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MONITORING TIGERS AND THEIR PREY IN THE CENTRAL TRUONG SON

A MONITORING, RESEARCH AND SURVEY PLAN

WWF-INDOCHINA
&
THE FOREST PROTECTION DEPARTMENT

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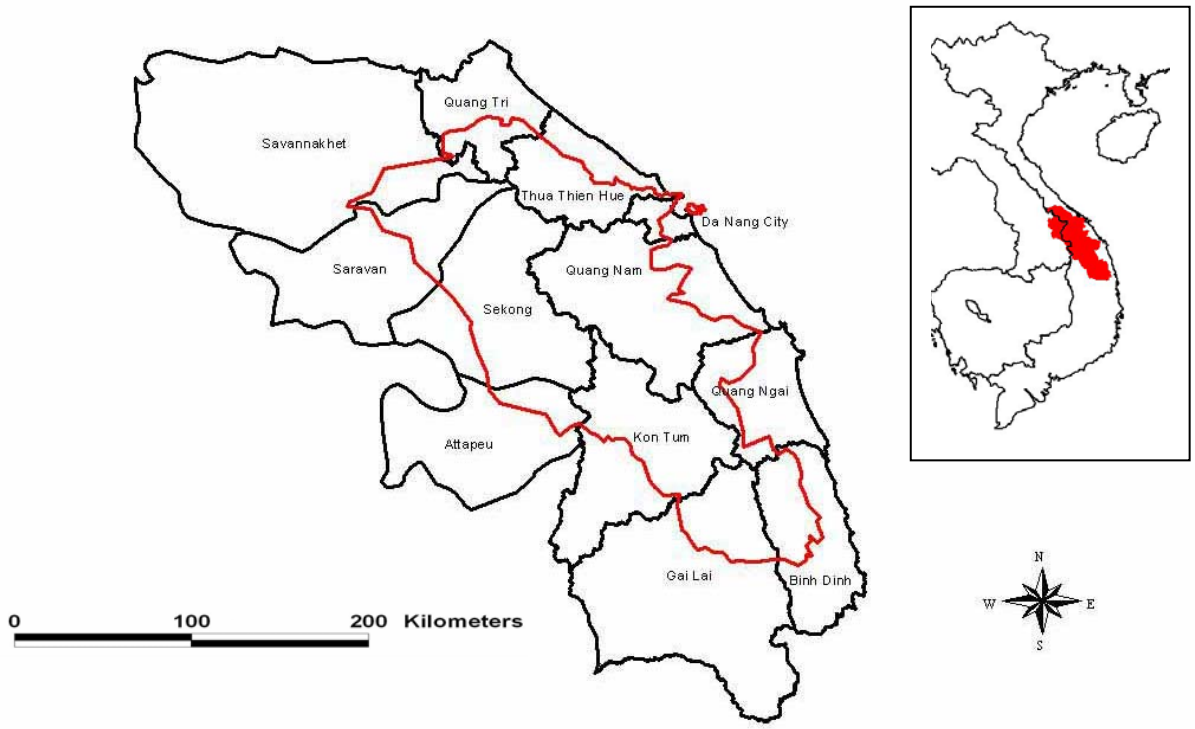
Aim

To implement a scientifically rigorous monitoring system for tigers and their prey as the basis for adaptive management and focused conservation interventions throughout the Central Truong Son Priority Landscape

Introduction

The Central Truong Son Priority Landscape is a critically important area for biodiversity conservation (Baltzer *et al.*, 2001). Incorporating seven provinces and one city in Vietnam and four provinces in Lao (see map 1) the landscape covers an area of 405,684km^2 of which 42.3% or 171,758km^2 is natural forest (Tordoff *et al.*, 2003).

