DICE UNIVERSITY OF KENT	Monitoring tiger and their prey species in Kerinci Seblat National Park, Indonesia

Final Report to 21ˢᵗ Century Tiger
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Introduction

Current Project Status

Kerinci Seblat National Park (KSNP), west-central Sumatra, is an important protected area for tigers because it is still contains large blocks of forest that continue outside the national park boundaries. Whilst these large forest blocks could support viable tiger populations, the pervasive threats of illegal logging and poaching of both tigers and their prey render the future of this species uncertain. In order to assess the impact of these different threats and the conservation strategies aimed at reducing them, reliable, scientific information is needed on the population trends of tigers and their prey. This report highlights project activities completed over the 12 months of Project Year (PY) 2, which aimed to collect baseline data on tigers and their prey in KSNP. More specifically the project objectives were:

- Conduct surveys of tigers and prey for PY2 in the KSNP monitoring programme;
- Continue to investigate the factors that determine tiger and prey abundance in KSNP;
- Determine tiger and prey population status in KSNP;
- Train KSNP staff and Indonesian students in tiger and prey monitoring techniques;
- Disseminate project information to project partners and policy makers; and,
- Monitor and evaluate project results and effectiveness.

The monitoring programme in PY2 was implemented and conducted under the following time scale (Table 1). Project activities from months one to six have been covered in detail in a mid-term report sent to 21st Century Tiger (July 2005). This current report covers all activities in PY2, but with a particular focus on activities from Months 7-12.

Table 1: PY2 programme activities from Month 1 (February 2005) to 12 (January 2006)

	Activity	Month											
		1	2	3	4	5	6	7	8	9	10	11	12
1.1	Steering committee meeting												
1.2	Workshop in Sumatra (KSNP HQ)												
1.3	New project personnel field survey												

#	Activity												
	training	▓											
1.4	Continue data collection (detection/non-detection surveys)	RAI	NY							SE	AS	O	N
1.5	Continue data collection (camera trapping)	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓
2.1	Tiger and prey landscape analysis											▓	▓
3.1	Workshop in Jakarta (Dept. Forestry)					▓							
3.2	Presentation to national universities						▓						
4.1	Mid-term M&E					▓							
4.2	End of year presentation – Dept. Forestry												▓
4.3	End of year presentation – KSNP HQ												▓
5.1	End of PY2 information dissemination - KSNP HQ and TPCUs												▓

First term activities

A summary of the first term activities (Months 1 to 6) is provided here.

Activity 1.1. Steering committee workshop

The steering committee with representatives from Fauna and Flora International (FFI), DICE and the Directorate General of Forest Conservation (PHKA) met in Sumatra during Month 2. During this time overall project progress and project expansion, including the identification and allocation of KSNP staff for Activities 1.3-1.5, was discussed. A timetable for PY2 was subsequently developed and implemented. A separate meeting was then held with the head of KSNP to discuss project progress and work plan.

Activity 1.2. Workshop in Sumatra (KSNP HQ)

A workshop was held during Month 2 in Sumatra (KSNP Head Office), involving all project collaborators (FFI, PHKA and local NGOs), was convened during this time and PY1 results were presented and discussed. All project data files were transferred to the KSNP Head Office computers.

Activity 1.3. Project personnel field survey training

As scheduled, during Month 2, project personnel comprising two KSNP forest rangers, four community scouts and two Indonesian national university graduates received four weeks training in field equipment use, including GPS and camera traps, and field survey methods. A tiger and prey monitoring programme, based on indirect sign (detection) surveys and camera trapping surveys, was then implemented for PY2 in KSNP.

