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TIGER CONSERVATION AND SURVEY TRAINING FOR THE CENTRAL VIETNAM TIGER CORRIDOR

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Barney Long

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Introduction

The Central Vietnam Tiger Corridor is a project jointly implemented by the Forest Protection Departments (FPD) of Thua Thien-Hue, Quang Nam and Kon Tum provinces and the World Wide Fund for Nature (WWF) Indochina Programme.

The Tiger Corridor covers a landscape which is of regional importance for the conservation of tigers in the wild and covers the priority landscape of the Central Annamites. The project area encompass important remaining forest habitat in Vietnam as well as contiguous large forest blocks and protected areas in adjacent Cambodia and Lao PDR. As such, this tiger conservation effort aims to contribute to the long-term persistence of tiger populations both within Vietnam and in Indochina as a whole.

The project takes a comprehensive approach to tiger conservation, both in terms of physical scope and in terms of actual project activities. In spreading activities over a wide landscape, the Corridor embraces the ecoregional approach to conservation. In Vietnam where tiger numbers are severely depleted and protected areas are small and fragmented a landscape-based approach is clearly necessary.

The project has three following objectives:

1. To build capacity among forest guards in anti-poaching and tiger survey techniques.
2. To carry out surveys and inventories in the project area in order to fill gaps in knowledge on tiger populations and the various threats they face.
3. To raise awareness among communities in the project area on biodiversity conservation in general and tiger conservation in particular.

This report presents the content of a training workshop for FPD on tiger conservation and survey techniques as well as the results of a short tiger survey which was used as part of the training course. The style of writing is deliberately not scientific so that the information is available to a wide audience. This is not meant to be a training manual however, it is hoped that the information presented with will be used by the participants to refresh their memory of course contents and by others to improve their skills and understanding of tiger ecology, conservation and survey methods. The results of the survey are presented within the framework of a report decided upon by the participants of the training to provide an example of how data collected during a survey can and should be presented in an accessible way.

The information presented here has been complied from key texts and from web sites. These are not continuously referenced in the text to facilitate accessibility of the information. A key bibliography is presented at the end of this document so interested readers can find out more information and to acknowledge the texts that have been invaluable in compiling this training course and report.

Training

A training course for the Forest Protection Departments (FPD) from each of the three provinces in the Central Vietnam Tiger Corridor was conducted in October 2001. An initial two days of classroom training was held in Tam Ky, the provincial capital of Quang Nam province. A field survey in Song Thanh Nature Reserve, Quang Nam province was then conducted. This was supposed to include seven full days in the forest, unfortunately a week of heavy and persistent rain forced a conclusion of the survey after only a single day. Three days were spent at the Nature Reserve to practice using survey equipment. A final day of classroom training in Tam Ky was held to bring together all that had been discussed during the course and how to present survey information in a report.

The aims of the first day were to introduce the tiger, its ecology, behaviour and conservation plight. Then, drawing from well documented global perspectives and conservation examples the participants thought about the threats and possible mitigation measures on the local level to facilitate interest, ideas, actions and belief that the tiger does have a future in Vietnam if dedicated individuals work together.

The second classroom day was focused on survey methodology and the use of equipment including maps, GPS's and camera-traps.

Only a single day of field survey was possible, during which the placement of camera-traps was explained along with the basics of field conduct, data recording and track identification.

Three days were spent at the reserve in which extensive practice in camera-trap placement, GPS use and footprint casting were available. Many discussions and question and answer questions were also held.

The final day was spent discussing the collation, storage and presentation of data.

Introduction to the Tiger
Panthera tigris

Tiger evolution

Tigers like all other carnivores descended from civet-like animals that lived during the age of the dinosaurs about 60 million years ago. The tiger is considered to have evolved in what is now China, over one million years ago. The South China tiger (*Panthera tigris amoyensis*), retains primitive skull features, such as more forward-facing eye sockets and a small brain case, which suggest that it is the most primitive of the sub-species and reinforces the belief that China is the birthplace of the tiger.

From China, tigers spread south to the islands of Sumatra, Java, and Bali in Indonesia, west to the Indian subcontinent, north into Siberia and west, north of the Tibetan plateau, to eastern Turkey.

Description

The tiger is the largest cat in the world. A typical male Siberian tiger, the largest sub-species, weighs around 225kg and, including the tail, measures more than 3 metres in length. The tiger has a distinctive reddish-orange coat with black stripes. The underside of the tiger is white. Although very rare, all white and all black tigers have been known to occur in the wild.

Tiger taxonomy

At the beginning of the twentieth century (1900) eight sub-species of tiger were found throughout Asia and Eurasia. In the past fifty years three of these sub-species have been driven to extinction by human activities: the Bali tiger (*P.t. balica*); Javan tiger (*P.t. sondaica*) and Caspian tiger (*P.t. virgata*).

Only five sub-species now remain:
The Amur or Siberian tiger (*P.t. altaica*) is the northernmost living tiger. It lives primarily in south-eastern Russia.
The South China tiger (*P.t. amoyensis*) occurs only in southern China.
The Indochinese tiger (*P.t. corbetti*) ranges across most of Southeast Asia.
The Bengal tiger (*P.t. tigris*) is found primarily in India but ranges eastwards to Myanmar.
The Sumatran tiger (*P.t. sumatrae*) is restricted to the Indonesian island of Sumatra.

Ecology and behaviour

Tigers are typically solitary hunters. Females generally have smaller, mutually exclusive home ranges whereas male home-ranges are larger and usually encompass two or more female ranges. Tigers mark their territories with urine, faeces, and by scratching on tree trunks. Range size varies according to prey abundance. For example in Royal Chitwan National Park in Nepal females range over 10 to 20km^2 and males over 30 to 70km^2. In contract in eastern Russia a female range is between 200 to 400km^2 and a males' 800 to 1,000km^2.

Tigers occur in a wide range of habitats:

- Evergreen forests of Indonesia, Malaysia and Indochina.
- Dry dipterocarp forests of mainland Southeast Asia.
- Mixed coniferous-deciduous woodlands of the Russian Far East.
- Mangrove swamps of the Sundarbans, India.
- Dry thorn forests of north-western India.

- Tall grass jungles at the foot of the Himalayas.

The tiger's habitat requirements can be summarised as having some form of dense vegetation cover, sufficient large ungulate prey and access to water. It is an adaptable species and so persists in many places.

Tigers are usually solitary, except for females with cubs. However males do associate with females for breeding and have been observed with females and cubs when feeding or resting. If a new male enters an area it may kill cubs fathered by other males so that it can breed with the female sooner.

Tiger cubs begin eating meat as early as two months old and can hunt by about one year of age. Cubs will stay with their mother for about two years. Life is dangerous for a tiger cub; only about one-half survive to their third year.

Unlike many other cat species, tigers like to enter water, often laying half-submerged in lakes and ponds during the heat of the day. In the Sundarbans of India tigers have been recorded swimming a 29km wide river and have been known to attack people in boats. In India's Ranthambhore Tiger Reserve tigers enter lakes to kill sambar and have been known to kill crocodiles.

Tigers hunt mainly between dusk and dawn. This may be due to human disturbance as in Ranthambhore Tiger Reserve where there is little threat from poaching, tigers frequently hunt during the day. The principal prey across their range consists of various species of deer and wild pigs, but they can kill larger prey items such as gaur, young elephants and rhinos. Large cervids make up three quarters of the tigers diet in most parts of range.

Tigers also kill smaller species including monkeys, porcupines, pangolins, birds, reptiles and fish. Tigers sometimes kill and eat other tigers, leopards and other carnivores including bears. They also readily eat carrion.

The average weight of prey taken across the species range varies. For example in Kanha National Park in India the average weight of prey is 66kg and is comprised mainly of large deer, but includes a variety of species from gaur to porcupine. In Thailand's Huai Kha Khaeng Wildlife Sanctuary the average weight of prey is only 14.7kg being comprised mainly of muntjac, porcupine an hog badger.

Home range size is determined by prey abundance as can be seen by the examples shown in table 1. Where populations of large cervids such as sambar have been depleted so have tiger populations.

Tigers can disperse large distances once they leave their mother. In Royal Chitwan National Park females generally move to the range adjacent to their mothers which is on average 10 to 33km away. Males have been recorded to disperse between 33 and 65km from their mothers range. Tigers have been known on occasion to travel over 150km.

Tigers usually attack large prey with a stalk from the rear after a period of concealment. A sudden rush and sometimes a spring brings down the prey. When seizing and killing prey, the tiger's main target is the neck. The throat is targeted in larger animals where the tiger will hold on until the animal dies from suffocation. This technique protects the tiger from horns, antlers and hooves and allows it to prevent the prey from regaining its feet. With smaller prey, tigers

prefer to bite the back of the neck, as close as possible to the skull so instantly killing the animal by compressing the spinal chord.

Table 1. Densities Reported for Tigers in Different Habitats

Location	Habitat Type	Ungulate Prey	Tiger Density tigers per 100km^2
Nagarhole, India	Broad-leaved humid forest	Very high	11.65
Ranthambhore, India	Tropical dry forest	Medium-high	10.00
Chitwan, Nepal	Moist monsoon & riparian forest	High	8.78
Kanha, India	Moist monsoon forest/meadows	High	6.92
Bengkulu, Sumatra	Lowland rainforest	Medium-high	3.73
Gunung Leuser, Sumatra	Montane and lowland humid forest	Medium-low	1.1-2.23
Huai Kha Khaeng, Thailand	Mixed seasonal forest	Low	1.03
Lazovskiy, Russia	Mixed deciduous- coniferous woods	Low	0.6-0.86
Sikhote Alin, Russia	Mixed deciduous- coniferous woods	Very low	0.13-.45

(adapted from Karanth 1991 and Rabinowitz 1993)

Tigers will only attack an animal when the danger of injury to itself is minimal as an injured tiger cannot hunt. The prey is usually dragged into cover before being eaten. An adult tiger eats between 18 and 40 kg of meat at a time beginning at the rump. If undisturbed, it returns to its kill for 3 to 6 days to feed until little remains.

Large prey is taken about once a week, however hunts are often unsuccessful. Tigers will seldom make the effort to continue with an attack if the stalk is unsatisfactory. For example, in Ranthambore Tiger Reserve, where there is a high density of prey, only one in ten attacks are successful.

Tigers have a reputation as man-eaters, especially in India. Between 1902 and 1910 an average of 851 people a year were killed by tigers. However, in recent times, with greatly reduced numbers of tigers, attacks on people have been relatively rare. Tigers become man-eaters usually as the result of incapacity to catch normal prey through age or injury. The normal situation is for tigers not to attack people and they tend to avoid contact with humans wherever possible. If disturbed a tiger will generally warn people away with growls, roars or even rushes.

The Indochinese Tiger

Indochinese tigers are distributed in eastern Myanmar, Thailand, Peninsular Malaysia, Cambodia, Lao PDR, Vietnam and southern China. Within this range, tigers fair best in remote forests in hilly and mountainous terrain, much of which lies along the borders between countries. Access to these areas is often restricted, and biologists have only recently been granted limited permits for field surveys. As a result, relatively little is know about the status of Indochinese tigers in the wild.

Indochinese tigers are a bit smaller and darker than Bengal tigers, with shorter, narrower stripes. Males average 2.7m from head to tail and weigh about 180kg. Females are smaller, measuring about 2.4m in length and weighing approximately 115kg.

Like the other sub-species of tiger the Indochinese tiger eats many animals, but focuses on deer, wild pig and wild cattle.

The specific range size of the Indochinese tiger is not known. An educated guess would be approximately 4 to 5 adult tigers per 100km^2 in optimal habitat with natural prey densities. However, prey densities are much reduced from the natural situation in Indochina and undisturbed habitat is very rare. Additionally hunting pressure is very heavy across the range of the sub-species, driven primarily by the trade in its body parts for use in traditional medicinal remedies. As a result the population density is probably only 1 to 2 adult tigers per 100km^2.

Global tiger populations

At the beginning of the 20th century it is estimated that there were 100,000 wild tigers. Now it is estimated that only 5,000 to 7,000 individual tigers remain in the wild (see table 2).

The tiger is classified as Globally Threatened: Endangered by the International Union of Conservation of Nature and Natural Resources (IUCN). This means it faces a very high chance of extinction in the wild in the immediate future. It is listed on appendix I of the International Conventional on Trade of Endangered Species (CITES) which makes it illegal to trade the species internationally. It is protected by national law in most countries in which it lives. In Vietnam it is protected under Decree 18 so all capture and sale of the species is illegal.

Most tiger populations today consist of fewer than 100 individuals and only about 40 per cent of them constitute a breeding population. This may lead to inbreeding and genetic problems.

Vietnam's tiger populations

According to the IUCN Cat Specialist Group, in 1997 there were estimated to be 1,227 to 1,785 Indochinese tigers in the wild. This figure is bassed on educated guesses, however, and is probably too high. It is likely that there are only about 100 tigers surviving in Vietnam.