Map 1. Provincial boundaries and the Central Truong Son Priority Landscape

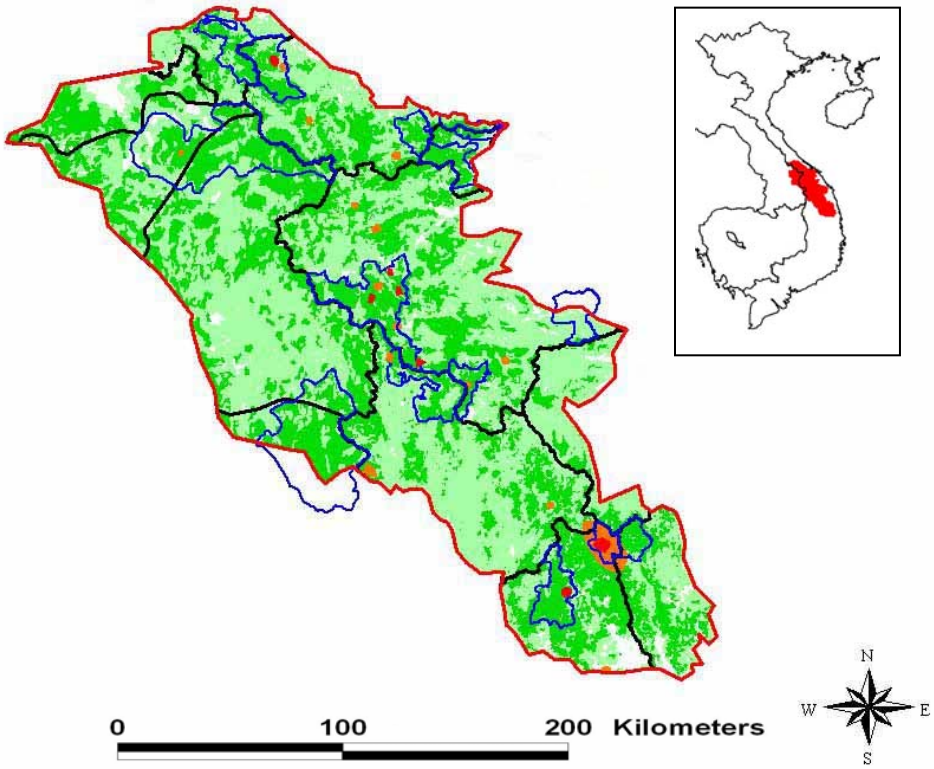


The Truong Son Mountains are a Pleistocene refugium (see Timmins & Trinh Viet Cuong, 2001) that host a suite of endemic species. In the Central Truong Son Priority Landscape the following endemic and newly described species are known or presumed to occur: saola (*Pseudoryx nghetinhensis*), large-antlered muntjac (*Muntiacus vuquangensis*), Annamite muntjac (*Muntiacus truongsonensis*), Heude's pig (*Sus bucculentus*), grey-shanked douc (*Pygathrix cinerea*) and Annamite striped rabbit (*Nesolagus timminsi*).

The landscape is centred along the mountain spine that runs south-eastwards forming the international boundary between Vietnam and Lao in the north of the landscape and the Ngoc Linh ridge in the south. Moist monsoon evergreen forest covers the mid and low elevations with sub-tropical montane forest at higher altitude. Primary forest cover is not continuous across the landscape as small breaks occur and roads bisect the area. These habitat disruptions, however, are often degraded forest, secondary forest or scrub (see map 2) so do not pose a dispersal barrier to many species less affected by edge effects.

Tigers are distributed across the landscape (see map 2), so with primary forest patches being connected by 'tiger friendly' habitats, the Central Truong Son Landscape should be managed as a single 'tiger unit'. Very little is currently known about tigers in the landscape, other than that they occur across the landscape at low densities. Map 2 shows recent records; the red locations are confirmed field sign and the orange locations unconfirmed reports. From this map, it can be seen that three key core areas of tiger presence exist in Phong Dien Nature Reserve, Song Thanh Nature Reserve and the Kon Ka Kinh – Kon Cha Rang – An Tuan protected area block.

Map 2. Forest cover, protected areas and tiger distribution in the Central Truong Son Priority Landscape



As well as the endemic ungulates mentioned previously Eurasian wild pig (*Sus scrofa*), red muntjac (*Muntiacus muntjac*), lesser oriental chevrotain (*Tragulus javanicus*), southern serow (*Naemorheedus sumartrensis*), sambar (*Cervus unicolor*) and gaur (*Bos gaurus*) occur, probably in this decreasing order of abundance. Ungulates larger that 20kg form the main prey base of tigers (Sunquist *et al.*, 1999, Karanth, 2001), with tiger density being directly correlated to ungulate density (Shaller, 1967, Seidensticker & McDougal, 1993, Karanth and Sunquist, 1995, Sunquist *et al.*, 1999). Ungulate density in the Central Truong Son landscape is probably low in comparison to the natural situation due to extensive, intensive snare trapping combined with little to no enforcement. Tigers require 3-4,000 kg of live prey per year to survive and crop approximately

10% of available prey in an area annually (Karanth, 2003). Considering natural reproductive rates of ungulates and predation by other predators, this cropping rate translates into a standing prey base requirement of about 400-500 ungulates required to support a single tiger in a given area for one year (Karanth, 2003), with breeding tigers requiring higher rates. Given this relationship, tiger home ranges vary in size across their distribution from 10 to 300 km^2 (Sunquist *et al.*, 1999, Miquelle *et al.*, 1999). In the Central Truong Son landscape, the number of ungulate species present is larger than in other tropical rain forest environments in Southeast Asia, albeit that each species is at reduced densities. It likely, therefore, that sufficient densities of ungulates persist, at present, to enable tigers to survive.