Activities 1.4. Detection/non-detection field surveys

In a submontane study site, a total of ten 1 km^2 grid cells were surveyed by two teams (four persons) to trial a detection/non-detection survey technique that is being developed within this project. Four main problems were encountered during these preliminary surveys: i) an insufficient number of teams to conduct multiple surveys; ii) difficulties of working during the rainy season; iii) low detection of tiger sign; and, iv) surveying an unrealistically large number of grid cells over a short time period. In response, the number of survey teams has been increased from two to four teams by reducing the number of staff per team from four persons/team to three persons/team and by recruiting additional staff. All staff have now been issued with waterproof raincoats and Wellington boots, in response to point (ii). Overcoming points (iii) and (iv) has proved more difficult because it involves matching statistical rigor with feasible field survey design. However, it was decided that collecting sufficient data (i.e. from 80 grid cells), which should result in much more reliable estimates of tiger and prey abundance (MacKenzie in press, J. App. Ecol), is essential to accurately monitoring focal species, and can be achieved within a six month period.

Activity 1.5. Camera trap surveys

A fully operation camera trapping campaign began in an area of hill- submontane forest, Sipurak, that included part of a former logging concession that has been recently repatriated into KSNP. Camera trapping was conducted continuously between Months 3 and 7. A total of 89 tiger photographs were obtained from a five month camera trapping period (Table 3).
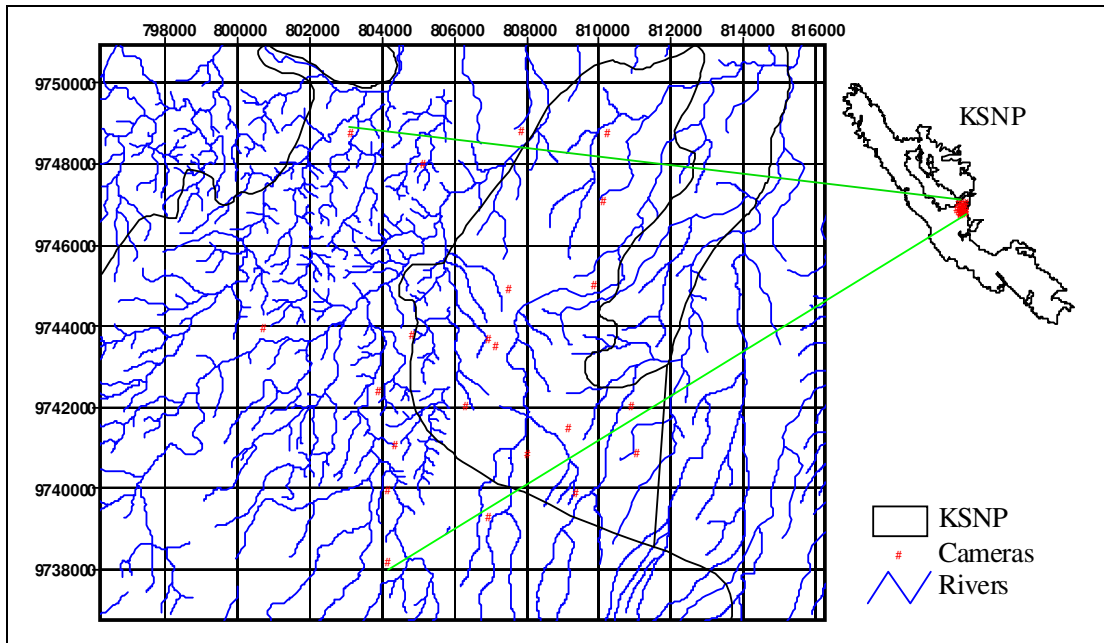
Figure 1. Camera trap location in the hill forests of Sipurak, KSNP.

From a total of 1277 identified photographs, 20 species of wildlife were recorded from Sipurak (Table 2). This included a substantial number of tiger records and all the main prey species.

Table 2. Camera trap photographs from Sipurak

No	Species	Records	No	Species	Records
1	Tiger	89	11	Clouded leopard	11
2	Bearded pig	275	12	Wild Boar	10
3	Pig-tailed macaque	225	13	Sambar	8
4	Great Argus pheasant	193	14	Yellow-throated martin	5
5	Porcupine	117	15	Asian wild dog	4
6	Muntjac	106	16	Rhinoceros hornbill	4
7	Sunbear	100	17	Marbled cat	3
8	Tapir	70	18	Serow	2
9	Golden cat	31	19	Banded linsang	1
10	Mouse deer	22	20	Binturong	1

Activity 3.1 Meeting in Jakarta (Dept. Forestry)

A workshop was held during Month 5 in Jakarta to discuss the monitoring project with the Department of Forestry and to introduce the Director of DICE, Prof. Nigel Leader-Williams, in order to then discuss increased collaboration between DICE and the Department Forestry. In attendance from the Department was the Director General for Nature Conservation and the Director of Protected Areas, who hitherto had not been exposed to this project and its donors.