Few places in Vietnam have confirmed tiger presence. The three provinces which the FPD/WWF Central Vietnam Tiger Corridor Project encompasses have a large majority of the records and probably represent the best place in Vietnam for the survival of the species. This prospect is enhanced by the prospect of the area becoming the focus of landscape level conservation planning activities with locally implemented conservation strategies.

Populations in Vietnam are fragmented and subjected to high hunting pressures. No protected areas are large enough to provide long-term security to the species in Vietnam. The connection of core areas of protected forest through a mosaic of non-protected, but managed forest in connection with strict law enforcement is essential to the survival of the tiger in Vietnam.

Threats to global tiger populations

The remaining tigers are threatened by many factors, including:

- A fast growing human population. For example Vietnam's human population has doubled in the last 30 years.
- Loss of habitat due to agricultural expansion and commercial logging.
- Illegal hunting of the tiger and its prey species.
- The expanded trade in tiger parts for use in traditional medicines.

Table 2. Global Populations of Tigers by sub-species and country

Tiger Sub-species	Minimum	Maximum
Bengal tiger (*P.t. tigris*)		
Bangladesh	362	362
Bhutan	67 (adults)	81 (adults)
China	30	35
India	2,500	3,750
Myanmar, Western	124	231
Nepal	93 (adults)	97 (adults)
	3,176	**4,556**
Indo-Chinese tiger (*P.t. corbetti*)		
Cambodia	150	300
China	30	40
Laos	present	—-
Malaysia	491	510
Myanmar, Eastern	106	234
Thailand	250	501
Vietnam	200	200
	1,227	**1,785**
Sumatran tiger (*P.t. sumatrae*)		
Indonesia (Sumatra)	400	500
	400	**500**
Amur (Siberian) tiger (*P.t. altaica*)		
China	30	35
Korea (North)	<10	<10
Russia	330 (adults)	371 (adults)
	360	**406**
South China tiger (*P.t. amoyensis*)		
China	20	30
	20	**30**
Javan tiger (*P.t. sondaica*)	**Extinct 1980s**	**—-**
Caspian tiger (*P.t. virgata*)	**Extinct 1970s**	**—-**
Bali tiger (*P.t. balica*)	**Extinct 1940s**	**—-**
Totals	**5,183**	**7,277**

Adapted from Peter Jackson's table shown on
http://www.panda.org/resources/publications/species/tiger99.html.
Most estimates are educated guesses.

Until the 1930s, hunting for sport was probably the main cause of the decline in tiger populations. Hunting for tiger skins was a major problem due to the demand for them as rugs, wall hangings, and fur coats.

Between 1940 and the late 1980s, the greatest threat was loss of habitat driven by the massive human population expansion and activities such as logging. In recent years, the illegal hunting of tigers for body parts for use in traditional medicines has become the major problem. The prosperity of the Southeast Asian and East Asian economies since the 1970s has led to an ever-increasing demand for these medicines. There has also been a significant increase in demand from Chinese communities in North America and Europe.

China's tigers are nearly extinct, but the demand for tiger products for use in traditional medicines is very large. China obtains its tiger products from neighbouring countries including Vietnam. The best data on the trade in tiger bone comes from South Korea where imports were legal and recorded by customs up to 1993. The statistics show that over six tonnes of tiger bone were imported between 1975 and 1992, which represents the equivalent of 550 to 1,000 tigers. To put this into perspective, this figure represents a minimum of 14% of all wild tigers alive today.

Resiliance

Tigers occupy a very varied range of habitats as shown above. Therefore they can adapt to many environmental conditions and survive in habitat mosaics. Their populations can grow rapidly when conditions are favourable for the following reasons:

- Gestation length is only 103 days.
- Females come into oestrus early after the dispersal of young.
- Females first breed at a mean age of 3.4 years.
- Litter size is on average 3 young.
- Inter-birth interval is 20-24 months.
- Dispersal of young is at 19-24 months.

Two examples of how resilient tiger populations can be are:

1. In Royal Chitwan National Park tiger hunts through the 1935-1936 season killed 77 tigers. In the 1939-1940 season 120 tigers were killed in the same area.
2. In Sikhote-Alin State Biosphere Reserve, Russia, the first tiger was seen in 1966. In 1993 24-31 individuals were present.

The Caspian tiger was driven to extinction by the removal of water side habitat due to human conversion of this vegetation for agricultural land. It was also extensively persecuted. The Javan tiger lost its habitat due to conversion of the forest to teak plantations. Its prey base was also removed by heavy persecution resulting in no cervids, few bovids and low boar densities in Meru-Betiri National Park where it was last reported.

If not persecuted , however, the tiger, can recover its populations due to its adaptability and resilience.

The tiger is threatened almost exclusively by human action. It can only be saved from extinction if effective habitat protection, strict enforcement of anti-poaching laws and education on the plight and importance of the tiger are implemented.

If the tiger is to be saved governments and other decision-makers must take immediate and decisive actions at the international, national and local levels.

Introduction to Tiger Conservation

Why is it important to save the tiger?

In India, saving the tiger means saving life itself.

Since India is primarily rural, it is heavily dependent on the 25 river systems that criss-cross this vast country. The rivers - which are replenished by the monsoon season - supply irrigation, power and drinking water. Along the rivers is some of the best tiger habitat on the subcontinent, so saving that habitat not only helps the tiger, it helps mankind.

The tiger is a species that represents the entire ecosystem. If it cannot survive, that is because the entire ecosystem is suffering.

And if that habitat is degraded, the trees cannot hold down the soil.

Our country is fully dependent on the monsoon. If the trees are cut, then when the monsoon comes, you'll have heavy erosion of the soil, which will choke the riverbeds with silt, which will result in widespread floods.

But these are difficult arguments to make when you are faced with millions of people, all of whom want the same thing: land to raise some crops and to graze their livestock, and fuel to stay warm and cook their meals.

Yet, despite all the problems, there are reasons to feel hopeful. Since the early 1990s, the Indian government has tripled the Project Tiger budget; there is a more watchful eye on poaching; vast improvements have been made in the pugmark (paw imprint) counting system; and there is a new spirit of co-operation between South Asian countries.

Saving the tiger means much more than keeping one animal off the list of extinct species. Each link in the chain of biodiversity is crucial, and each link lost affects others. So saving the tiger means saving ourselves.

(P.K. Sen, Director of Project Tiger).

Results of group discussion on why tiger conservation is important

Tigers are an important to maintain an ecological balance within an ecosystem.
As predators tigers play an important role in the control of prey populations. Predators target the weaker animals in a population and so remove the old, sick and less strong animals maintaining the fitness of the remaining population. Tigers also play an important role in population regulation of species such as deer and pig, both of which can become agricultural pests. By preying on these species the tiger keeps both their numbers down and their preference for dense cover high so the likelihood of them becoming large scale pests is reduced.

Tigers are one of the world's best flagship species
The aesthetic appeal and powerful respect that tigers receive from people all over the world allow the species to be used as both flagship and umbrella species:

- As a 'flagship species' the tiger is a valuable tool for raising public awareness, action and funding for forest ecosystems and promoting the alternative values of forest such as watershed protection.
- By protecting the tiger and its habitat it acts as an 'umbrella species' as all other species are protected within the conservation framework established for the tiger.

Tigers are invaluable for future generations

The aesthetic value of the tiger can not be underestimated. The children of tomorrow will want to know about tigers and have the opportunity to see them. The knowledge that tigers were driven to extinction by human activities is not a message the children of tomorrow will want to or should hear.

Each tiger population is a valuable genetic resource

As tiger populations shrink and become fragmented the probability of inbreeding increases. Each population is therefore important to sustain so that with good conservation planning populations can be interbreed once again, negating inbreeding.

Ecotourism potential

People want to see tigers and the forest in which they live. The potential draw of tiger areas is large and is one way to achieve sustainable conservation funding.

Culture and religion

Tigers are an integral part of the culture and religion of almost all countries within its range. In many countries it is a sacred animal and is revered and protected. As an important part of a country's natural heritage it is the moral duty of people to help conserve the species.

Results of group discussion on global threats to tiger populations

Poaching of tigers

Even though it is illegal to kill a tiger, wild tigers are still being poached today because their body parts can be sold on the black market for a lot of money. Tiger parts are used in traditional medicines because some people believe they have special powers due to the strength of the animals. Forestry and wildlife departments across the range of the species are too understaffed and under-budgeted to be effective against the onslaught of poachers. While the exact number of tigers being poached is unknown, some sources have estimated that one tiger a day is being killed in India.

Tigers are poached for:

- Their pelts. Due to the beauty of the tiger some people like to display the skin of a tiger in their house. The skin looks much more beautiful on the animal!
- Traditional medicines believe the powers of the tiger are transferred to man if used in medicine. Modern drugs are much more effective than tiger parts and many parts of the tiger have no medicinal value to them.
- People, especially in the past, like to kill tigers for sport due the thrill of conquering such an impressive animal.
- Tigers are often killed as they are believed to be responsible for the death of domestic livestock.

Poaching of prey base

Tigers need a large supply of ungulates in order to survive. The loss of prey base has two effects:

1. Direct loss of food meaning more time and energy is spent hunting and less time and energy breeding.
2. Less prey means tiger home ranges increase in size. This makes them more vulnerable to external pressures such as habitat fragmentation and the likelihood of coming into contact with humans.

It is unlikely that tigers can reproduce successfully at prey densities below 2 to 5 ungulates per km^2.

Habitat Loss

Across all of Asia, forest cover has been lost due to conversion for agriculture and bad logging practices. Only small islands of forest, surrounded by a growing and relatively poor human population are left. Tigers are running out of forest.

Population Fragmentation & The Genetic Threat

As habitat is lost and forest areas become smaller and fragmented, groups of tigers become separated from each other by villages and farms. This means that tigers in one area can no longer mate with tigers in nearby areas. This leads to tigers having little choice of breeding partners. Most tiger populations today consist of fewer than 100 individuals and only about 40 per cent of these individuals constitute the breeding constituent of any population. Inbreeding is inevitable and father-daughter and mother-son matings have been recorded. The balance of the sexes may be distorted by an excess of males or females surviving to maturity, thus increasing the impact of inbreeding. A loss of variability and genetic deterioration may follow, with lowered cub production and survival, which may not be apparent until they have reached a level that threatens the population.

Impact of Catastrophes

Small isolated populations are especially vulnerable to catastrophic events: natural disasters, such as forest fires, floods, hurricanes, and epidemics; and human-induced events, such as deforestation, and destruction of habitat. For example extensive fires in the forests of north-eastern China in 1987 may have led to the deaths of Siberian tigers, and reduced prey numbers. Monsoon floods and hurricanes regularly kill tigers in India.

Results of group discussion on causes of threats to global tiger populations

Weak Law Enforcement

Most countries which have tiger populations are party to the convention in the international trade in endangered species CITES. This prevents all sale of tiger parts across international borders. However it is hard to enforce and many countries do not have the technology or finance to analyse products to test what species have been used in their preparation. Internal trade is also very difficult to control as it requires a lot of manpower, trade intelligence, time, and effective laws. Prevention of poaching is also difficult as large areas need to be covered to effectively remove all snares set for tiger.

High economic cost

Tiger parts are used for numerous reasons from rugs to traditional medicines. As tigers are hard to catch and increasingly rare and the sale of their body parts is illegal in most countries, the price of tiger parts is very high. This high economic benefit is what drives the poachers and will continue to do so until the threat of being caught poaching or trading the species outweighs it.

Need for land driven by human population growth and in migration
Human populations are growing rapidly. More people therefore need to farm the land in order to feed themselves. Agricultural land is obtained by clearing the forest. More land is also needed for plantations, urban development and transportation networks. Forest clearance has and is continuing to result in less habitat for tigers and is fragmenting populations reducing their long-term viability.

Poor people
The rural community of tiger range states is very poor. People often do not have the option of conservation and even less understand the need for tiger conservation. Many people from rural communities, do not have jobs so when they are not needed in the fields they often go the forest to hunt. Additionally, the conservation of tigers is costly as it requires large tracks of managed forest, strict law enforcement and population monitoring. All of these activities require large inputs of man hours, equipment and skills; things that can not be afforded by many countries.

Livestock predation
Tigers can be the cause, or presumed cause, of the loss of livestock. This leads to their reputation as pests and their persecution. Tigers only prey on livestock if they are injured (usually as a result of failed poaching attempts) or if their natural prey base has been reduced to such low levels by mans' over exploitation that they have no choice.

Lack of awareness
Rural communities often do not have access to good education. As such their understanding of the importance of the tiger and the forest ecosystem is low. With no knowledge of why the tiger and the forest is important it is understandable why people do not see the problem with killing the species or removing the forest.

Fun
Man likes to hunt. Killing tigers or going into the forest for any reason is often done because people enjoy it. In the past, before the tiger was protected, people used pay large sums of money to hunt the tiger.