Both tigers and its ungulate prey are targets for hunting in all areas of the Central Truong Son landscape. Hunting of tigers is rare, probably due solely to the low density of the species making it very time and resource consuming to hunt. However, tigers are still a prime target, with some wildlife traders working out of the landscape offering $70 for information on the location of tiger tracks. Occasionally tigers are killed in retaliation for the loss of livestock.

Ungulates are especially heavily targeted, with snare traps being ubiquitous throughout, including core zones of protected areas. Given the high reproductive potential of tigers, the population could recover if this relentless pressure on the prey base was eased. Trapping pressure is currently high due to the demand of bush meat in the wildlife trade, local dependence on wild sources of protein and human-wildlife conflict. This pressure results in a probable continual decrease in ungulate density, which will eventually deplete the prey base for tigers to a level where reproduction and survival is not possible. It is essential that core areas throughout the landscape become closed to access and that a no hunting/trapping rule is strictly enforced. This is the only way that ungulate populations can recover and tiger breeding areas can be secured.

Given the above facts, any system that wishes to monitor tigers across a landscape must obtain information on tiger distribution, tiger breeding, threats to tiger including depredation caused by human-wildlife conflict, ungulate abundance and threats to ungulates. The methodology described below (based on Karanth & Nichols, 2002 and Karanth *et al.*, 2003) has been designed to ensure these issues are addressed in a scientifically rigorous manner, whilst taking into account the constraints faced in Vietnam. The result is a comprehensive monitoring system on all relevant scales which is capable of being conducted by Forest Protection Department rangers on limited resources. This document is designed for implementation in the Vietnamese side of the Central Truong Son landscape only at present.

Tiger surveys and population monitoring in the Central Annamites Priority Landscape are highly constrained by logistical and ecological factors. These factors can be summarised into a lack of trained personnel and highly depleted tiger and prey populations. However, tigers are still present across the Central Annamites Priority Landscape and through an integrated programme of landscape scale conservation and land use planning, implemented on the ground through local community involvement and trained rangers, a specific tiger competent to the Central Truong Son Conservation Initiative will be highly effective.

The methodologies and activities described in this document would make a significant contribution to the core indicator 'population of key target species in protected areas' within the monitoring and evaluation system for forest landscape restoration in the Central Truong Son landscape (Dudley *et al.*, 2003).

Objectives

Tiger objectives

Phase I 2004

Phase I - Landscape

- To define the distributional range of tigers in the Central Vietnam Tiger Corridor (Thua Thien Hue, Quang Nam and Kon Tum provinces)
- To identify changes in tiger distribution over the last decade in the Central Vietnam Tiger Corridor
- To clarify the breeding status of tigers in the Central Vietnam Tiger Corridor
- To identify threats to tiger populations across the Central Vietnam Tiger Corridor

Phase I – Priority site

- To determine whether the tiger population of Song Thanh Nature Reserve is stable

Phase II 2005-2006

Phase II - Landscape

- To define the distributional range of tigers in the Central Annamites Priority Landscape
- Confirmation of tiger presence in priority Forest Management Units of the Central Annamites Priority Landscape
- To identify changes in tiger distribution over the last decade in the Central Annamites Priority Landscape
- To clarify the breeding status of tigers across the Central Annamites Priority Landscape
- To identify and monitor threats to tiger populations the Central Annamites Priority Landscape

Phase II – Priority site

- To confirm and locate core tiger breeding areas in and around Song Thanh Nature Reserve

Prey Objectives

Phase I 2004

Phase I - Landscape

- To define the distribution and composition of tiger prey species across the Central Vietnam Tiger Corridor
- To identify changes in tiger prey distribution over the last decade in the Central Vietnam Tiger Corridor
- To identify threats to tiger prey populations across the Central Vietnam Tiger Corridor

Phase I – Priority site

- To define the distribution of tiger prey species throughout Song Thanh Nature Reserve
- To identify and prioritise key threats to tiger prey throughout Song Thanh Nature Reserve

Phase II 2005-2006

Phase II - Landscape

- To define the distribution of tiger prey species across the Central Annamites Priority Landscape
- To identify changes in tiger prey distribution over the last decade in the Central Annamites Priority Landscape
- To develop an index to quantifiably monitor tiger prey densities and threats in key forest management units across the Central Annamites Priority Landscape

Monitoring background

For an effective monitoring system to be established under current constraints, a simple methodology that can be built upon in the future as capacity and tiger populations increase is required. Monitoring systems require both elements of spatial sampling and observability (Karanth & Nichols, 2002). These elements are required to be simple, yet replicable, and have some confidence and/or effort score associated with them.

