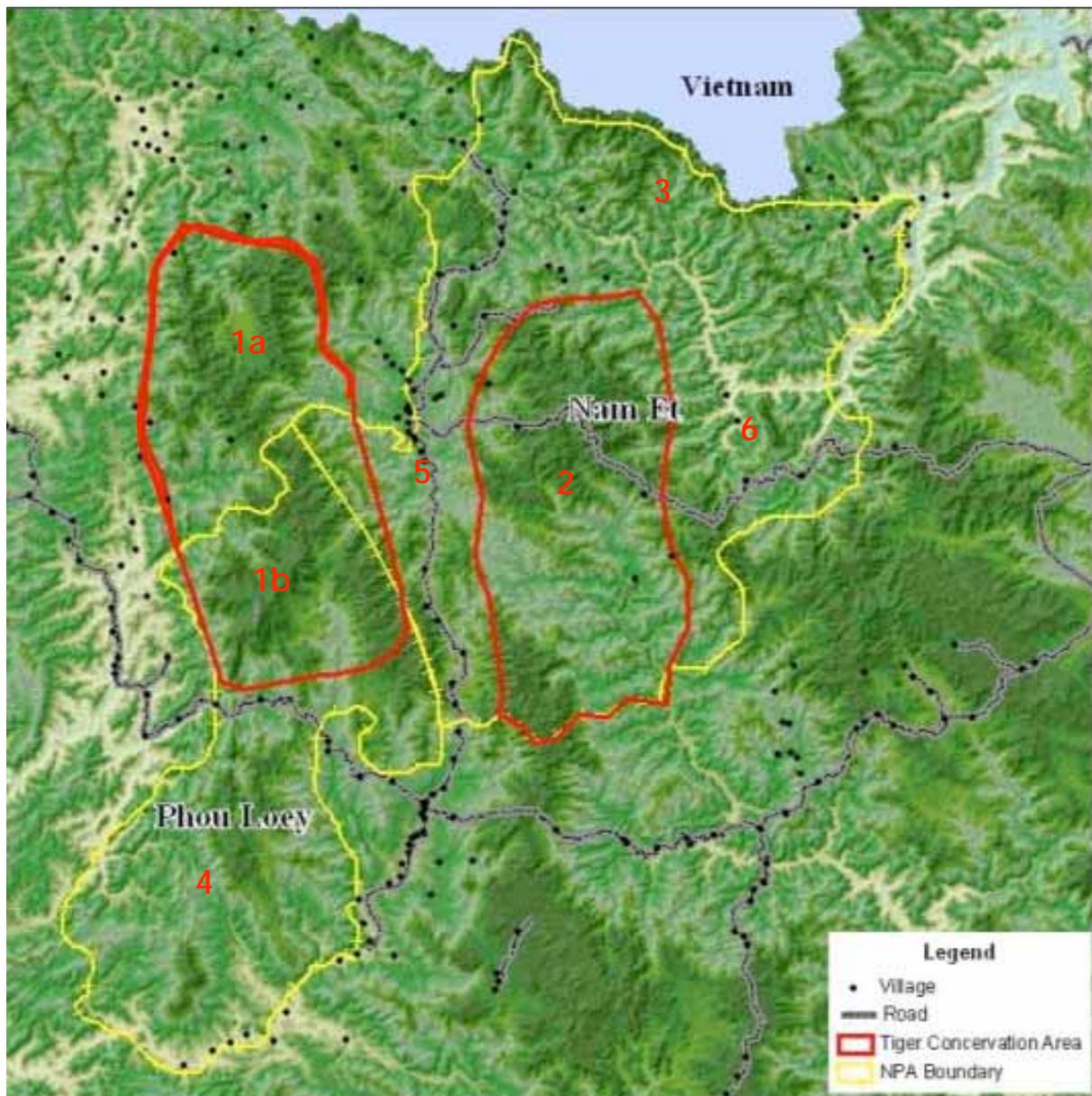


Fig. 1. Boundary of Nam Et Phou Louey NBCA showing core zones and geographic areas identified by participants. Areas are 1a=tiger core zone (currently outside NPA boundary), 1b=tiger core zone (inside NPA), 2=tiger core zone, 3=Lao/Vietnam border area, 4=southwest managed area, 5 central managed area, 6=eastern managed area.