Lack of trade enforcement
Very few tigers would be poached if the trade demand was not high. Enforcing the wildlife trade is a very different skill and approach to enforcing good forest management. The wildlife trade is complex and operates on many different levels from the village level up to the international level. Enforcement agencies tend to concentrate on the direct cause of wildlife exploitation rather than addressing the driving force which is the trade. Small wildlife traders would be very easy to close down, but this is seldom done.

Forest fire
Bad agricultural practices lead to frequent forest fires in some places. Fire removes forest cover and opens the land available to agriculture taking away the opportunity for the forest to recover. Large areas of tiger habitat are lost to fire each year.

Weak policy
Conservation policy is often weak, not giving sufficient power to wildlife enforcement agencies to effectively stop illegal wildlife exploitation and trade. Development policies almost never include environmental considerations. Weak policy is driven by a lack of effective dialogue and communication between government departments and with these departments and development and conservation agencies.

Construction, especially roads
Development projects rarely incorporate a conservation component and the effects on the environment are often not considered. Roads usually have the largest impact as they open up areas to hunters and development. Development and agriculture spreads along roads rapidly isolating forest blocks on either side so fragmenting wildlife populations. Other construction projects such as dams can remove large tracks of tiger habitat.

Results of group discussion on solutions to the threats to global tiger populations

Increase the risks of being caught hunting
Hunters will continue to poach tigers and sell them to wildlife traders unless the risk of being caught hunting is substantially increased. Subsequent prosecutions must occur and punishments must outweigh the possible benefits obtained from poaching and selling a tiger.

Increasing the risk of being caught hunting should involve an increase the number and frequency of patrols by FPD including patrols across numerous areas both inside and outside of protected areas.

Increase capacity of enforcement agents
In order to effectively monitor tiger populations and enforce wildlife law, FPD require and requested training in subjects such as tiger population monitoring, wildlife trade investigative techniques and effective patrolling. The provision of good equipment is essential to effective law enforcement.

Trade enforcement
The removal of the demand for tiger parts would vastly decrease the hunting pressure on the species. The removal of this demand requires the demolition of the wildlife trade locally, provincially and nationally. To do this the capacity of FPD requires raising (see above) and the general awareness of the plight of the species raising (see below).

Raise awareness
Communities dependent on the forest are often very open to the concepts of conservation as they understand the need for sustainable resource extraction. Explanations of the plight of the tiger and the potential benefits that can be gained from the survival of the species such as the control of wild pigs and ecotourism would also help to decrease pressure on the species if the message is delivered in an appropriate way.

Raising the awareness of people from urban centres is also important as this should decrease the demand for tiger products. It is this demand that drives the trade in wildlife so its removal would lower prices, decrease volumes traded and upset the balance between financial benefits of trading illegally and the risks of being caught.

Include local communities in forest management and protection
If people have a stake in the successful delivery of a project or concept then it stands a much higher chance of success. Local communities are often dependent on the forest for many resources so understand the need for effective management. An integral component of effective management is tight enforcement agreements and strict monitoring of hunting and resource extraction restrictions.

Livelihood development
Communities adjacent to forests are often poor and dependent on the extraction of forest resources. The development of alternative options to forest resource extraction, shifting agriculture and hunting are important factors in the long term alleviation of pressures on the tiger and its habitat.

Increase protected area coverage
Tigers require large amounts of habitat. Such large areas can not realistically be protected in countries where human densities and the demand for land are high. It is therefore imperative to manage landscapes with a mosaic of management systems to ensure continuous forest cover. Core protected areas, however, are necessary to provide safe havens where tigers can survive and breed so that the surrounding mosaic can be re-colonised and sub-populations can be re-connected. The development of as large a network of effectively managed protected areas as possible is crucial to the long-term survival of the tiger.

Change policy
In many countries development policy does not take environmental issues into consideration. Legal policies often favour the poacher or wildlife trader and punishments for convicted wildlife crimes are often too weak to provide any deterrent against further offences. Such policies need to be addressed if conservation is to succeed.

Include conservation and sustainable development in planning
Land use planning and rural development rarely address environmental issues as an integral component of development. For such development to be sustainable long term, however, the environment is a critical factor to include in planning activities. As mentioned above tigers require large areas of forest in which to live. Such areas can only be secured by integrating non-protected forest into locally applicable management strategies during rural development and land use planning.

Better co-operation between government departments and stakeholders
FPD alone can not secure the future of the tiger in Vietnam and this scenario is identical world wide. Wildlife protection agencies need to work closely with the police, courts, international border police and customs to ensure effective law enforcement of wildlife crimes. Development agencies and government departments dealing with agriculture, transport and community development should also be major partners of wildlife protection agencies. This will ensure forest cover remains during development activities and that such development can be linked to conservation benefits and forest stewardship.

Reforestation
In order to re-establish forested links between substantial forest blocks, reforestation should occur at strategic sites. This is important to ensure all sub-populations of tiger and other wildlife are connected, retaining viable populations.

Case studies of Tiger conservation

India's Project Tiger

(Adapted from http://www.panda.org/resources/publications/species/tiger99.html and Thapar, 1999)

In 1969 an Indian forest officer called Kailash Sankhala sounded the alarm that India's tigers were rapidly heading for extinction. Shortly after, India placed a ban on tiger shooting and other

countries followed its example. In 1972 a census of all Indian tigers was conducted; the results were shocking. India probably had fewer than 2,000 tigers compared to 40,000 at the turn of the century. Alarmed by India's rapidly declining tiger population, WWF helped the Indian Government initiate Project Tiger.

Project Tiger focused on habitat preservation through protected areas. Their goal was to conserve entire ecosystems, including all species. India declared the tiger as its national symbol and 23 tiger reserves were established. Each reserve included a core zone free of human use and a buffer area in which conservation-oriented land use was regulated. The reserves were chosen to include different types of tiger habitat, ranging from teak and bamboo forests to dry jungles and tropical mangrove estuaries. Tiger reserves were established with strict law enforcement that saw ungulate and tiger densities increase:

- Illegal agricultural encroachments were stopped.
- Livestock grazing was controlled.
- People were re-settled.
- Poaching was addressed.
- Domestic dogs were eliminated as they helped in the hunting of tiger prey.

By 1983, when India celebrated the 10th anniversary of Project Tiger, the tiger population had doubled to 4,000. At that time, in India, the successes seemed to outweigh the failures. In addition the protection of India's tiger habitat had initially been shown to be advantageous, not only to the tiger but also to local people. Some villages adjacent to tiger reserves benefited from a more regular supply of water and reduced soil erosion as a result of watershed protection, and fewer forest fires. Nevertheless, many villagers were suffering from lack of access to forest products and damage to their crops by wild animals from the reserves, as well as from loss of livestock to tigers. This led to serious conflicts between park management and local communities.

In 1982 Hemendra S. Panwar, the director of India's Project Tiger, sounded a second alarm: "The sustainable success of Project Tiger depends on the management of nature conservation areas on the one hand and the development of communities on the other. The timely task for park planners is to explore and foster means of coexistence beyond park boundaries and into local communities. If this is not achieved, national parks and reserve systems in the developing world will perish".

The conflict between humans and tigers and other wildlife was growing. The new challenge was to further develop tiger conservation so that it benefited both people and wildlife. In 1992 reports from India's showcase tiger reserve, Ranthambhore, revealed that poachers had been steadily poisoning, and snaring tigers. This had gone unnoticed during most of the 1980's. Reports that tigers were being killed for their bones were disregarded. The Indian and international conservation communities were complacent, while the tiger was actually in a state of potentially disastrous decline. The Indian government's official figure was 28 for Ranthambhore, compared with over 40 in 1989. Some experts estimated the numbers had fallen to fewer than 20.

In 1999 at the Tigers 2000 conference Valmik Thapar, one of the leading Indian tiger conservationists, outlined the problems of Project Tiger and made a plea to start from scratch. He stated that political will started to diminish in 1987, coinciding with the introduction of a free market economy. Governmental policy and financial processes were blamed for slow and ineffective transfer of money and policies. If the tiger is to be saved Thapar stressed, it must be done with a combination of both guns and guards and love and affection.

The new strategy Thapar outlined is an integrated approach including:
- The identification of priority sites.
- The posting the right person in the right jobs.
- Fully equipping forest guards.
- Field research.
- Community-based activities.
- Education and awareness activities.
- Monitoring and Evaluation.

Project tiger was very successful in 1970's, but deteriorated in the 1980's and 1990's. Valuable lessons can be learnt from this example:

- ***A species is never saved and we must always be vigilant.***
- ***Community involvement in conservation projects is essential to long-term sustainability.***

Anti-poaching and population stabilisation in Russia

(Adapted from Galster and Eliot, 1999)

This radical, but effective approach is built on two assumptions:
1 That the government wants long-term stabilisation of tiger populations.
2 That the Poachers want a short-term financial gain and will poach tigers where the risks are low enough to make it worth while.

The initial counter-poaching plan was to create a massive ranger force to patrol and stamp out tiger hunting. The reality of this plan was that it was too expensive and unrealistic.

The plan that was initiated was called Operation Amba. This used small, mobile anti-poaching patrols to:
- Maintain a periodic presence in all areas.
- Follow up on reports of poaching and trading gangs.

A Tiger Department within the Ministry of Environment was established. 15 rangers were employed to patrol an area similar in size to Vietnam, although the human population is much lower.
Stage 1: January to April 1994
Initial activities were named 'Psychological operations' and aimed to:
- Make people think there were many more rangers than there actually were.
- Make poachers think that rangers could appear from anywhere.
- Make traders think that informants were everywhere.

This was achieved in three ways:
1 Using the element of surprise
Three patrols were quietly deployed into three areas. They would check vehicles and stop people in the forest during very intense activity periods of three days. Then, without a word the three patrols would move to a new area to return to the same area the next week or month.
2 Developing an intelligence network
During patrols rangers would inform local people about their mission and ask for information on hunters and traders. This facilitated the development of an informant network.

3 Publicity
The operations were made very public using word of mouth and effective use of the press to publicise the operation.

In the first four months of operations poaching did decrease, but rangers would get to poaching activities after the tiger had been killed. Awareness of the operations was raised significantly with the aim of letting people know that poaching would not be so easy any more. Information on the underground wildlife trade was obtained and undercover investigations started.

Stage 2: May 1994 to 1995
Only 8 months after the operation started, the risk of getting caught was slowing the trade in tigers.

Scientific work was also being conducted. This was collecting data on tiger roaming patterns and critical tiger habitats so that a habitat protection plan could be prepared for tiger conservation. This plan aims to link protected areas with multiple-use areas with management regimes sensitive to tiger conservation. The gazettement of new protected areas was also thought of as essential to increase tiger densities. Areas of plantation and forest not capable of supporting a resident tiger population were included in the habitat plan as they maintain connectivity between populations and require little political or administrative cost to incorporate.

Links to other government authorities such as police special forces and transportation departments were made. This was essential in cracking down on the trade in endangered wildlife.

Stage 3: 1995 to 1996
Political support at high government levels was secured. This was essential in ensuring prosecutions for poaching and trading tigers were successful.

International training in law enforcement and CITES was provided to increase the effectiveness of operations.

Stage 4: 1997
Performance by this time was excellent. For example in the first three months of 1997, 1700 vehicles were inspected, 1900 hunters were questioned and 76 hunting shacks were raided.

Lessons learnt from the project:
- Local involvement is essential:
  Through the media.
  By the explanation of objectives to local communities by rangers.
- Skills and equipment:
  Good equipment leads to effective work.
  Training in investigative techniques and wildlife law led to increased effectiveness.
- Political backing:
  High-level political support is essential for operations and prosecutions.
- International links:
  For financial support.
  To co-operate in the control of the international trade in wildlife.
- Public relations is essential:
  Local support for operations is needed if the project is to be successful.
  International support to support fundraising efforts.

Tiger Conservation Units (TCU's) – a planning tool for sustainable tiger conservation

(Adapted from Dinerstein *et al.,* 1997)

The ideal tiger conservation strategy would be to protect all remaining blocks of natural habitat containing tigers, prevent poaching, and to stop all illegal trade of tiger products. Limited financial and human resources and the demand for natural habitats for other uses, however, necessitate that conservation activities be prioritised and strategically directed. TCU's present a framework based on the ecology and behaviour of tigers that helps to identify and prioritise areas with the highest probabilities of tiger survival (see Appendix 1 for a map showing the TUC within the range of the Indochinese tiger).

Tiger Conservation Units (TCUs) are defined as "a block or a cluster of blocks of existing habitats that contain, or have the potential to contain, interacting populations of tigers."

Prioritisation of TCU's was based on:
- Habitat integrity.
- Poaching pressure.
- Tiger population status.

TCUs were categorised as Level I, II or III, representing a descending order of priority. They were designed to facilitate conservation based on the principles of landscape ecology. That is they aim to establish 'a network of core areas and corridors across the larger spatial matrix of other land use options.'

TCU's highlight the need for trans-boundary co-operation as many span international borders. This is a global approach so it should be noted that many level II and III TCU's are of high importance on the national scale and so are important to national conservation strategies. This approach to tiger conservation was developed in 1997 when little data for Indochina was available. Additionally the Indochina data omitted recent information on confirmed tiger presence so may not be accurate.