Spatial sampling

Not all areas can be investigated due to the size of the area and the resources available. A representative area of the landscape should therefore be sampled. Sampling must be both standardised and replicable if trends are to be detected and management consequently adapted. Standardisation of sampling could be geographical, area, time or distance based, but must remain constant over time. A scale of survey effort is required in addition to the data obtained from each sample. For example, the number of interviews conducted, the time spent on a transect, or the number of camera-trap hours.

Observability

This represents the probability of an animal or indirect sign being recorded. If this can be obtained, the true number of animals can be calculated. If this probability can not be calculated, then an index of abundance can be obtained and used to show changes in abundance over time. Under the constraints currently faced in Vietnam, the effort involved in calculating this probability is too high for available resources. Therefore, establishing indices to monitor changes that can be fed into adaptive management systems is the most realistic and resource efficient way to approach tiger and prey monitoring.

Methodology

Interview surveys

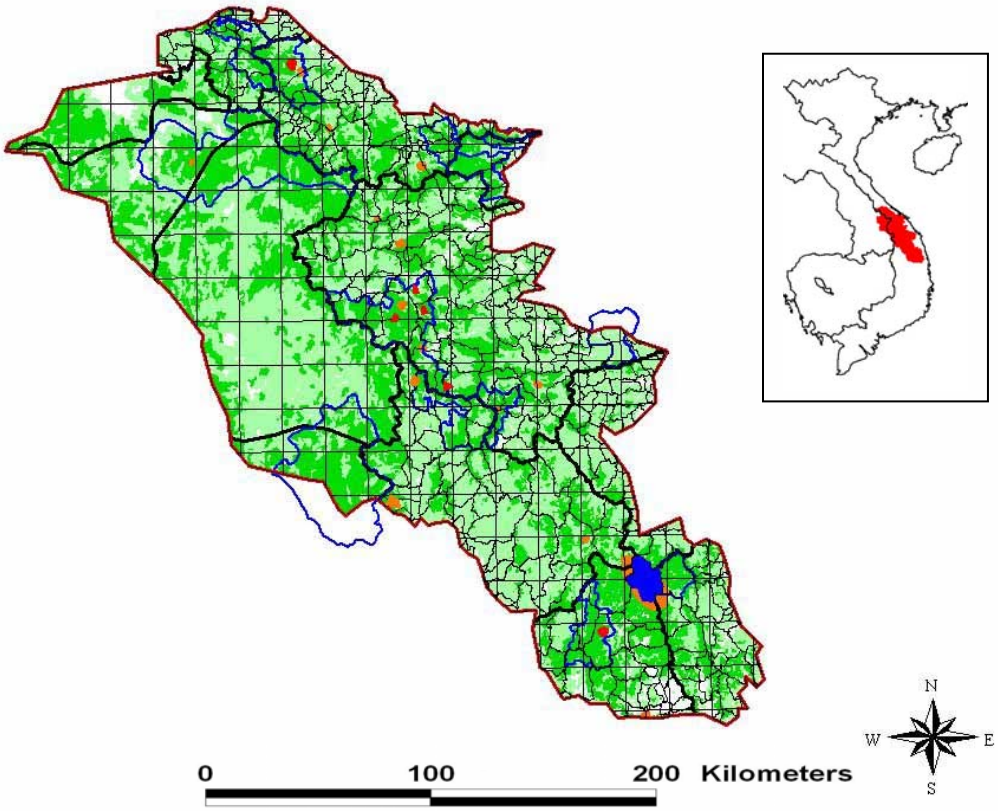
The most appropriate sample unit in Vietnam is the commune (see map 3) as each commune is a discrete and stable political unit with a single ranger assigned to it. This provides a simple, direct and replicable route to local knowledge. Using communes also gives a sufficient number of samples, whilst being manageable with available resources. In Quang Nam province, for example, 48 communes should be sampled with 8 rangers available for tiger work. Although a 10 minute sampling grid (see map 3) may be more systematic, this approach would be less effective at gaining implementation support due to a local lack of understanding of macro-scale scientific monitoring, whilst gaining minimal scientific advantages.