Step 5. Improve our understanding of threats to tigers and supporting factors for tigers

A facilitated discussion was staged to identify direct threats and stakeholders for tigers. Individuals and groups causing the threats were identified, along with divisions in the reserve where these threats occur. The results were tabulated on large sheets of paper and posted at the front of the meeting room. The sheets were numbered and photographed for future reference. The discussion was then repeated for threats to tigers which act indirectly through either prey or habitat, and who causes these threats.

Step 6. Summarize the relationships among threats and stakeholders.

Using Excel charts, we drew the links between threats and stakeholders separately for tigers, prey species and habitat. The resulting relationship chain diagrams were projected onto large pieces of paper, translated into Lao in class, and verified by the participants.

Step 7. Examine ways to break the links that connect threats with stakeholders and threaten the prescribed goals for tigers.

We considered the kinds of conservation interventions that can be applied to break the links in the relationship chain diagrams. For example, to reduce poaching of tigers, we could increase the number of staff patrolling, or focus patrolling efforts in places where tigers are hunted etc. Arrows are drawn on the diagrams to indicate where the interventions would be made.

Step 8. Evaluate and make recommendations for improvement of the NEPL NPA wildlife protection strategy based on the workshop results.

We compared the interventions identified from this exercise with the current wildlife protection strategy in the NEPL NPA noting interventions that are missing from the current strategy, and activities in the strategy that could be modified or improved. Threats that can be addressed by the project were identified. Threats that may not be easily solved at the site level and need to be addressed at the regional or national level were noted.

Results

From the group discussions the types of threats to tigers were identified as those that act directly on tigers, and those that act indirectly on tigers by affecting either tiger prey species, or impacting tiger habitat.

Direct threats to tigers

Killing of tigers

Tigers are killed deliberately or are sometimes killed as retribution for example, because of livestock killings. Various methods are used to kill tigers, including using explosives, using traps, using livestock as bait, using poison, using guns, or combinations of these.

People who kill tigers with guns are those who have access to homemade guns (poor locals or Vietnamese) or automatic weapons (village militia or military). There are at least 5 semi-

automatic weapons in each village (Venevongphet & Johnson, 2006). During a 5-hour drive along the road that accesses villages in the centre of the reserve we counted no less than 8 men with automatic weapons.

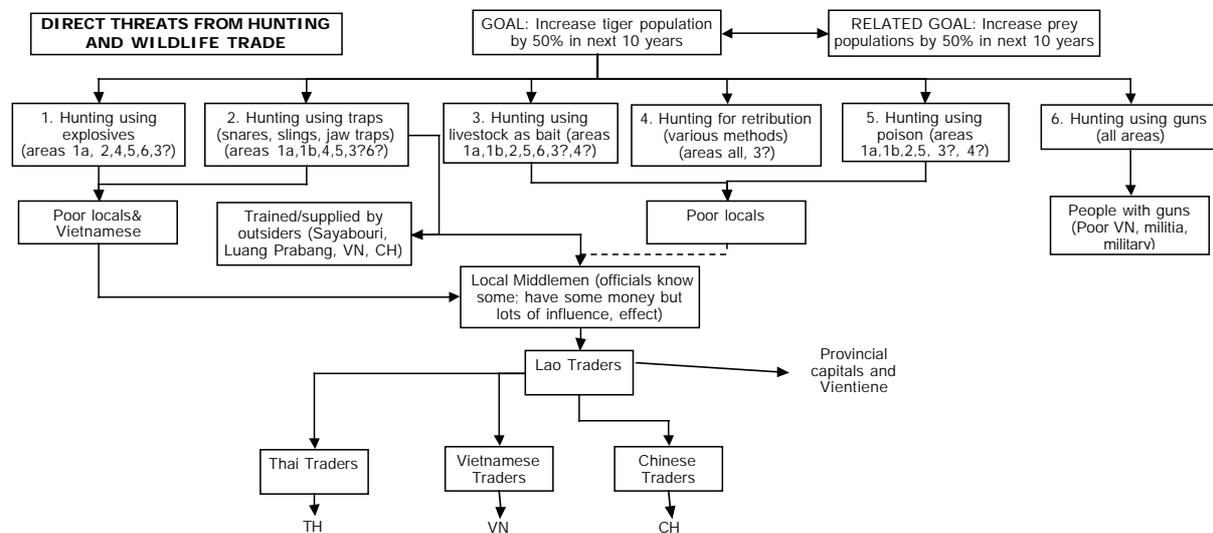


Fig. 2. Relationship chain diagram showing links between threats to the goal of increasing tigers by 50% of their current population in 10 years, and groups/individuals causing threats (negative stakeholders). Areas where threats occur are shown in Fig. 1.