This analysis ranked the following as acute priority survey areas:
- Hien and Nam Giang districts of Quang Nam province.
- Western Thua Thien Hue province.
- Kon Plong district of Kon Tum province.

Tiger Distribution and Conservation in Thua Thien Hue, Quang Nam and Kon Tum Provinces

Aims

- To facilitate thoughtful approaches to strategizing for tiger conservation.
- To compile all distribution data on the tigers of the Central Vietnam Tiger Corridor.
- To identify priority areas for tiger conservation.
- To discuss the threats to tiger populations, their causes and potential solutions to facilitate and focus future conservation efforts.

Tiger distribution in the Central Vietnam Tiger Corridor

During a recent WWF analysis of the Central Annamite Priority Landscape (CA1) all confirmed and unconfirmed tiger records were plotted onto land use maps. This data was presented to the participants. Each province then worked together to compile additional data that they had, but that was not available in reports. These data were added to the existing distribution maps to obtain a representation of tiger distribution throughout the tiger corridor (map 2). The additional data cannot be considered as confirmed tiger presence so is presented in map 2 as 'FPD data'. Some of this data was backed up by evidence, however, such as the location in northern Nam Giang district, Quang Nam province. Here a track measuring over 10cm in length was seen ten days prior to the training course.

Prey distribution in the Central Annamite Corridor

Each provincial FPD then compiled a list of prey species per district across the tiger corridor. This was used to rank the districts according to prey availability. This is an adaptation of work conducted in Thailand which presumed prey diversity was positively correlated to prey density. Therefore the more diverse the prey base, the more abundant the prey base would be. Areas with a high diversity of prey therefore should be able to support higher densities of tigers if hunting pressure is not added to the equation.

The ranking system used was:
1: muntjac species + wild pig
2: muntjac species + wild pig + cervid/bos/saola+serow
3: muntjac species + wild pig + cervid + bos/saola+serow

These figures are presented on map 2.

Tiger distribution according to TCU's

Eight TCU's are located within the Central Vietnam Tiger Corridor:

Level I:	113
Level II:	107
Level III:	105, 110, 111, 112, 114, 115

From map 2 it can be seen that perhaps some of these TCU's are not isolated from each other. Detailed and accurately ground-truthed satellite image interpretation is required to asses the appropriate location and separation of these TCU's.

Priority sites for tiger conservation within the Central Vietnam Corridor

From map 2 it can be seen that most confirmed tiger locations are in Thua Thien Hue province. Additionally Phong Dien, A Luoi and Nam Dong districts are all ranked 3 for prey diversity as is the adjacent Hue district in Quang Nam province. The district south of Hien is where Song Thang Nature Reserve is and this is contiguous with Ngoc Linh Quang Nam and Ngoc Linh Kon Tum. Unconfirmed tiger records are found in or around these three protected areas. This stretch of the corridor encompasses known tiger populations and large tracks of protected areas. If both the protected and non-protected area matrix is managed properly, tigers have a future in this landscape.

Tiger conservation; problem tree analysis for the Central Vietnam Corridor

A problem tree was created for the Central Vietnam Tiger Corridor by the participants of the training workshop (fig 1). This draws on the experience of the forest protection departments and the tiger conservation field teams of each province.

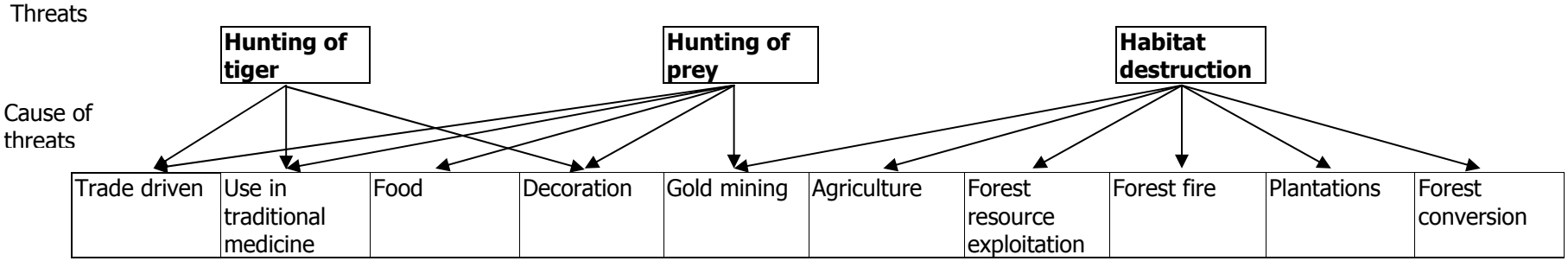
A basic analysis was conducted to identify the major threats and most effective conservation interventions to facilitate strategic planning for tiger conservation within the region. The threats were simply ranked according to importance by each province. There was variation between the provinces in what threats are the most severe, so the ranks were totalled to give a region wide ranking. From this approach the hunting of tigers for the trade and agricultural encroachment on their habitat were identified as the most important threats to the survival of the tiger within the Central Vietnam Tiger Corridor.

The suggested mitigation measures were ranked both vertically and horizontally. Vertical ranking allows for the identification of priority solutions for each threat such as increase law enforcement to combat the killing of tigers driven by the wildlife trade. Horizontal ranking was done simply by using the frequency of each solution across the problem tree. Increased law enforcement and conservation awareness were the most frequently listed solutions to the threats.

An analysis of the solutions was then conducted. In this basic analysis the importance of each solution was assessed by looking at the vertical and horizontal ranking together. To do this the horizontal rank was multiplied by the vertical rank for each time the solution was mentioned in the matrix. These multiplications were then totalled for each threat mitigation measure. Some solutions were then added together. For example increased law enforcement and capacity building for FPD staff were put together as the later leads to the former. This analysis gave a clear result that the following threat mitigation measures will have the greatest impact if implemented within the Central Vietnam Tiger Corridor (in descending order):

1. Law enforcement coupled with FPD training and equipment.
2. Conservation awareness.
3. Enhanced co-operation between government departments.
4. Involvement of local people in conservation activities.

Fig 1. Problem tree analysis for the Central Annamite Corridor



Horizontal ranking of threats across the tiger corridor

Province										
QN	4	6	3	10	1	2	5	7	9	8
KT	2	5	4	8	10	1	6	7	9	3
TTH	1	6	3	9	10	4	2	5	8	7
Total	7	17	10	27	21	7	13	19	26	18
Rank	**1=**	**5**	**3**	**9**	**8**	**1=**	**4**	**7**	**10**	**6**

Vertical ranking of mitigation measures

5*	Law enforcement including capacity building and equipping FPD	Awareness	Awareness	Awareness	Law enforcement: Move gold miners out of the forest	Awareness	Awareness	Awareness	Appropriate land use planning

4	Development of a network of local co-operators	Alternative livelihood generation	Increased co-operation with government agencies and communities	Increased co-operation with government agencies and communities	Alternative livelihood generation	Population planning and the control of unofficial migration	Establish sustainable resource extraction systems	Strengthened law enforcement	Co-ordination between government agencies to incorporate conservation and development
3	Benefits for local people including changes in policy	Law enforcement including both hunting and trade	Strengthened law enforcement	Strengthened law enforcement	Increased co-operation with government agencies and communities	Involve local people in forest protection	Strengthen law enforcement	Establishment of fire protection groups	Awareness
2	Enhanced co-operation with government agencies	Capacity building and equipment for FPD	Alternative livelihood generation	Capacity building and equipment for FPD		Alternative livelihood generation	Implement strict management schemes	Capacity building and equipment for FPD	Strengthened law enforcement
1	Awareness		Capacity building and equipment for FPD			Encourage-ment of wet rice cultivation and planning of swidden agriculture	Capacity building and equipment for FPD	Financial investment	

*5 being the most important mitigation measure, 1 being the least.

Law enforcement: (8x5)2 + (8x4)1 + (8x3)4 + (8x2)1 + FPD training and equipment: (6x5)1 + (6x2)3 + (6x1)2 =	278
Awareness: (8x5)6 + (8x3)1 + (8x1)1 =	272
Co-operation between government departments: (5x4)3 + (5x3)2 + (5x2)1 =	100
Involvement of local people: (5x4)3 + (5x3)2 + Sustainable NTPF extraction: (1x4)1 =	94
Land use planning: (1x5)1 =	5
Financial investment: (1x1)1 =	1

Survey Training

Navigation

Field work relies on the ability of the person involved being able to locate themselves at any given time whether for navigation purposes or for putting location data to biological information. Proficient navigation relies on the understanding of maps, compasses and global positioning systems (GPS's).

Maps

All participants were familiar with the basics features of maps such a identifying villages, roads and rivers as well as how to use a compass properly so these will not be discussed here. The following is an outline of features that were not fully understood by some prior to the training:

Seasonal streams:

Identified on the map as a dashed line interspersed with three dots, and usually connected to a river (see fig 2). This represents a river that does not have water for the whole year so when surveying during the dry season they can not be relied upon to hold water and support a campsite.

Contours:

Contours are lines on the map joining all places of equal elevation above mean sea level. Using these lines the topography of the land can be deduced (see fig 3). The distance between contour lines indicates the gradient of the slope; lines close to each other represent steep slopes where as widely species lines represent gentle slopes (see figs 2 and 3).

Contours also allow for the identification of valleys and ridges. Valleys produce 'V'-shaped lines with higher altitudes at the tip of the 'V'. Ridges produce more 'U'-shaped lines with lower altitudes at the tip of the 'U' (see fig 2).

Spot heights:

These are represented by a dot with a number next to it (see fig 2). These are placed on the summit of some peaks to provide the maximum altitude of the peak.

Scale:

The scale indicates how much area of ground the map represents. The best scale for fieldwork are 1:50,000. This means that every unit (1 cm) on the map is equal to 50,000 of those units (50,000cm or 500m) on the ground. Therefore on 1:50,000 maps the grid lines are spaced every 2cm and so represent $1km^2$ squares. Planning is best done on smaller scale maps such as 1:250,000 maps. The scale is usually stated on the bottom of a map in addition to a scale bar being shown (see fig 2). The latter is simply a line representing a certain length on the map.

Grid lines:

Maps are covered by a series of straight lines forming a grid. These 'grid lines' are spaced according to the scale (see above) but allow for accurate locations on the map to be given in numerical form. Each line has a representative number on the outside of the map. By giving a combination of numbers a location or 'grid reference' can be calculated.

Grid references:

A four figure grid reference locates the area within one square. The amount of area this square represents depends on the scale of the map. One square on a 1:50,000 map will represent $1km^2$.