Rangers should visit each commune in the final quarter of each year. In each commune 'tiger contacts' should be established. These should comprise of the most renowned two or three hunters in the commune. They should be trustworthy and a respected part of the community, thus enabling them to obtain the relevant data. Once identified, these hunters should engage in gathering and recording all information in the commune related to tigers throughout the year. Rangers should approach these tiger contacts on an annual basis and through them complete the commune interview sampling unit recording sheet (appendix I). A minimum of two contacts in each commune should be interviewed each year to strengthen analysis by having multi-observers in each sample.

The interview form (appendix I) should be completed, with all sections completed or marked as no information being received. Interviews can obtain miss-leading information so each answer should

be qualified and justified and where appropriate comments from the interviewer noted to enable an informed assessment of the accuracy of the data collected.

Map 3. Vietnamese communes of the Central Truong Son Priority Landscape and a 10 minute sampling grid

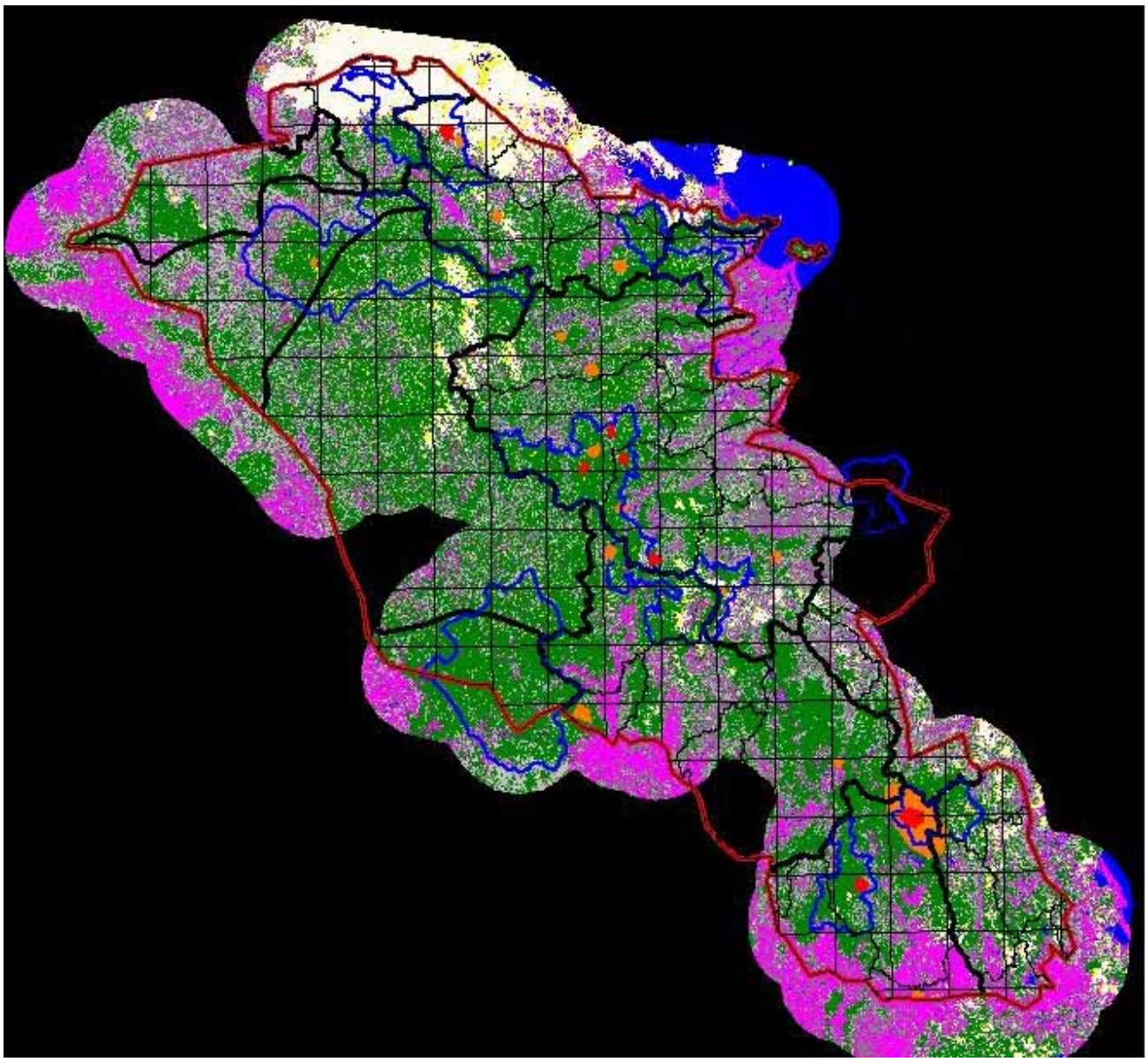


Presence/non-detection surveys

Information obtained from interview surveys should be used to prioritise areas requiring field surveys aimed at confirming the presence of tigers. It should be noted that non-detection during a survey does not equate to absence of tigers from an area. Tiger sign is difficult to find when animals are at low densities and conditions in tropical moist forest make the formation of indirect sign problematic and its persistence short-lived.