Poor locals and Vietnamese use explosives that are homemade, left over from the war (UXOs), or illegally bought from field crews of the irrigation department or road construction companies. Traps such as snares, slings and jaw traps are brought in by outsiders from Sayabouri and other places. Sometimes long snarelines are found such as in area 1a. Locals sometimes receive training in how to use the traps from these outsiders. Poor locals sometimes poison tigers or graze their livestock inside the core zones to attract tigers which they kill. Some locals who genuinely lose livestock to tigers sometimes kill tigers in retribution using various methods.

Finally, there are gaps in information about direct threats to tigers for areas 3, and less so for area 4.

Trade of tigers

Whatever the method for killing tigers, there is always someone ready to purchase tiger carcasses. These local middlemen are people who live in the villages, have some money, and are influential people, in some cases the village headman or local businessmen. The middlemen trade tiger carcasses with Lao traders who come from outside the province, or with Thai, Vietnamese or Chinese traders. Although communications are difficult, it appears that there is always a way of getting information out once a tiger is killed, presumably via motorcycle messengers or other people with vehicles. Tiger carcasses leave the reserve and go out to other Lao provinces or leave the country along various routes e.g. to Vietnam via Xam Nuea, to China via Udomxai, or to Thailand via Sayabouri.

Indirect threats to tigers

Hunting and trade of tiger prey species

Hunting and trade of large ungulates that are key prey species for tigers poses a threat to tigers and achieving the stated goals for the project. Of special concern are large ungulates which are prey species for tiger. Gaur and sambar are Lao protected species. Sambar is considered a protected species in Viengthong District. Muntjac spp. are managed species and Wild pig is unprotected.