Activity 4.1. Mid-term project monitoring and evaluation

This activity was conducted according to the schedule, through a workshop where all project partners met, reviewed and evaluated the project activities and their results. The main outputs were improving the design of the camera traps to stop water leaking in (a new tin roof has now been made for each camera), expanding the monitoring programme to simultaneously cover the Bengkulu (southern) area and the Jambi/West Sumatra (central) area and modifying the detection/non-detection surveys. The main problems identified in surveying Bengkulu were the inaccessibility of forest areas in Bengkulu (a new vehicle was subsequently funded by 21st Century Tiger) and the lack of project personnel (a new monitoring team will be set up in 2006 when if pending grants are successful).

Second Term Activities

In this section we detail the second term activities (Months 7 to 12) and the numerous additional activities conducted that were not part of the original proposal.

Activity 1.4. Detection/non-detection field surveys

An output from the mid-term monitoring and evaluation activities, conducted during Month 6, was the development of a new sampling protocol to obtain on-going information on the occupancy of tigers and their prey across KSNP. To achieve this, KSNP has been divided into six monitoring blocks based on their geographical location (Fig. 2). Detection/non-detection surveys then began in Block 4 during Month 10. It is

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anticipated that these surveys will be completed within six months. So far, a total of 36 grid cells (2 km^2) have been surveyed by four teams at one day intervals.
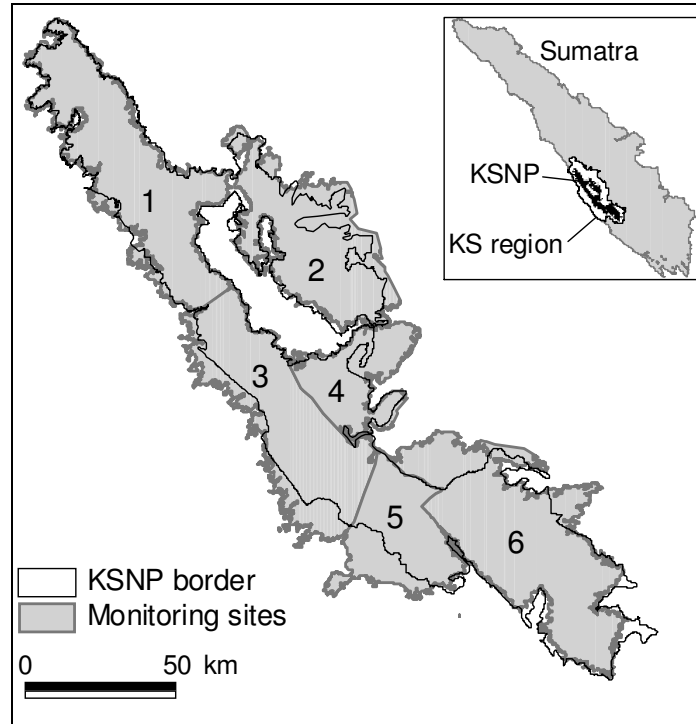

Fig. 2. Proposed monitoring blocks for detection/non-detection surveys

Activity 1.5. Camera trap surveys

Camera trapping within a capture-recapture framework was completed in Sipurak, a hill forest study site, during Month 7. From these surveys, the closure test did not reject the null hypothesis that the population was closed during the period of camera trapping ($z = -1.048$, $P = 0.147$). Five individual tigers were identified from 50 tiger photographs (not all 89 photographs due to closure test restrictions), with an estimated capture probability of 0.3611 and a tiger abundance of 6 individual tigers ± 1.28 (S.E.). Whilst Model M_h in CAPTURE was ranked second to the null Model M_o, Model M_h was selected in preference because it is a more realistic model that assumes each individual tiger has a unique capture probability. Using the mean maximum distance moved (MMDM) within the strip width boundary method, an effective sampling area of 294.1 km^2 was calculated that yielded a tiger density of 2.0 adult individuals/100 km^2 (2.0-4.1, 95% C.I.s). In comparison, this density estimate was similar to the 3.3 adult individuals/100 km^2 (0.7-

15.4, 95% P.I.s) derived using the same dataset but within an encounter rate indices method developed by Carbone et al (2002, Anim. Con.).