Fig 2. Map features

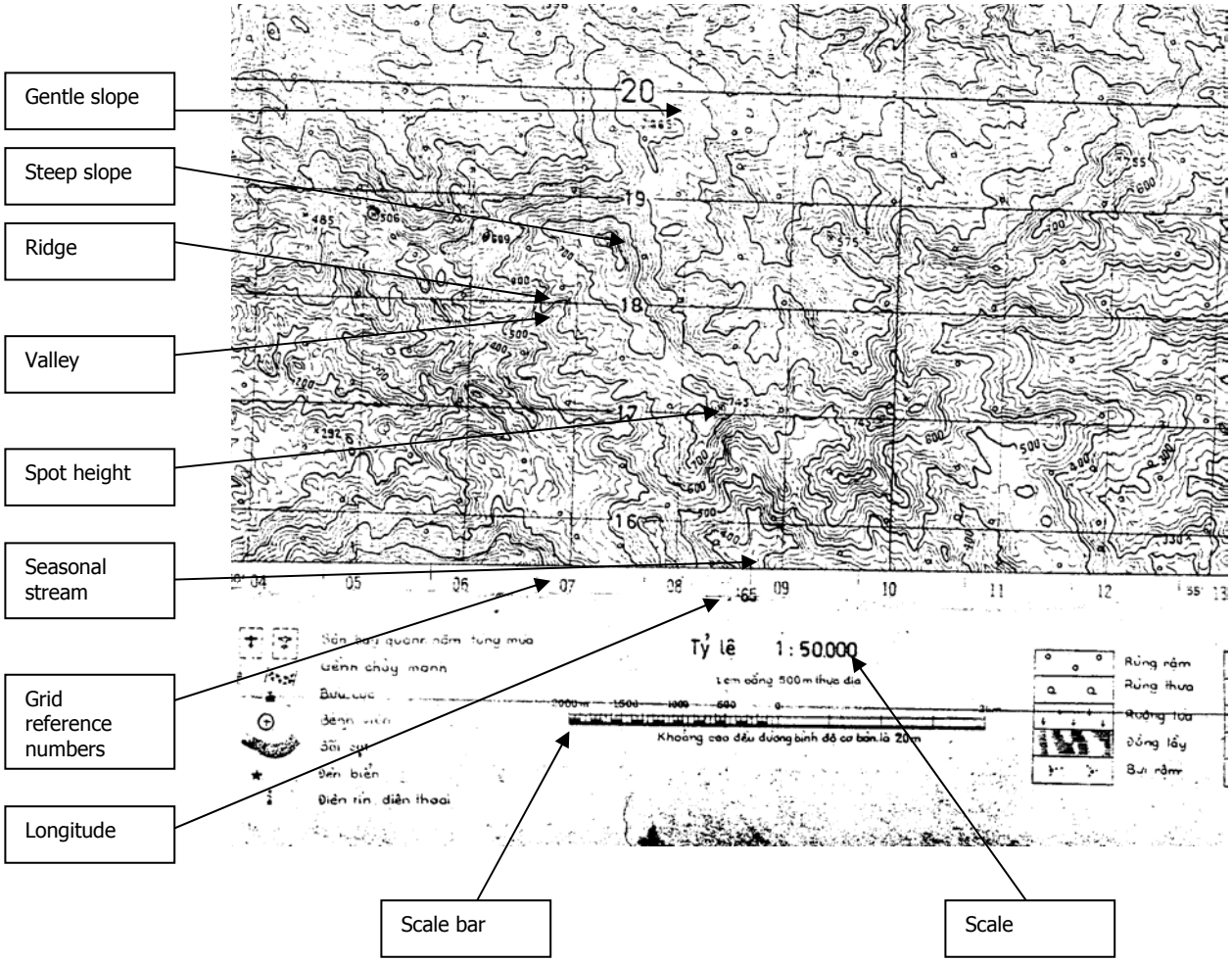
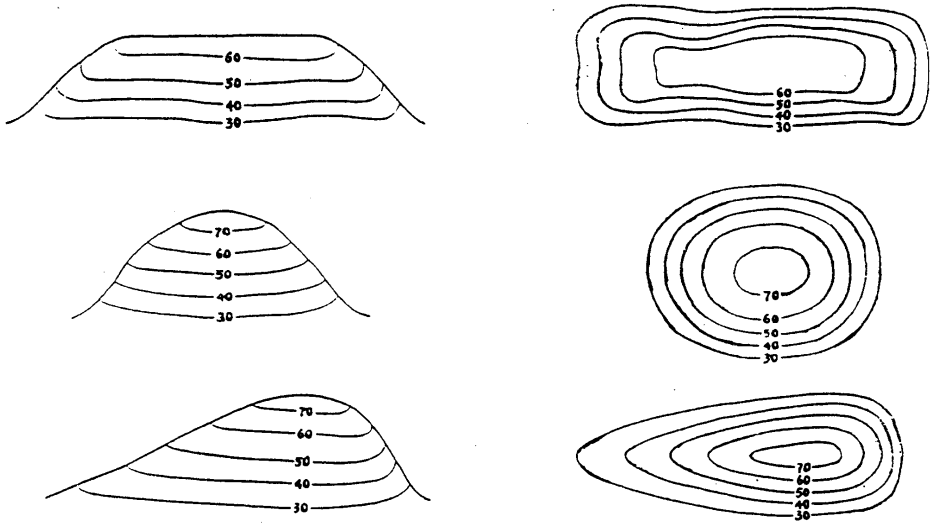
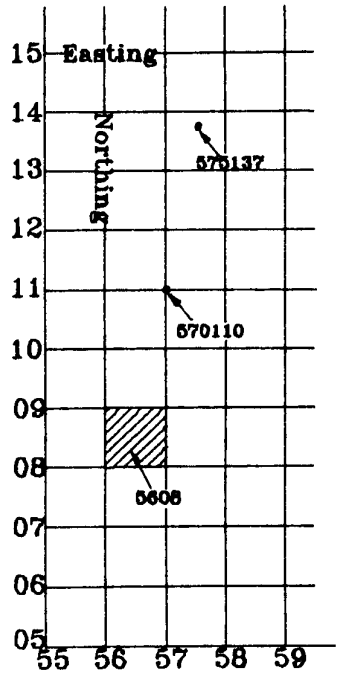


Fig 3. Contours and topography



Taken from Johnsingh (1994)

Fig 4. Grid references



Taken from Johnsingh (1994)

Four figure grid references are obtained by taking the number (or co-ordinate) of the vertical line (easting) and putting it next to the number (or co-ordinate) of the horizontal line (northing) (see fig 4).

If more accuracy is required each grid square can be divided into ten equal graduations to give squares one hundredth of the size of the grid square (on 1:50,000 maps these graduations equal $100m^2$). A six figure grid reference is therefore obtained (see fig 4).

Latitude/longitude:
The above system describes an easy method for locating yourself, others or locations on a map. As each line only has two figures this system is restricted to particular maps and so can not be easily used for storing locations across large areas such as a tiger corridor wide database. For global information a system called latitude and longitude is used. This works on the same principles as the grid lines, but has more numbers because it covers the whole world.

The latitude of a given location indicates how far north a location is form the equator. The longitude of a given location indicated how far east of 0^o (a line running from the north pole to the south pole that cuts though England, Europe and Africa) a location is. These numbers are shown on the edge of maps (see fig 2), but do not have corresponding grid lines so are not practical for locating places in the field. The co-ordinates that are obtained when using a GPS for example are given as:

N15°40.247' E107°42.938'

This shows that the location is fifteen degrees and 40.247 minutes north of the equator and one hundred and seven degrees and 42.938 minuets east of the 'Greenwich line', 0^o, or zero degrees. Minutes are used as the graduation between degrees.

When in the field it is best to use the first method, but for quoting locations in reports the latitude/longitude system should be used. A GPS can convert between the two systems (see below).

GPS training
A GPS is a useful navigation aid, but they should not be relied upon by themselves. A GPS should always be used in conjunction with maps, compasses, your own knowledge and the knowledge of your guide.

Most GPS's are accurate to ± 50m so exact placement on a map must be done using your own judgement with reference to the surrounding topography. The altitude on GPS's is not accurate unless left for an extended period of time to collect many data.

GPS's collect data from satellites. When in the forest or in mountainous terrain large proportions of the sky can be blocked from view preventing the GPS from receiving data from the satellites. In order to effectively use a GPS in such conditions it is essential that the user actively seeks out areas where a break in the canopy exists or navigates to the top of a hill or ridge in order to have the maximum coverage of sky as possible.

The GPS presents the location as a series of numbers that relate the to co-ordinates discussed above. Each location is called a 'waypoint'. Waypoints can be stored in the GPS, but it is important to write them down as well in case the unit breaks, gets lost or gets wet.

The 'go to' function should only be used when the user is completely lost as it does not provide a

logical route, but a compass bearing. It is useful to always have a waypoint for your camp just in case you need to use this function.

Practical steps to using a Garmin 12XL GPS:

Turn on: [□] and wait till the page showing the satellite numbers and positions appears.
Position yourself so that the GPS has the best chance of receiving data from at least three satellites. Holding the GPS high above you head often helps in receiving data from satellites.
When the GPS is in contact with a satellite, a bar will appear next to the corresponding number. This bar will turn black when the GPS has got sufficient data from the satellite to calculate a position.
Wait till the page changes.
A page with your position will appear. For example:
48 Q 0414487
UTM 2405833
Press [MARK]
Use the arrow pad [▼] to highlight the waypoint number
Press [ENTER]
Use the arrow pad [▲ ▶] to name the waypoint
Press [ENTER]
Use the arrow pad [▼] to highlight SAVE?
Press [ENTER]
This waypoint is now saved.

To recover a saved waypoint press [PAGE] until the MAIN MENUE appears
Use the arrow pad [▼] to highlight WAYPOINT LIST
Press [ENTER]
Use the arrow pad [▼] to highlight the waypoint you want to view
Press [ENTER]
To delete use the arrow pad [▼] to highlight DELETE?
Press [ENTER]
Use the arrow pad [▼] to highlight YES?
Press [ENTER]
or
To return to the WAYPOINT LIST press [QUIT]
To return to the MAIN MENU press [QUIT]

To convert waypoints into latitude/longitude press [PAGE] until the MAIN MENUE appears
Use the arrow pad [▼] to highlight SETUP MENU
Press [ENTER]
Use the arrow pad [▼] to highlight NAVIGATION
Press [ENTER]
Use the arrow pad [▼] to highlight POSITION FORT: UTM/UPS
Press [ENTER]
Use the arrow pad [▼] until hddd^{o}mm.mmm' appears
Press [ENTER]
Press [QUIT] twice to return to the MAIN MENUE then go to the waypoint you want to view (see above).

To find your way back to a saved waypoint press [GOTO]
Use the arrow pad [▼] to highlight the waypoint you want to go to
Press [ENTER]
Take the bearing and use a compass to follow in that direction.

Survey planning

Before embarking on a survey it is important to know why you are going and what data you want to collect. For this you need to decide on an aim and supporting objectives (see p. 40 for an example from the tiger survey conducted for this project).

When you know what information you want to collect you can decide upon what methods to employ, what your target species are and where you are going to go. It is very important that these steps are taken to ensure that time is spent on collecting useful data in the correct way and from an appropriate site. The survey logistics cannot be organised until these parameters are set.

Every survey should include an evacuation procedure and someone must be told where the survey will take place and when it is due to finish. Safety should always be the overriding concern of the survey team.

Mammal survey techniques

Data can be collected in many ways during surveys. In general these fit into two categories; direct Methods and indirect methods. Direct methods include data collected from observations, live trapping, photo-trapping and tape recording. Indirect methods include data collected from hunting trophies, tracks, feeding sign and damaged vegetation. The difference between these is that direct methods collect data that can be verified by an independent source and so act as confirmed records. Indirect methods often cannot act as confirmed presence of a species and so must be presented carefully in reports.

Interviews

Who to interview?

People who spend most time in the forest are the best people to ask. For mammal interviews hunters are usually the most knowledgeable people, but other groups such as rattan or medicinal plant collectors should not be ignored as they can be a source of good information, especially about threats to the forest.

What to ask?

The worst thing to do is to ask 'is this species here?'. Questions must be broad and neutral and it is best to avoid species specific questions. One way to get information is to ask how many of a certain group of animals (such as cats) there are, then get very detailed descriptions of each species known to the interviewee. Be very careful not to lead descriptions; let the interviewee tell everything they can remember first then ask if there are other animals that look like that group of animals. Keep asking the same question from different angles to ensure that descriptions and other information remains consistent throughout the interview. It is also a good idea to ask strange questions like 'does that cat have blue legs' to make sure you are not leading answers.

Tips:

- Ask basic questions about the species' ecology as good hunters will know this level of detail and it is very useful in helping to confirm identifications. It also helps to obtain the local name of the species.
- The interviewer should give the impression of limited knowledge of the local wildlife to make the interviewee feel knowledgeable and so tell all the information they have.
- When describing colours it is a good idea to get the interviewee to point to a similar colour in the immediate vicinity of the interview as colour interpretation varies widely between individuals.
- Ask for verification of a species presence by trying to see remains of hunted animals.

Always ask when and where the species was last seen. If it is thought to be extinct, get the date of the last sighting/shooting.

Only when you think you have a good idea of the species show pictures of many species and ask for the species in question to be picked out. Pictures should include species not present in the area as a control.

IF THE INTERVIEW IS NOT CONCLUSIVE, NOTE THE RESULTS, BUT DO NOT USE IN REPORTS.
NO DATA OBTAINED FROM INTERVIEWS ARE CONCLUSIVE .
ALL INTERVIEW DATA SHOULD BE CLEARLY MARKED AS SUCH IN A REPORT.

Always record details of the interviewer:
- Name
- Ethnic group
- Age
- Village/Commune
- Which forest areas they enter

It is helpful to find out information on the threats to the forest and species:
- Why people go to the forest?
- Why they catch each species?
- What they do with each species?
- Cost of each species if sold?

Surveys
The aim of surveys is to see as much as possible. For this to be successful surveyors must walk slowly and quietly, wear dull colours and not smoke. The fewer people the better, but remember that there should always be at least two people in a team in case of accidents.

Make good use of local guides who have the best local knowledge of animals and the forest.

Try and cover as many habitat types as possible and, if possible, survey each habitat type for a representative length of time.

DO NOT RUSH A SURVEY.
ALWAYS REMEMBER THAT SAFETY COMES FIRST.