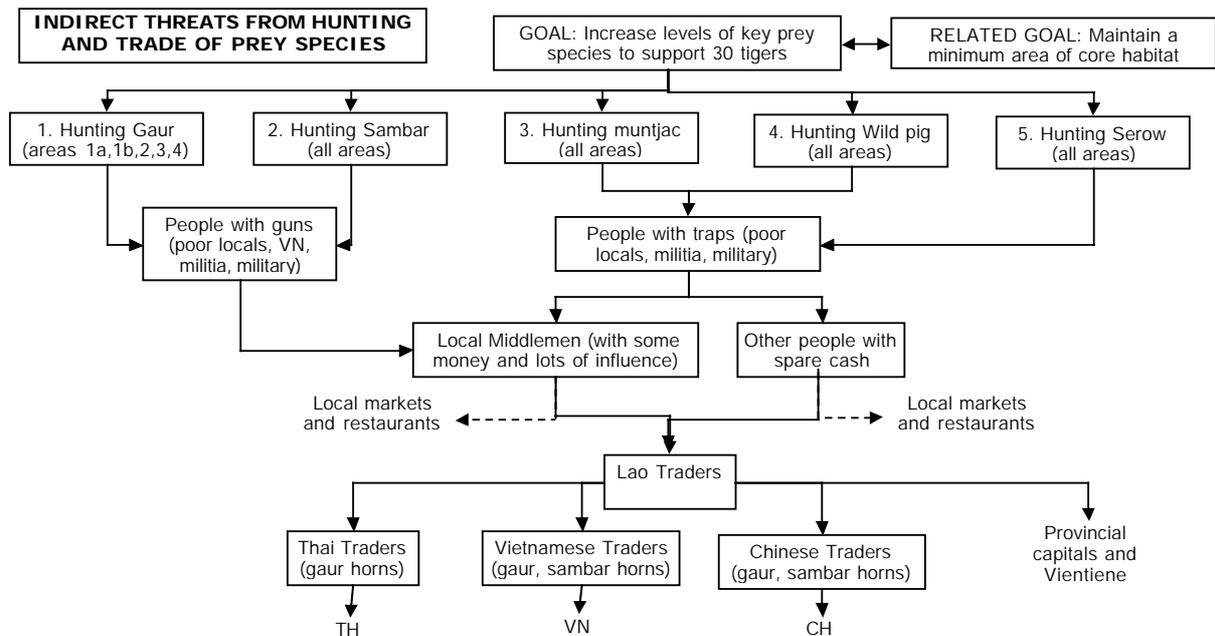


Fig. 3. Relationship chain diagram showing links between threats to the goal of increasing levels of key prey species to support 30 tigers, and groups/individuals causing threats (negative stakeholders). Areas where threats occur are shown in Fig. 1.

Gaur and Sambar are hunted with homemade guns by locals, and with semi-automatic weapons by village militia and military. These same groups also use traps to hunt Muntjac spp., Wild pig and Serow. Normally, people hunt these species for food and to make extra cash but during times of food shortage e.g. if rice crop fail, they increasingly hunt to compensate their loss.

Local middlemen and other people with spare cash e.g. rich residents in Viengthong District, drive the hunting of tiger prey species by providing resources for hunting e.g. traps, and transportation to get hunted animals out of the reserve and to local markets and restaurants. Motorcycles, buses and private vehicles are used to move hunted wildlife to local markets and on to urban markets. Wild meat is consumed locally while horns and other parts are exported out of the province as trophies. Lao traders are involved in this as are traders from other countries. In particular, horns of gaur and sambar are exported to Thailand, Vietnam and China.

Although wildlife trade and export of wildlife across country borders is banned by the Forestry Law (Ministry of Agriculture and Forestry, 1996), wild meat is openly sold at restaurants in Luang Prabang, and in settlements along road routes into the reserve from Luang Prabang. Some wild meat is traded at the local market in Viengthong District. During our visit we were given detailed information on prices of hunted animals by

restaurant owners in Nam Bak District, Luang Prabang Province. There appears to be a lack of enforcement of the Forestry Law as pertains to the articles on wildlife trade.

Impacts on tiger habitat

A related goal to increasing the tiger population is to secure a minimum area of core habitat for tigers. Threats to achieving this goal are habitat loss which occurs due to land clearance for shifting cultivation, timber cutting for sale, and timber cutting for NTFP collection. During a visit to Sone Neua we saw recent evidence of land clearance and timber cutting along the main access road in area 5. We saw timber cut for firewood. Poor locals and Vietnamese are hired by rich locals or outsiders to do the clearing/cutting during the months of March and April. Timber companies also hire the poor to illegally cut timber inside the reserve. Rich Chinese buy illegal timber from the timber companies. Of special concern is the cutting of timber to facilitate collection of NTFPs such as orchids, aloewood, rattan, vine bark, and tree bark. These products sometimes have very high value and therefore there is a strong incentive to collect them in the reserve. For example, 1kg of high grade aloewood may exceed the market price of a dead tiger. Orchids harvested in the reserve are exported to China.

Aside from habitat loss, degradation of tiger habitat may occur due to a number of factors, including deliberate lighting of fire. Fires are started to flush out wild animals which are then hunted. This is done by poor locals, Vietnamese and militia. Fires are also started to create areas for grazing of livestock. This is done by poor locals, military and perhaps also poor Vietnamese. Mineral licks are important feeding areas for large ungulates, and hunting areas for tigers. These places are disturbed by people who poach and graze livestock.