Activity 2.1 Tiger and prey landscape analysis

From 1848 active camera days at 29 camera placements, 550 tiger prey photographs were obtained. This was equivalent to a relative abundance (or encounter rate, ER) of 29.76 tiger prey photographs/100 days. In comparison, a total of 89 tiger photographs were obtained, which was equivalent to a lower ER of 4.81 tiger photographs/100 days.

Regression analyses were then used to investigate which combination of spatial factors best explained combined tiger prey ER and tiger ER. The factors included in the analysis were presence of poaching, distance to forest edge, distance to public roads, distance to settlements, distance to rivers and elevation. A linear multiple regression analysis showed that combined tiger prey ER was not related to any of the spatial factors (Table 3).

Table 3. Relationship between tiger prey ER and the different spatial factors

Factor	Coefficients ± S.E.	t	P
Log_{10} Distance to forest edge	-	-	n.s.
Log_{10} Distance to public roads	-	-	n.s.
Log_{10} Distance to settlements	-	-	n.s.
Log_{10} Distance to rivers	-	-	n.s.
Log_{10} Elevation	-	-	n.s.
Constant	-	-	n.s.

Next, a multiple linear regression, with the inclusion of tiger prey ER as an independent factor, showed that tiger ER was only related to the single factor of distance to settlements (Table 4). Thus, tiger ER was greater at distances further from settlements (Figure 3).

Table 4. Relationship between tiger ER and the different spatial factors ($r^2 = 0.159$)

Factor	Coefficients ± S.E.	t	P
Log_{10} Distance to settlements	0.710 ± 0.330	2.155	0.041
Log_{10} Distance to forest edge	-	-	n.s.

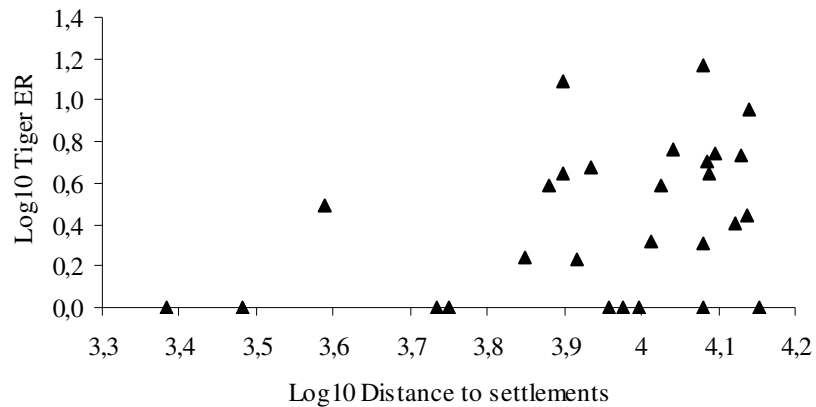|			
Log$_{10}$ Distance to public roads	-	-	n.s.
Log$_{10}$ Distance to rivers	-	-	n.s.
Log$_{10}$ Elevation	-	-	n.s.
Log$_{10}$ ER tiger prey	-	-	n.s.
Constant	-2.384 ± 1.303	-1.831	0.079

Fig. 3. Relationship between tiger encounter rates (ER) and proximity to settlements

Activity 3.2 Presentations to national universities

During Month 10, project presentations were given at the universities of Indonesia (Jakarta), National (Jakarta), Bengkulu (Sumatra), Andalas (Sumatra) and the Institute of Agriculture (Bogor). This was delayed from the originally scheduled Month 7, so that the presentations coincided with term times and an anticipated increase in student attendance. Three students in attendance subsequently joined the project. A success of this project over PY2 has been its expansion in now working with seven Indonesian universities. Capacity building within Indonesia still remains a priority for this project.