Presence/non-detection surveys should be conducted during the wet season (October to January) when indirect sign is easier to detect. Surveys should focus on the remotest forest areas and last 10 days. Each year, a minimum of 4 such surveys should occur in each province. Standardisation of this approach would ideally use a grid, such as the 10 minute grid shown on map 4. This has little meaning to on-the-ground forest management, however, so it is felt that the landscape should be divided into 'forest management units' with surveys focused on the most likely of these to yield tiger sign. The most appropriate forest management unit in Vietnam is a continuous block of forest within a district. This definition takes into account how forests are managed in Vietnam, with a district FPD, protected area or State Forest Enterprise being responsible for each forest block. Map 4 shows forest blocks within each district and shows that in Quang Nam for example 11 major forest management units exist within the landscape whereas the province's forest covers part of a minimum of 22 units when using the 10 minute grid.

Map 4. Forest cover map and districts showing appropriate Forest Management Units with a 10 minute sampling grid overlaid



The probability of detection is increased if multiple observers survey the same forest management unit. The best way to achieve this situation logistically, would be to have 4 rangers survey an area, with daily surveys conducted out of a camp in two different directions, with each survey being conducted by 2 rangers. Surveys must not repeat the previous day's route or the route of the other group. A camp could be surveyed for two days before moving camp and repeating. In a 10 day survey, therefore, 3 camps would be required offering 6 days of multiple observer surveys and 4 days of single observer surveys.

Trained tiger and prey survey rangers have to be used to conduct this methodology. If rangers are not confident of accurately assigning pugmarks to species level, drawings, measurements, plaster casts and photos should be taken and the track recorded as 'large cat'. Data should be recorded on a separate data sheet for each daily survey (see appendix II). It is important to record the

distance covered using a pedometer and the time of survey each day to enable an index of survey effort to be assigned to each forest management unit.

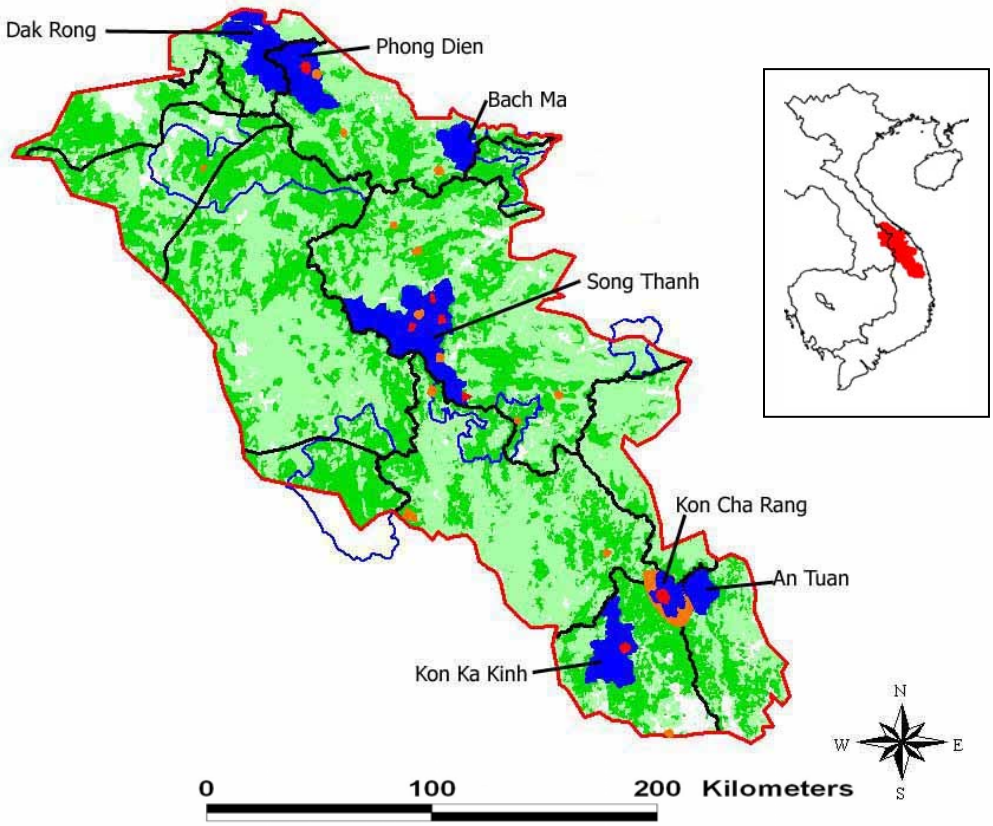
Every tiger record should be recorded on a GPS and incorporated into a centrally held GIS database.