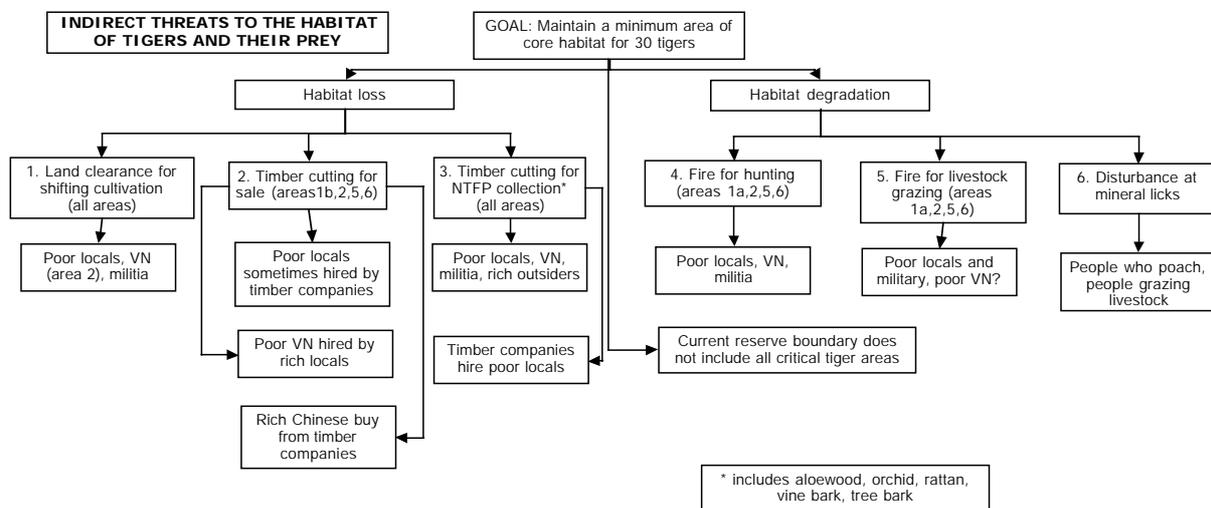


Fig. 4. Relationship chain diagram showing links between threats to the goal of maintaining a minimum area of core habitat for 30 tigers, and groups/individuals causing threats (negative stakeholders). Areas where threats occur are shown in Fig. 1.

Discussion

In this section we discuss the various threats to tigers and suggest ways to reduce or mitigate the threats.

Direct threats

Reducing killing of tigers

There are two main reasons for killing tigers; to sell and to seek retribution for example, for livestock that tigers kill. There are strong incentives to kill tigers due to the high market price and proximity to markets in neighbouring countries.

1. Hunting using explosives. According to the Forestry Law, use of explosives in the reserve is illegal. Patrolling in villages in reserve, combined with investigations will help to detect explosives which should be confiscated. Separately, agreements are needed with construction companies and other sources of explosives and explosive materials, not to sell these items to locals.
2. Hunting with snares supplied by outsiders. Snares are indiscriminate in their effect and sometimes injure people. Patrolling is needed inside the reserve to detect and dismantle snares, and villagers need education about dangers of snares. The use of traps should be banned with new local regulations for Viengthong and Viengkham Districts.
3. Hunting using livestock as bait. A new regulation banning grazing inside the reserve is needed. The law will need to be enforced by patrols focussing on the core zones.
4. Hunting for retribution. Occasionally villagers lose livestock to tigers. An education programme is needed to teach villagers how to protect their livestock. Compensation schemes have potential in places where incidences of livestock killing are low and density of farmers is low e.g. Myanmar (Lynam *et al.*, 2006). Given the high number of people living inside NEPL, and the current behaviour of farmers, it's highly likely that a compensation scheme would be abused and therefore it is not recommended.
5. Hunting using poison. Use of poisons inside reserve should be banned and the ban enforced with patrolling in villages and confiscation of poisons. Poisons such as rat poison kill wildlife and domestic livestock indiscriminately, so villagers should be educated about the dangers of using poison.
6. Hunting using guns. There are problems with the illegal use of homemade guns and legal weapons used for village defence. For homemade weapons, patrols and investigations are needed to detect bearings and barrels used in making guns. There is need for tighter controls on the use of ammunition & legal weapons in military camps with agreements made with local commanders of military camps not to allow legal weapons for hunting. Some middlemen are a part of the problem since they supply weapons and ammunition from outside the reserve. Establishing checkpoints at access points to reserve will help restrict influx of weapons into reserve. The use of automatic ammunition should be monitored in villages. NEPL is part of a former war zone, so there are lots of weapons/ammunition still hidden in forest. Systematic patrolling inside the reserve will help detect war weapons and ammunition.