Activity 4.2 End of Project Year 2 presentation – Directorate General of Forest Conservation

A joint workshop between the 'Tiger and Prey Monitoring Programme' and the 'Tiger Protection and Conservation Programme' involving all project collaborators convened in Jakarta during Month 12 to present and discuss projects results. The meeting was chaired by the Director General of PHKA, and attended by the Indonesian Institute of Sciences,

FFI, DICE and the head of KSNP. Project partners congratulated both projects on their hard work and success. The main issues raised by our project partners were the status of roads that are planned to bisect KSNP and the problem of illegal logging inside KSNP. Clear and concisely written reports documenting all tiger and prey monitoring project results and conclusions have been sent to PHKA, the Indonesian Institute of Sciences, donors and project partners.

Activity 4.3 End of year presentation – KSNP office

As scheduled, the end of PY2 presentation was held in the KSNP head office in Sumatra. The presentation covered field survey work (camera trapping and detection/non-detection surveys) and the significance of the results, forest cover change work, priority areas in need of protection resulting from this work and the future timetable for PY3.

Activity 5.1 End of Project Year information dissemination

As scheduled, all field, remote sensing and other spatial data were transferred, with assistance from the KSNP GIS officer, to the KSNP headquarters and the GIS section in PHKA. These data are now located in the GIS office and freely available to other researchers and organizations.

Additional activities

There were some significant additional activities conducted during PY2, which are summarised here.

GIS training and tutorial production

A series of basic and intermediate ArcView GIS tutorials that include all the salient topics for tiger conservation have been produced in both English and *bahasa* Indonesia. Examples of some of the topics included are downloading GPS data into a GIS, mapping and displaying tiger locations, constructing camera trap polygons and associated buffers to enable tiger density estimation. Using the field datasets collected from PYs 1 and 2, GIS and statistical training was provided for all project members, including staff from the

Tiger Protection and Conservation Units. A separate, more advanced training session was then run on the interpretation of satellite images to map forest cover and forest change.

These tutorials have been distributed to 15 conservation NGOs, Indonesian conservation GOs and universities running conservation projects within Indonesia. Furthermore, 11 organizations running conservation projects across nine countries in Asia have been sent these tutorials. The tutorials will be made freely available when they are published on the project website, during the next update.

Field survey manual: matching theory and practice

In response to a lack of field survey materials available in *bahasa* Indonesia, the Project Manager wrote and produced a concise technical manual that outlines monitoring objectives, field survey theory and how to apply this in the field. This manual was included with the GIS training CDs sent out.

Deforestation map

Four Landsat 7 ETM+ satellite images providing complete and cloud free coverage for the KS region in 2004 were purchased during Month 10. These images were radiometrically and geometrically corrected and then converted into forest cover maps using an on-screen digitising technique. The resultant 2004 forest cover map was overlaid on a 2002 forest cover map, which was derived using the same technique, to compare rates of deforestation (forest conversion to farmland) across the KS region and within KSNP (Figure 4, Table 5).
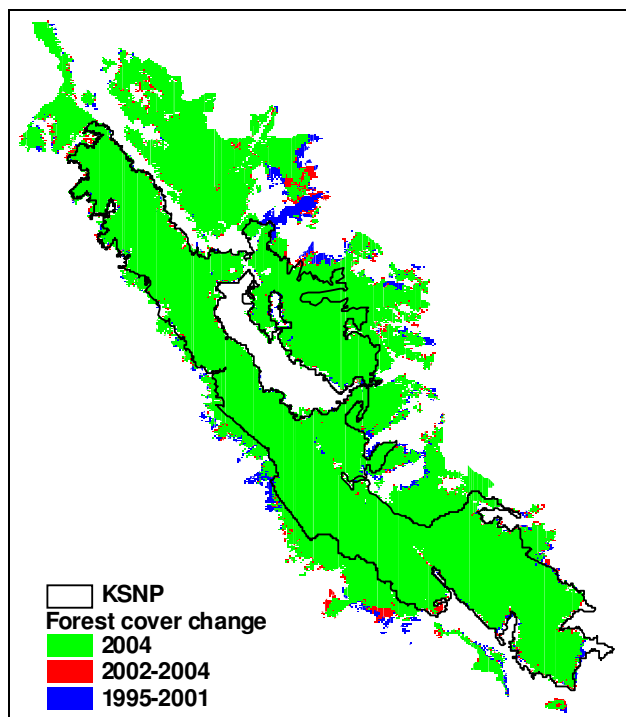
Fig. 4. Forest cover in 2001 and forest loss between 1995 and 2001 in the KS region