Data recording

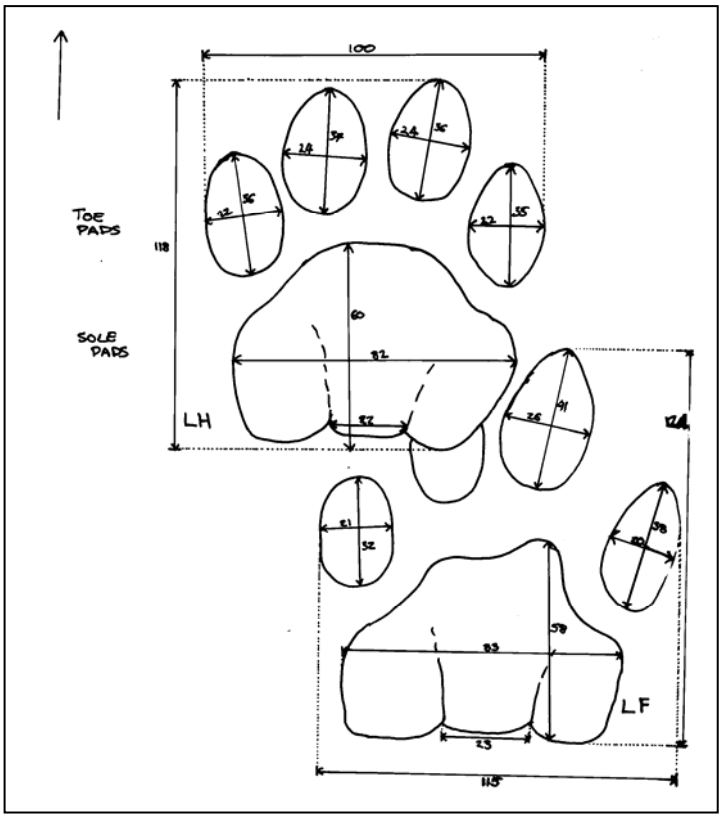
SURVEY RESULTS ARE ONLY AS GOOD AS THE NOTES TAKEN AND THE DATA COLLECTED.

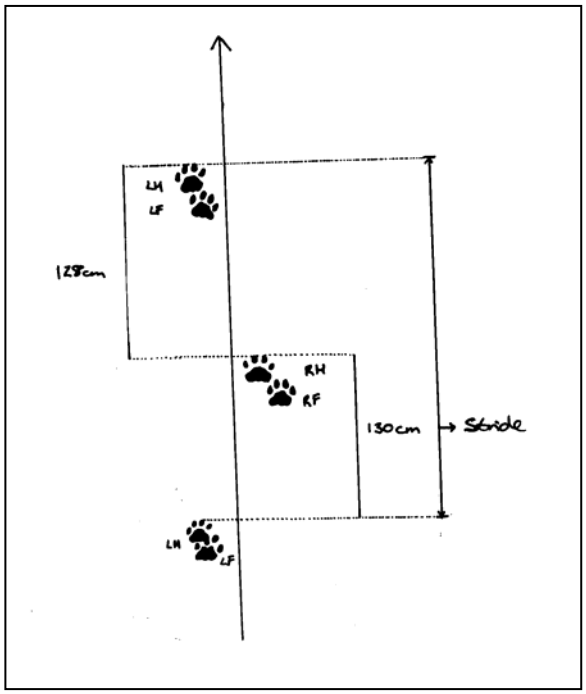
Always write everything down at the time you see or hear it. Information is always forgotten if this is not done.

Write in pencil as this is not affected by rain; ink can run and all data can be lost. Data can be recorded directly onto recording sheets or a note pad in the field. All data must be transcribed onto recording sheets at camp each night so that one set of data is safely stored. An example data recording sheet is presented in appendix 3.

Data recording sheets should be stored at one location for a protected area or district and a duplicate set stored at the provincial level. Data should then be transferred into a provincial level data base.

Fig 5. Track measurements





It is important to remember to record human activities as well as wildlife. This provides monitoring data on forest exploitation and the effectiveness of law enforcement activities.

Routes should be recorded by noting co-ordinates obtained from GPS locations and incorporating them into data recording sheets. The start and end time of a survey should be recorded so that the duration of the of the survey can be calculated. The allows a crude comparison of encounter frequency between areas to be made. For the same reason it is worth recording the length of each survey. This can be done very roughly by drawing the survey route on a topographic map and then laying a piece of string over this line. The sting is then stretched out and measured against the map scale bar to give the length of survey.

Record all data on target species (these species relate to your aims and objectives). For common, non-target species it is fine to just note each record at a new habitat, elevation or location.

When an observation is made the following must be recorded:

- What species
- Location (GPS co-ordinate)
- Elevation
- How many individuals were seen
- Habitat
- Time
- Date
- Detailed description - size, shape, colour, movement, features; it is helpful to make a sketch

If gibbons are heard singing record your location and take a compass bearing of the group. If the number of individuals singing and their distance from the recorded can be deduced then note this information down. It is important to record the time the song starts and finishes.

When a track is encountered the following must be recorded:

- What species
- Size. Give measurements; for ungulates measure total length and total width. For carnivores see figure 5.
- Shape; it is good to make a tracing or accurate drawing.
  Tracings should be made by using a sheet of Perspex laid down on the track with an OHP sheet or piece of tracing paper over it. The drawers head should be directly over the track. Practice drawings should be made before the final drawing is taken.
- Plaster cast; for key species.
  1. Clean the track, making sure not to distort the shape, but closing all cracks and holes.
  2. Construct a mud wall around the track about 2cm high, making sure there are no cracks or holes in it.
  3. Prepare the plaster. The container used to mix the plaster in and the stick used to stir the plaster should be clean. Plaster must be kept dry at all times. Do not beat the plaster, but rapidly stir it so to reduce the number of air bubbles produced as they weaken the plaster. Prepare sufficient plaster to fill the track and 1-2 cm above to the rim of the mud wall.
  4. Using a leaf to direct the plaster into the delicate parts of the track first, slowly pour the plaster into and over the track.
  5. Leave to dry for at least twenty minuets before taking up. The plaster will become warm during the drying stage. When it is cool and hard it can be removed.
  6. Remove by digging around and under the cast.
  7. Remove excess mud.

8. Leave for 24 hours before cleaning the cast.
9. Inscribe the species name, location of casting, date and your name on the back.
10. Store the cast somewhere where it can be accessed by people wanting to see it.

- Location (GPS co-ordinate)
- Elevation
- Substrate
- Habitat
- Date

Care must be taken when identifying tracks. Only put a species identification to a track if the track is clear, fresh and not distorted. If an identification is not certain, then record it to genus or order level. It is better to have little, good data than lots of bad data.

Most scats can not be identified to species with certainty. If a scat from a large carnivore is found, it is worth recording its content. This can help to clarify the diet and ecology of the Indochinese tiger.

Photo-trapping

Why photo-trap?

- To record species presence.
- To identify tiger numbers; individual tigers can be identified using the unique pattern of stripes on each animal. Stripes on the flanks and the back of the legs are usually the best areas to use in such comparisons as they are subjected to the least distortion from a tiger photographed in different gaits and from different angles.
- To compare areas for species composition and encounter frequency.
- To obtain photos for use in awareness and publicity campaigns.

The Camera

The cameras are similar in both widely used photo-traps. To use them they are simply turned on, film loaded and the date and time set as in any compact camera. When setting the flash make sure it is set to 'fill-in flash'. To change the date and time use the [SELECT] button to make a number active and the [SET] button to change the number. Most information is obtained if the camera is set to show the date and time. For a diagram explaining camera use see fig 6.

TrailMaster 1500

The TrailMaster 1500 consists of three components; the transmitter (the small square box), the receiver (the elongate box with three buttons) and the camera. This camera-trap works by emitting an infra-red beam between the units. When the beam is broken by an animal passing between the units it causes a photograph to be taken.

Put the batteries in the transmitter and make sure the spikes of the tree prongs are pointing out. Turn the transmitter on using the switch on the underside of the unit and secure it to a tree about 35cm off the ground with the front of the unit facing the place the receiver will be placed.

Turn the receiver on using the switch on the underside of the unit.
Press [TIME SET] – *[00:00]* will appear on the screen. This is the time.
Press [R/O ADV] to correct the hour.
Press [TIME SET] to activate the minutes.
Press [R/O ADV] to correct the minutes.
Press [TIME SET] – *[Yr 00]* will appear on the screen. This is the year.
Press [R/O ADV] to correct the year.

Press [TIME SET] – *[0.00]* will appear on the screen. This is the date.
Press [R/O ADV] to correct the month.
Press [TIME SET] to activate the day.
Press [R/O ADV] to correct the day.
Press [TIME SET] – *[-P 5]* will appear on the screen. This is the number of pulses that must be broken before a photograph is taken.
Press [R/O ADV] until the display reads *[-P 5].*
Press [TIME SET] – *[cd 2.0]* will appear on the screen. This is the camera delay or the time in minutes the unit will wait before taking a photo after a photo has been taken.
Press [R/O ADV] until the display reads *[cd 2.0].*
Hold down the [TIME SET] button and then press the [SET UP] button – *[00:1n]* will appear on the screen.
Press [R/O ADV] until the display reads *[01:1n].* This turns the camera on.
Press the [SET UP] button – *[1n:00]* will appear on the screen.
Press [R/O ADV] until the display reads *[1n:00].* This ensures the camera stays on.
Press the [SET UP] button – *[00:1F]* will appear on the screen.
Press [R/O ADV] until the display reads *[00:1F].* This ensures the camera stays on.
Press the [SET UP] button – *[1F:00]* will appear on the screen.
Press [R/O ADV] until the display reads *[1F:00].* This ensures the camera stays on.
Press [SET UP] button – *[00:2n]* will appear on the screen.
Press [R/O ADV] until the display reads *[00:2n].* This ensures the camera stays on.
Press the [SET UP] button – *[2n:00]* will appear on the screen.
Press [R/O ADV] until the display reads *[2n:00].* This ensures the camera stays on.
Press the [SET UP] button – *[00:2F]* will appear on the screen.
Press [R/O ADV] until the display reads *[00:2F].* This ensures the camera stays on.
Press the [SET UP] button – *[2F:00]* will appear on the screen.
Press [R/O ADV] until the display reads *[2F:00].* This ensures the camera stays on.

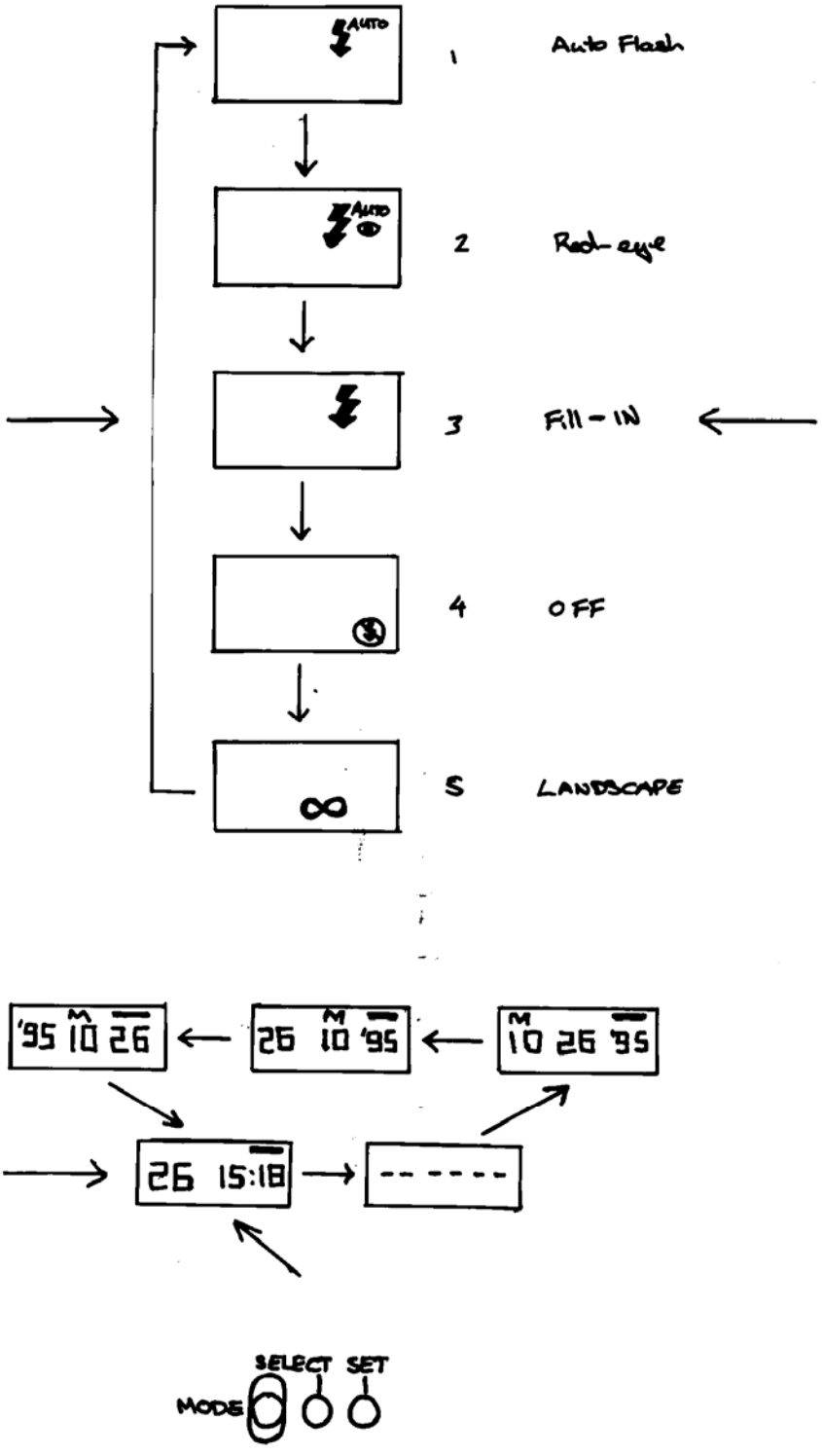
Set the receiver at the same height as the transmitter. Aim the transmitter at the receiver by pressing [SET UP]; this will cause a red light to flash when the two units are correctly aligned. In order to ensure the most efficient set up, the receiver must be must be directed to detect the strongest part of the infra-red beam. This is done by rotating the receiver up and down and side to side to identify the area of detection; the centre of which is most optimal. Fasten the receiver so that it points to the centre of the detection area.