Reducing trade of tigers

7. Local middleman are possibly the group posing the greatest threat to tigers/prey and should be a target group for conservation interventions. There are middlemen in

every village. The profile of the local middlemen is a local with money who has a bus or motorcycles at his/her disposal. As the mobile telephone network expands, the work of the middlemen will become more efficient.

- Establish checkpoints near the houses/villages where middlemen live
 - Conduct surveys to find out who in each village is involved with middleman
 - Conduct surveillance to observe movements and behaviour of middlemen
 - Establish a network of informants to be supported/paid by the project
 - Target villages that are problem villages include Paphai, Par Lao, Muang Sone, Khet Pattanna (Development Zone), Xam Nuea town, Viengthong town and others.
 - Local radio and TV advertisements to influence locals not to get involved in illegal wildlife trade
8. Cross-border smuggling. Tigers are illegally exported across country borders. Border controls on wildlife should be strengthened with training for customs and police using training materials that have been developed for the purpose of training enforcement staff (WCS, 2004).

Efforts to reduce tiger poaching can be helped by recruiting the District Governors, and local military and police commanders, and village headmen to participate in conservation activities. Groups who don't hunt tigers and/or some prey species e.g. gaur may help conservation efforts. These groups include some Lao lowland groups e.g. Phou Thay, Thay Daeng, Thay Dam, Sao Luang, Khamou, and some family groups.

Indirect threats

Reducing hunting and trade of tiger prey species

The main reasons for hunting is to eat and to sell but there are no villages completely dependent on wild meat. During times of food shortage e.g. rats destroy crops, villagers go to forest to hunt wildlife, and sell wildlife to buy rice or food. Solutions to the threats of hunting and trade in tiger prey species are the same as for tiger hunting/trade but with the additional problem of dealing with local outlets for wild meat such as restaurants and markets.

The problem of wild meat for sale in restaurants can be reduced if

- Officials agree not to eat wild meat or support outlets that sell wild meat
- Restaurants are regularly monitored for illegal wildlife
- Restaurant owners are educated about the problems they cause by selling wildlife from the reserve
- A "green" restaurant programme is established with promotion and support for restaurants that agree not to sell wild meat e.g. give free advertising, certification that can be shown in restaurant.

The problem of markets that sell wild meat can be addressed by

- Monitoring markets for illegal wildlife
- Meetings and wildlife awareness presentations for market sellers to educate them and influence them not to sell illegal wildlife e.g. good citizens don't trade wildlife.
- A "green" programme to support markets that don't sell wild meat

- Wildlife conservation advertising in markets and access routes into and out of the reserve. The 23 signposts that have been placed strategically at markets are a good start.

The problem of villages with families who hunt can be addressed by

- Support programmes for villages that agree not to hunt e.g. supplementary rice or other food supplies in crisis years. Such programmes should start in area 5 because it is in the middle of the reserve between two core tiger areas.
- Where possible, establish agricultural development projects e.g. aloewood plantations outside the reserve, and support the voluntary relocation of villages out of the reserve to join these projects.

As before, local middlemen are a key problem group since they facilitate and support hunting of large ungulates, supplying both hunters with equipment and traders from outside the province with wildlife.

Village headmen, militia heads and military commanders should be recruited to participate in conservation projects. These individuals can help reduce hunting the reserve and influence others not to hunt.

Reducing impacts on tiger habitat

1. Land clearance. Currently the policy is to allow shifting cultivation in places with poor forest but some families still cut in other areas. We observed that the law is ignored because there is no enforcement. To solve the problem there should be better landuse planning, with areas zoned for shifting cultivation, and relocation of some villages away from strict conservation zones. Financial and technical support will be needed for agriculture/livestock development projects which should be conducted outside the reserve.
2. Timber cutting for commercial sale. This can be reduced immediately by establishing checkpoints along access routes into the reserve which are manned 24hrs a day. Gates should be closed at night with vehicle access allowed only during daylight hours. Patrolling in reserve will help detect handsaws and other timber harvesting equipment. Support from locals will be needed to obtain regular and accurate information on illegal activities, with information paid for by the project.
3. Timber cutting for NTFP collection. Dealing with this problem is a high priority given the incentives to harvest certain high value species such as aloewood and orchids, and because of the collateral damage associated with these activities from teams of collectors in the forest for several weeks to a month, and eating wild meat. NTFP collectors will also hunt tigers if they find them. Systematic patrolling inside reserve combined with checkpoints along access routes and a network of informants will help to reduce illegal activities associated with NTFP collection. Projects to train locals to grow orchids, rattan, aloewood, bamboo shoots, and get them out of the forest should be mounted but only outside the reserve and not in villages near core zones.
4. Fire for hunting. There are local regulations on fire, but these need to be expanded to declare a complete fire ban in March-April. This should be combined with increased patrolling to enforce the ban along with awareness raising in villages about fire