In addition to tiger presence/non-detection, ungulates and other animals observed should be recorded to help further knowledge on the area. Every ungulate track observed on the route travelled should be recorded with the same species not being recorded for another 50m to ensure no pseudoreplication occurs. If ungulate tracks can not be identified to species level, they should be recorded as ungulate track only. In addition, every trap encountered should be recorded. This methodology will enable i) a comparison of relative prey abundance and trapping pressure across the landscape and ii) an index for monitoring changes over time in one forest management unit.

Abundance index surveys

In order to establish a rigorous monitoring system for tiger prey, more standardised methodologies are required, utilising more resources and personnel time. Therefore, these methods should be restricted to forest areas with intensive forest management in locations believed to be core areas for tiger distribution and potential breeding sites. The most appropriate locations are protected areas, where staff are allocated to scientific and monitoring roles. In the Central Truong Son Priority Landscape 7 such protected areas have been identified (see map 5).

Map 5. Priority protected areas for abundance index and camera-trapping surveys



In order to obtain an index, methodologies have to be standard and repeated at set times. Straight line transects are the most rigorous method for such an approach, but the terrain of the Central

Truong Son makes these logistically difficult. Wandering transects, therefore, provide the most appropriate local solution. Wandering transects are walks of a certain length which attempt to be as straight as possible, but where the terrain prevents straight lines, then deviations can be made. Transects should be 2km in length and placed in a manner that incorporates all sectors of the protected area. Truly random placement and orientation of transects is not required as logistics will constrain such a rigorous approach.

The approximate size of each protected should be divided by 20 to provide the length of transects to be walked. Song Thanh Nature Reserve for example is 930km^2 so 46 km of transects should be conducted. Transects should be conducted during the wet season (October to January).

Each transect should be marked both on the ground and on a GIS. In the field the start point should be clearly marked using paint spray on a tree or a metal tree tag. The direction of the transect should also be marked. An approximate compass bearing should be taken and the transect created by marking trees every few metres whilst following this bearing. The transect should not be cut or cleared in a manner that may facilitate its use as a trail because this will provide a higher index than the natural situation. Transects should not follow human or animal trails deliberately, but may cross them, or join them temporarily, should the compass bearing coincide with them. Every hundred metres should be clearly marked in the field, this being calculated with a 100m rope or GPS track counter, and on the GIS.

Transects should be walked slowly so that every track within 1m of the transect line is observed. The transects are broken up into 100m sections, during which the presence or absence of a species should be noted on a data recording sheet (see appendix III). Presence of a species can involve a sighting or the detection of tracks, faeces or hair. If a species can not be identified, but is clearly distinguishable from other species recorded in that 100m section of the transect, it should be noted on the data recording sheet.

A protected area tiger prey index or species abundance index can be created using the average number of records per 100m section. If repeated at the same time each year, changes in abundance can be detected and management of the prey base adjusted accordingly.

Camera-trapping

If conducted properly, with cameras effectively cared for and battery and film changes occurring according to a pre-determined schedule, camera-traps provide further index of prey abundance as well as providing the best opportunity for confirming tiger presence in an area.

Each of the priority protected areas should have a minimum of 10 camera-traps with others available to be deployed in key forest management units outside of the protected area network. Cameras should be placed for 10 months (10 battery and film changes) at one site before having 2 months rest during the height of the wet season and being moved to another section of the protected area. Cameras should be located in sites with the highest likelihood of photographing tigers. Each camera should be set within a 1km grid square so that a trapping grid of 10km^2 is established.

Camera data should be carefully recorded both in the field and on camera-trap data recording sheets (attachment IV). Photos should be labelled, scanned and stored in a manner that facilitates data analysis and ease of database searching.

Other requirements

This document outlines a methodology for monitoring tigers and their prey in the field. In order for this to be effective, intensive training of rangers from each province and each protected area needs to occur. A 'tiger team' should be established in each province to focus training on a core team, in which the required skills can be built. A team of 4 to 8 people in each province should be chosen and trained.

The data obtained from these activities should be collated at the provincial level, but stored centrally and linked to a GIS to enable landscape scale monitoring and adaptive management.