Attach the camera to a tree, cover with the rain guard and connect to the receiver. Make sure the camera is positioned so that a target animal will fill the frame; this usually means setting the camera back off a path. Vegetation will have to be cleared to make sure nothing obstructs the view of the camera. Vegetation can grow up and break the beam so it is important to clear ground vegetation.

Once the trap is set press [TIME SET] to activate it.

On returning to the trap press [R/O ADV] – a date will appear.
Press [R/O ADV] – *1* will appear on the screen then disappear and be replaced by a time. This represented the time of the first event (time the beam was broken).
Continue doing this and note the data in your field notes until [*thru*] appears on the screen.
Press [SET UP] – [*c lr*] will appear on the screen; to delete data press [SET UP] to retain data press [R/O ADV].

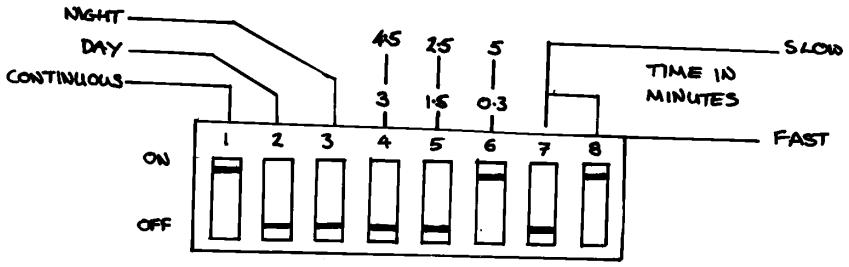
Fig 6. Camera setting



CamTrakker
This camera-trap works using a motion and heat sensor. It is just one unit.

Insert the batteries.
Take off the Velcro patch and see what colour the light is. A button on the side of the trap can be pressed; red is off (no photos will be taken), green is on (photos will be taken). Make sure it is on red.
Set the trap to the desired configuration: 1, 6 and 8 should be on (switches up) and 2, 3, 4, 5, and 7 should be off (switches down) in order to receive optimal results during biodiversity surveys. These configurations allow the trap to work only at night (3; on), only during the day (2; on) or all the time (1; on). The camera delay (the time between photographs) is set to fast (8; on) or slow (7; on). The time in minutes is then set using 4, 5, and 6 (See fig 7).
Set the camera and load the film.
Place the camera in the box making sure it's view is not obstructed.
Put the lid on and secure with the locking flange.
Tie to a tree set back from the location an animal is likely to walk so that the whole animal will fit in the photograph.
Angle the trap so that the sensor is targeted on the place where an animal is likely to walk. This is done by walking around the area; when the sensor detects you the light on the front will flash red.
Secure tightly to a tree, padlock the locking flange to the trap and to a metal chain that goes round a large tree to prevent the camera being stolen.
Press the button on the side of the trap so the light turns green.
Replace the Velcro and leave the trap.

Fig 7. CamTrakker options



Camera placement
Camera traps can get stolen. They should therefore be placed in locations where animals are moving, but the threat of human detection is low. Areas of forest far from villages are therefore the best places to set traps.
Traps should be set for specific species; tigers for example like to use open paths (so do hunters!), but remember to set cameras back so that they photograph the whole animal.
Make sure traps are set at right angles to paths so that the flank of an animal is seen not its head or rump.
If two traps are put on the same path, put them on separate sides so that both flanks of a tiger are photographed; this helps with identification of individuals.

Try to place traps in open areas facing north-south as the bight sunlight in the early morning and evening can set them off accidentally.

Camera care

Change batteries every two months. It is good to check traps monthly though in case the batteries or film need replacing.
Don't keep going back to the camera as human scent may deter animals for going near them.
It is a good idea to put some silica gel in each unit to keep them from getting damp.
When camera-traps return from the forest make sure they are cleaned.
Do not store camera-traps with batteries in.

Data recording

Always record results on a data sheet, a set of which should be held at the provincial FPD office (see appendix 2).

Survey Results and Report Writing

The final day of the training course was on report writing. During this session each section of a report and its appropriate contents were discussed. The results of the survey are therefore presented here in the format decided upon by the participants to act as a working example of how to apply data to a report format.

Executive summary

[This section is aimed at decision makers who do not have time to read the whole report, but who would read a summary. As such it should be short and stress the results and recommendations so that the message given within the report is conveyed to the reader.]

- Tigers were not confirmed in Song Thanh Nature Reserve, but interview data indicates that they are present.
- Preliminary assessments of prey availability suggests that low tiger densities could occur in Song Thanh Nature Reserve.
- As part of the wider conservation efforts in the Central Annamites, Song Thanh Nature Reserve is an important core area of protected forest.
- Training of staff form three provincial FPD's occurred.

Acknowledgements

See page1 for an example.

Introduction

Background

The Central Vietnam Tiger Corridor is a project jointly implemented by the Forest Protection Departments (FPD) of Thua Thien-Hue, Quang Nam and Kon Tum, and the World Wide Fund for Nature (WWF) Indochina Programme.

The Tiger Corridor covers a landscape which is of regional importance for the conservation of tigers in the wild and covers the priority landscape of the Central Annamites. The project area encompass important remaining forest habitat in Vietnam as well as contiguous large forest blocks and protected areas in adjacent Cambodia and Lao. As such, the Central Vietnam Tiger Corridor Project aims to contribute to the long-term persistence of tiger populations both within Vietnam and in Indochina as a whole.

The project takes a comprehensive approach to tiger conservation, both in terms of physical scope and in terms of actual project activities. In Vietnam where tiger numbers are severely depleted and protected areas are small and fragmented a landscape-based approach is clearly necessary.

The project has three following objectives:

1. To build capacity among forest guards in anti-poaching and tiger survey techniques.
2. To carry out surveys and inventories in the project area in order to fill gaps in knowledge on tiger populations and the various threats they face.
3. To raise awareness among communities in the project area on biodiversity conservation in general and tiger conservation in particular.

Aim

To conduct a baseline tiger distribution survey encompassing many techniques so that all fifteen participants become proficient in tiger surveys.

Objectives

- To collect baseline data on tiger distribution in Song Thanh Nature Reserve.
- To collect baseline data on tiger prey distribution in Song Thanh Nature Reserve.
- To train/learn techniques used during surveys:
  Map reading
  Compass work
  Use of GPS
  Effective camera-trap placements
  Track casting
  Track identification
  Data collection

List of participants

From Nguyen

Survey area

[Include all relevant information on the survey area. Information such as latitude and longitude, protection status, habitat types and reference to a map must be given.]

Location

The survey was conducted in Song Thanh Nature Reserve (15°13′ - 15°41′ N to 107° 21′ - 107° 50′ E). The reserve was approved by Quang Nam Provincial People's Committee in November 2000 (Le Nho Nam 2001), however it has not yet been approved my MARD (BirdLife & FIPI, 2001). The reserve is situated within Nam Giang and Phuoc Son districts of Quang Nam province (see map 2).

Background

Song Thang Nature Reserve is part of the largest contiguous areas of conservation coverage in Vietnam, being adjacent to Ngoc Linh (Quang Nam) and Ngoc Linh (Kon Tum). It therefore holds one of the largest probabilities of retaining a population of tiger for the foreseeable future in Vietnam. In addition to this, the reserve is contiguous with forests to the north and east in Hien and Que Son districts and to the west in Lao PDR with forest links to the north and south of Quang Nam province. The potential area of tiger habitat is substantial, therefore, and so the presence of tigers in core sites afforded legal protection is essential to a tiger conservation strategy.

Other species of conservation interest present in Song Thanh include the grey shanked douc langur (*Pygathrix cinereus*), giant muntjac (*Megamuntiacus vuquangensis*) and the Truong Son muntjac (*Muntiacus truongsonensis*).

Geography

The core zone of Song Thanh Nature Reserve covers 93,249ha of which 95% is evergreen forest. The area is mountainous with many peaks over 1000 m a.s.l., especially in the south of the reserve as it nears the Kon Tum plateau (BirdLife & FIPI, 2001). The northern side of the reserve reaches as low as 80m a.s.l. so the altitude gradient is large.

The Song Thanh, Dak Pring and Tam Paete rivers drain into tributaries of the Va Gia river which is one of the major river of Quang Nam province. The reserve is a critical watershed for this river which in recent years has flooded regularly causes serious hardships to the people of Quang Nam.

Survey timing

The survey was conducted between 18th and 23rd September 2001. Only the first three days, however, could be spent in the forest due to heavy and continuous rain making crossing rivers too dangerous to continue with the survey. Survey effort was therefore minimal but this meant that more time could be spent on training exercises even though these were centred at the FPD ranger station.

Methods

[Your methods should be clearly defined so that they can be replicated in the future to obtain directly comparable data.]

Interviews

Three interviews were conducted, one by each provincial FPD. They were overseen by the trainer so that the interviewers could see where more detailed questioning is required and how not to lead the interviewee into giving the answer they think the interviewee wants to hear; especially with species identification. Interviews were focused on tigers with little biodiversity data being sought. All information obtained from interviews are clearly shown in this report so that the reader can distinguish it from field data.

Field survey

Only one day of field survey was possible due to the weather. Activities focused on the proficient use of maps, GPS and compass and the identification of tracks. Camera-traps (TrailMaster 1500 and CamTrakker) were to be placed in the forest, but the onset of the bad weather cut the days survey short so only potential sites were investigated.

Navigation was aided by 1:50,000 topographic maps, compasses and either Garmin XL12 or Eagle Explorer GPS's. Footprints were identified with the help of Pham Nhat *et al.* (2001) and van Strien (1983). Data was recorded in note books during field work and transcribed onto data recording sheets (see appendix 3), copies of which are held at Quang Nam FPD.

Results

[This section should present your results only]

The data collected is presented in appendix 4 as an example of how to fill in data recording sheets to their full potential. A full list of species recorded is presented in appendix 5. Map 3 shows the survey route. Global status follow Hilton-Taylor (2000) and Vietnamese status follows MOSTE (2000).

Tigers and their prey

No evidence of tigers were recorded in the field, although interviews suggest that the species still remains in Song Thanh Nature Reserve. The impression received during interviews is that tigers are not targeted by hunters in the area, although occasionally they are killed by snares. One man interviewed was convicted of killing a tiger two years prior to the survey because he trapped a tiger after it killed one of his cows. He sold the tiger for ten million Vietnamese Dong, but the fine he received was equal to this amount. A two year suspended sentence was also given. The

attitude of the man seemed to suggest that this punishment was not a strong deterrent to hunting tigers.

Local people were aware of the importance of tiger and they attributed this to the awareness activities conducted by the provincial FPD as part of the Central Vietnam Tiger Corridor Project.

Tiger prey appear to be targeted by hunters, especially wild pig as they are perceived as an agricultural pest. Sambar tracks were seen once during the field survey and pig tracks were seen an numerous occasions. In one site a large group of pigs had passed recently as a large area had been dug up by their foraging behaviour; many different sized tracks were found.

Key species

[In this section present the finding for globally and regionally threatened species]

Douc langur species *Pygathrix sp.*
IUCN global status: *P. nemaeus* – Globally Threatened; Endangered A1cd
P. cinerea – Data Deficient
Vietnam status: *P. nemaeus* – Endangered
P. cinerea – not listed
A single animal was seen in primary evergreen forest almost at the furthest point from the Song Thanh [river] that was reached. The forest at this location was markedly less disturbed than closer to the river which acts as an entry route to the reserve. The animal was not seen clearly although it was observed to have a long tail with white on the cheeks. Both the red- and grey-shanked douc langur may occur in the reserve.

Crested Argus *Rheinardia ocellata*
IUCN global status: Globally Threatened; Vulnerable A1cd+2cd
Vietnam status: Threatened
A dropped feather was found on a ridge path at 510m a.s.l. in primary evergreen forest.

Human activity

One camp occupied by three men with two dogs, a gun and fishing nets were observed. A freshly felled tree was found and in a separate location and a recently used logging skid trail was seen. Felled trees were obviously being taken out of the reserve and transported down the river. Two old traps set for small animals were found. Although this data set is small the time spent surveying was limited so extrapolations would suggest that the human activity close to Song Thanh (river) is high. Evidence of human activity decreased with distance from the river so the core of the reserve is probably virtually untouched.