hazards to wildlife. Signposts should be erected along access routes notifying locals of the fire ban during March-April.

5. Fire for livestock grazing. Modify livestock grazing practices through education programmes and restrict grazing to certain areas, with the restrictions enforced by patrol units.
6. Disturbance of mineral licks. Survey and record the locations of mineral licks and zone these locations as livestock-free and hunting-free areas. Notify locals of the restrictions through village meetings. Patrol mineral licks to enforce the ban and detect poachers.

Addressing all biological threats to tigers

Experience from other conservation areas suggests that local communities may be encouraged to support wildlife conservation programmes if there are perceived benefits to their livelihoods through participation. It may be possible to make agreements with some local communities in return for village support programmes e.g. support for dealing with pest species, providing salt, building wells. The Participatory Landuse Planning or PLUP programmes in Mondulhiri, Cambodia (T. Evans pers. comm.) may be a model for NEPL.

Other threats

1. Lack of community support for conservation because of a lack of community development.
2. Lack of coordination between agencies and communities inside and adjacent to the reserve. There are 46 villages inside reserve in Viengthong District, 30 outside reserve, and 11 villages in Viengkham District, all outside reserve, 2 villages in Hua Muang, and 4 villages in Xem Nuea. Some villages in area 5 have helped provide information on tigers. Villages outside reserve have not been helpful.
3. Lack of coordination between government agencies; forestry, police, customs, trade, military
4. Lack of information from villages about illegal activities because there are no incentives for people to give information. Need a policy to pay or support people who provide information.
5. Lack of information about threats in some areas, notably areas near the Vietnam border and areas in the southwest of the reserve.
6. Lack of equipment, esp. transport. The reserve is large 3446km² but there are only 1 4WD vehicle and 2 motorcycles available for management activities. Some field equipment supplied by WCS includes six GPS units, ten tents and ten backpacks. There is no radio communications system which is a seriously impediment to coordinating activities over such a large area.
7. Lack of protection due to insufficient law enforcement. The sale of wildlife in local markets and restaurants, open destruction and clearing of tiger habitats, and unconcealed use of weapons are indications that people perceive no risk from wildlife crime. If there is no enforcement the behaviour of hunters, traders etc is no different from one in which no wildlife laws are in effect (Rowcliffe *et al.*, 2004).
8. Lack of infrastructure for protection. There is a HQ but no guard posts. Need permanent substations at strategic points of entry/exit into reserve (8-10 points).
9. Lack of funds to support conservation activities. Currently the main activities in reserve are management and protection. After the IUCN project in 2002-3, there were no conservation activities until WCS arrived in 2003/4. Wildlife surveys were done in the past few years, with conservation advertising, and a livestock depredation

study, land use planning and planting forage in villages with tiger and human conflict. These activities involved 28 villages.

10. Lack of trained staff. During 2002-3 reserve staff numbered 14. Currently there are only 4 staff but one is away on study leave. There are only 4 WCS staff including 2 technical and 2 support staff, 10 villagers who help with camera-trapping, 3-4 education staff, and 14 patrol team staff (6 are government staff, 2 staff trained in patrol techniques, and 8 are villagers). This is low relative to numbers needed (>3 guards/rangers/100km²) for effective protection (Bruner *et al.*, 2001).
11. Lack of staff motivation because enforcement work is dangerous, but there is a lack of support for field staff. One patrol team focuses on roads and villages outside the reserve with the other forest patrols inside the reserve. Training in recording data has been done but there was no formal training in other areas. Need training in techniques, communications, budget, patrol procedures. Patrol teams do not do dedicated protection work, perform other duties.

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