Monitoring tiger and prey populations and documenting their extirpation from the landscape is not the objective of these activities. To reverse the current trend of declining populations, this monitoring project requires sister activities in strict law enforcement, especially in priority protected areas, an extensive wildlife trade crackdown and 'tiger friendly' land use planning.

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Appendix I

Sample Interview Questionnaire for each Commune Sampling Unit

Date: *day/month/year* Interviewer: *name of ranger*
Commune: *name of commune* Village: *name of village* UTM location: *xxxxxxxN xxxxxxxE* Interviewee: *name of person being interviewed* Ethnicity: *ethnic group of interviewee*

Tigers:

Present (Present 2-5 years ago) Present 6-10 years ago Present > 10 yeas ago No information

Date of last evidence: …*December 2001*.....
What evidence: …*Footprint observed by local hunter*.....
Any evidence of cub/breeding behaviour: …*Cub seen in 1993*.....
Justification of identification as tiger: …*Footprint bigger than 10cm according to person who saw it*.....
Information status: first hand (second hand) third hand
Level of confidence in report: high (medium) low

Note:
first hand: interviewee saw the evidence
second hand: evidence seen by someone who informed the interviewee
third hand: evidence seen by someone who told someone else, who told the interviewee

Prey:

Species	Present/absent	Abundance			Population inc/dec in last 5 years
		Common	Present	Rare	
Sambar	✓	-	-	✓	Dec
Serow	✓	-	✓	-	Same
Saola	×	-	-	-	-
Hog deer	×	-	-	-	-
Truongson muntjac	✓	-	✓	-	Same
Large-antlered muntjac	✓	-	✓	-	Same
Red muntjac	✓	✓	-	-	Inc
Wild pig	✓	✓	-	-	Inc
Banteng	×	-	-	-	-
Gaur	×	-	-	-	-
Elephant	×	-	-	-	-

Note:
1. Make each box to prevent incorrect interpretation of the data
2. Populations can increase, decrease or stay the same
3. Hunting intensity can he low, medium or high

Hunting/snaring:

Method	Locals	Outsiders	Locals	Outsiders	Intensity					
	Present/ absent	Present/ absent	Inc/dec in last 5 years	Inc/dec in last 5 years	<1hr		2-5 hrs		>5 hrs	
					local	outs	Local	outs	local	outs
Ungulate snaring	✓	✓	*Same*	*Inc*	high	low	high	mid	-	high
Ungulate shooting	×	✓	-	*Dec*	-	low	-	low	-	low
Big game snaring	×	✓	-	*Dec*	-	-	-	low	-	low
Pit traps	-	-	-	-	-	-	-	-	-	-
Stake traps	✓	-	*Dec*	-	mid	-	low	-	-	-
Explosives	-	-	-	-	-	-	-	-	-	-
Others (specify)	-	-	-	-	-	-	-	-	-	-

Is organised big game hunting present? Y / (N)

Have any livestock been lost to tigers? (Y) / N

Details (when/where/how often/species/identification verification): …*June 1999, 1 cow and 1 buffalo were killed in village 3. The tiger was killed so sure of identification*.....

Action (locals/government/what): …*Pit fall trap was made and tiger killed. Man who killed the tiger was arrested, and fined 10,000,000 VND, but the tiger was sold for 30,000,000VND*.....

Appendix II

Wildlife Survey Data Sheet

Location			Date			Personnel	
Distance covered			Weather				
Time start			Time Finish			Survey time	

Time	Species (include human activity)	Location (UTM & Lat/Long)	Habitat	Altitude	Evidence (track/ sighting etc.)	Remarks (measurements, compass bearing etc.)

Appendix III

Abundance Index Survey Data Sheet

Protected area: .....
Transect number: .....
Ranger 1 name: .....
Ranger 2 name: .....
Date: .....
Weather: .....
Time start: .....
Time finish: .....

100 m section	Species presence										No. Traps per 100m
	Muntjac	Pig	Sambar	Hog deer	Serow	Saola	Gaur	Macaque	Unidentified	Unidentified	
1											
2											
3											
4											
5											
6											
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Appendix IV

Camera-trap Data Sheet

Location		Negative code		Sheet No	

Trapping site	
Camera ID	
Habitat type	
Altitude	
Trapper	
UTM Easting	
UTM Northing	
Latitude	
Longitude	

Date set	
Date retrieved	
Date out of film/collected	
No. trap nights	
No. Trap days	
Bait	
Total number of mammals	
Total number of birds	
Humans (non-surveyors)	

Photo ID	Negative No.	Results