Table 5. Change in forest cover for KSNP and the KS region from 2002-2004

	KSNP	KS region
Forest cover in 2002 (km^2)	12646.0	21893.4
Forest cover in 2004 (km^2)*	12474.7	21100.2
Forest change (km^2)	-171.2	-793.2
Deforestation rate (%/yr)	0.68	1.81

*Preliminary results pending ground-truthing surveys

Deforestation rates in the KS region have increased from 0.96%/yr (1995-2001) to 1.81%/yr (2002-2004), or nearly a doubling in rates (Table 6). Whilst the 2002-2004 deforestation rates were substantially higher outside of KSNP, the deforestation rates inside KSNP have increased more rapidly from 0.27%/yr (1995-2001) to 0.68%/yr (2002-2004).

Table 6. Change in deforestation rates for KSNP and the KS region from 1995-2001 and 2002-2004

	Deforestation rate (%/yr)	
	KSNP	KS region
Forest change 1995-2001	0.27	0.96
Forest change 2002-2004*	0.68	1.81

*Preliminary results pending ground-truthing surveys

World Bank and UNESCO meetings

During Month 12, two separate meetings were held with the World Bank's Forestry Governance Office (Mario Boccucci) and World Resource Institute Director (Fred Stolle) and then with the UNESCO deputy director (Han Qunli). During these meetings the latest 2002-2004 forest change maps for the KS region were exposed and discussed in light of the recent proposals for roads construction through KSNP and the need for on the ground action (i.e. government support for law enforcement). Consequently, each organisation expressed an interest and willingness to help in lobbying the Department of Forestry and provincial governors to veto these planned roads.

Zonation meeting

At the request of the Head of KSNP, the Project Manager attended a KSNP zonation meeting in Bogor during Month 12. Whilst the different conservation zone categories were discussed for KSNP, the 2002-2004 forest change maps and tiger monitoring data enabled more detailed decisions to be made.

Study visit to Wildlife Conservation Society (WCS) project in Way Kambas National Park

During Month 8, after camera trap surveys had finished in Sipurak, the project staff had a working break by visiting a related conservation project in Way Kambas National Park, southern Sumatra. The purpose of the weeklong trip was to exchange ideas and experiences, and maintain staff motivation and enthusiasm through forging stronger links with the WCS staff working on similar tiger and elephant conservation issues in a protected area. The trip served as a useful introduction to the WCS human-elephant conflict mitigation project, which is a planned activity for KSNP as part of the project expansion in PY3.

Poster display at the annual Lake Kerinci Festival

At the request of the Head of KSNP, project staff prepared and presented a poster display at the Lake Kerinci Festival in Month 7. The festival, attended by local and provincial

government and local communities, provided a good opportunity to promote the project to a much wider audience and give greater exposure for our donors.

Finally, the project would very much like to acknowledge and offer a debt of gratitude for the support offered by the collaborators and donors listed below,

Collaborating Institutions

PHKA

FFI-Indonesia program

The Bureau of KSNP

UNAND, West Sumatra province

UNIB, Bengkulu province

UNAS, Jakarta

UI, Jakarta

IPB, Bogor

University of Islam As-syafiah, Jakarta

Universitas Negeri Jakarta, Jakarta

Donors

US Fish and Wildlife Service

21st Century Tiger

Rufford Small Grants for Nature Award

Peoples Trust for Endangered Species