Discussion

[This section allows you to talk about your results in context to other sites in the region and even globally for some species. It is also the section in which problems with your methods and your general thoughts on the area should be presented.]

Although the presence of tigers was not confirmed, previous data (see Wilramanayake *et al.,* 1997) and interviews during this survey suggest they are still present. The field data, although far from comprehensive, suggests the presence of a suitable prey base. The evidence of high human activity is worrying and could pose a threat to the survival of the tiger, its prey and its habitat is not effectively enforced.

Song Thang Nature Reserve is part of the largest contiguous areas of conservation coverage in Vietnam and so is crucial to the survival of tigers nationally. The reserve also lies within an effectively unbroken stretch of forest spanning the majority of the Central Vietnam Tiger Corridor and beyond, although connections are small in places. This large stretch of forest which incorporates all or part of eight TCU's will be subjected to numerous conservation projects at the landscape level with local implementation over the next few years. Although tigers are in dire straits in Vietnam at present, there is an opportunity in the Tiger Corridor to secure their future as part of a multi-faceted approach to conservation if tiger specific activities are integrated in to other projects.

The survey was too short to assess the biodiversity value of Song Thanh Nature Reserve although the presence of douc langurs hints that its value is high. The grey-shanked douc langur is currently only known from Vietnam and has a small distribution including Song Thanh Nature Reserve.

Training was hampered by the weather. Most time was spent at the FPD station on the border of the reserve. Although this prevented field experience with track identifications it did present an opportunity for more one-on-one training in GPS, track casting and camera-trap placements. This actually benefited the training and all participants were given the opportunity to practice al skills whilst being closely supervised.

Conclusions

Tigers were not confirmed during the survey, but interview data suggests that they still remain in Song Thanh Nature Reserve.

Initial survey results suggest a prey base sufficient to support a low to medium density tiger population is present in the reserve.

Human activities in the Nature Reserve are high, adding pressure to tiger populations within what should be a strictly protected core area within the Central Vietnam Tiger Corridor.

Song Thanh Nature Reserve should act as a source of tigers within the Central Vietnam Tiger Corridor. Many non-protected areas within the corridor are due to have conservation activities implemented within the next two years so the both the protected and non-protected area matrix should be managed to keep forest, prey and tiger populations.

The training component of the survey was successful as intensive sessions could be conducted due to the weather. A lack of field practice was evident due to the weather; this seriously hampered track identification training.

Conservation recommendations

[Recommendations must be linked to your conclusions]

Tiger conservation in Song Thanh Nature Reserve

- Increased enforcement is required to decrease human activities, especially hunting, within the core zone of the reserve.
- The investment plan should be approved by MARD so that government funding can be released to help strengthen protection activities and the management board.
- An intensive awareness campaign focusing on tiger, its importance and plight should be conducted throughout the buffer zone of the reserve.

Landscape planning across the Central Vietnam Tiger Corridor

- Forest areas between protected cores such as Song Thanh Nature Reserve need to be conserved to keep continuous forest throughout the Central Vietnam Tiger Corridor. Such protection can be achieved in many ways such as forest enterprises, community forestry and special-use forest.
- Increased communication between government departments, conservation organisations and local stakeholders to ensure land use designation and management is sustainable.

Research on the biodiversity value of Song Thanh Nature Reserve

- Surveys on all taxa are needed to fully assess the reserve's biodiversity value. Vegetation, mammal and bird surveys are the most important as they allow good comparisons with other areas and many endangered species may be identified.

Training re-enforcement

- Each participant should have regular field activities to facilitate self practice of the techniques learnt.
- This report should be translated and distributed to all participants and their colleagues.
- Refresher courses should be held to re-enforce training if required.

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Appendices

[See end of document for Appendices]

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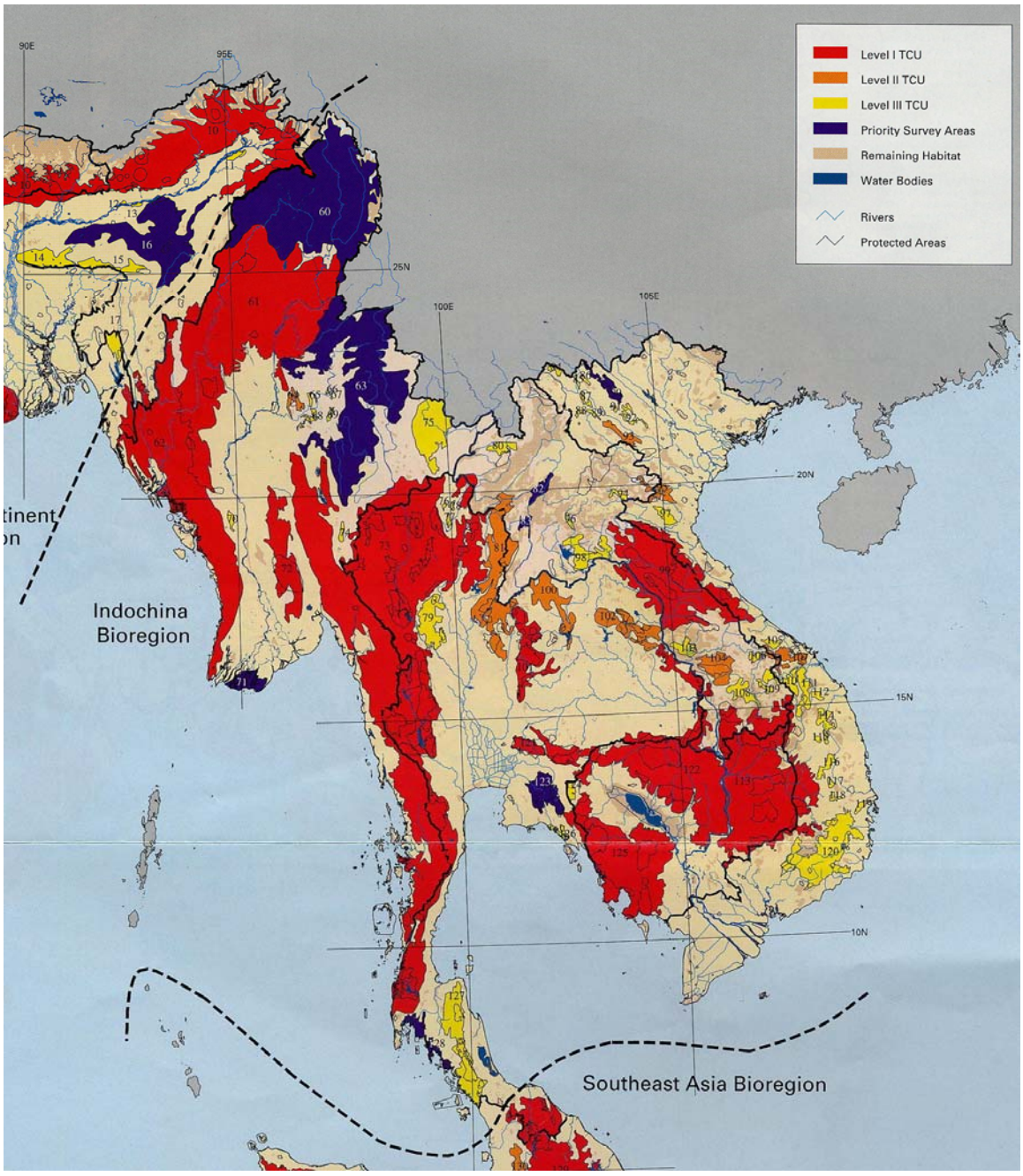
Appendix 1. Tiger Conservation Units
Taken from Dinerstein *et al.* (1997)



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

Wildlife 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.)

Wildlife Data Sheet

Location	Song Thanh NR		Date	18/10/2001		Personnel	Thua Thien Hue, Quang
Distance covered	6.75km		Weather	Warm & dry		Nam and Kon Tum FPD's + WWF	
Time start	06:50		Time Finish	10:20		Survey time	3hrs 30mins

Time	Species (include human activity)	Location (UTM & Lat/Long)	Habitat	Altitude	Evidence (track/ sighting etc.)	Remarks (measurements, compass bearing etc.)
06:40		0791114E 1734384N N15°40.247' E107°42.938'	Village	100m		Forest Protection Department ranger station
07:15		0790045E 1733215N N15°39.621' E107°42.332'	Scrub	85m		
07:40		0790114E 1731687N N15°38.792' E107°42.359'	Old village; scrub +	90m		
08:30		0789959E 1730442N N15°38.119' E107°42.265'	Riverside scrub	90m		
09:15		07902883E 1729160N N15°37.422' E107°42.439'	Secondary evergreen	95m		
10:30		0790575E 1728780N N15°37.214' E107°42.596'	Disturbed primary Evergreen	100m		Camp

Wildlife Data Sheet

Location	TK 309		Date	19/10/2001		Personnel	Thua Thien Hue, Quang
Distance covered	3km (1 way)		Weather	Warm, rain 12-		Nam and Kon Tum FPD's + WWF	
Time start	09:00		Time Finish	16:10		Survey time	7hrs 10mins

Time	Species (include human activity)	Location (UTM & Lat/Long)	Habitat	Altitude	Evidence (track/ sighting etc.)	Remarks (measurements, compass bearing etc.)
09:00		0790575E 1728780N N15°37.214′ E107°42.596′	Disturbed Primary Evergreen	100m		Camp
09:15	Fisherman's camp		Disturbed Primary Evergreen	100m		No people seen. Fishing nets present.
09:20	Old trap		Disturbed Primary Evergreen	100m		For small mammals/birds
09:25	Logging trail	0790592E 1728781N N15°37.214′ E107°42.606′	Disturbed Primary Evergreen	110m		Fresh skid trail
09:40	Sambar		Disturbed Primary Evergreen	200m	Track	
10:00	Cut Tree	0790709E 1728040N N15°36.812′ E107°42.666′	Disturbed Primary Evergreen	260m		Recently felled – same tree as kid trail (09:25)
10:40	Old trap and fire	0791095E 1727573N N15°36.556′ E107°42.878′	Disturbed Primary Evergreen	300m		For small mammals/birds
10:55	Wild pig		Primary Evergreen	300m	Track	
11:20	Wild pig		Primary Evergreen	450m	Track	
11:20	Bear sp.		Primary Evergreen	450m	Claw marks	Old
11:35	Crested argus	0791067E 1726961N N15°36.225′ E107°42.858′	Primary Evergreen	510m	Old feather	
13:10	Douc langur sp.		Primary Evergreen	500m	Sighting	1 seen. Not clear; white cheeks, chest and tail seen
15:20	3 men		Disturbed Primary Evergreen	260m	Sighting	3 men, 2 dogs, 1 riffle – sent them back to camp.

Wildlife Data Sheet

Location	Song Thanh NR		Date	20/10/2001		Personnel	Thua Thien Hue, Quang
Distance covered	6.75km		Weather	Heavy rain		Nam and Kon Tum FPD's + WWF	
Time start	11:10		Time Finish	16:10		Survey time	7hrs

Time	Species (include human activity)	Location (UTM & Lat/Long)	Habitat	Altitude	Evidence (track/ sighting etc.)	Remarks (measurements, compass bearing etc.)
11:10		0790575E 1728780N N15°37.214' E107°42.596'	Disturbed Primary Evergreen	100m		Camp
	Walk through disturbed primary forest then scrub/re-growth forest east of Song Thanh (river)					
16:10		0791114E 1734384N N15°40.247' E107°42.938'	Village	100m		Forest Protection Department ranger station

Appendix 5. Species recorded in Song Thanh Nature Reserve

No.	Scientific name	English name	Evidence	Global status (Hilton-Taylor, 2000)	Vietnam status (MOSTE, 2000)
	Mammalia:				
	Primates:				
	Cercopithecidae				
1	*Pygathrix sp. (namaeus / cinereus)*	Douc langur sp.	O	GT:EN / DD	E / ?
	Carnivora:				
	Ursidae				
2	*Ursus sp. (thibetanus / malayanus)*	Bear sp.	T	GT:VU/DD	E
	Felidae				
3	*Panthera tigris*	Tiger	I	GT:EN	E
	Artiodactyla:				
	Suidae				
4	*Sus scrofa*	Wild pig	T		
	Cervidae				
5	*Cervus unicolor*	Sambar	T		
	Aves:				
	Galliformes:				
	Phasianidae				
1	*Rheinardia ocellata*	Crested argus	T	GT:VU	T
	Psittaciformes:				
	Psittacidae				
2	*Psittacula alexandri*	Red-breasted parakeet			
	Passeriformes:				
	Corvidae				
3	*Corvus macrorhynchos*	Large-billed crow			
	Sturnidae				
4	*Sturnus nigricollis*	Black-collared starling			
5	*Acridotheres tristis*	Common Myna			
	Pycnonotidae				
6	*Pycnonotus jocosus*	Red-whiskered bulbul			
	Passeridae				
7	*Motacilla cinerea*	Grey wagtail			