Monitoring tiger and their prey species in Kerinci Seblat National Park, Indonesia

Final Report, July 2006

A report to Rufford Small Grant (for Nature Conservation)

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Project Period:	1 July 2005 to 30 June 2006
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Summary

This report covers all activities completed during Project Year (PY) 2. The main aim of PY2 was to assess tiger populations in poorly known areas in the 13,300 km^2 Kerinci Seblat National Park (KSNP) and use this information to improve tiger conservation management. The project has achieved this by increasing the capacity amongst Indonesian scientists through training and research that has enabled all project staff to successfully conduct high quality camera trap surveys to estimate tiger density and to conduct detection/non-detection surveys, a new method developed by this project, to estimate tiger prey abundance. These tiger and prey data were used as part of a global tiger assessment that subsequently identified KSNP as one of the two highest priority areas for the long-term survival of tigers in Sumatra. The tiger and prey data were also used by the Indonesian Department of Forestry to reclassify project study sites as core protection zones inside KSNP and to present a strong case to provincial government to veto the construction of a road that would have bisected KSNP. The project has continued to expand and now works with six Indonesian universities. In fact, it was some of these students that were part of the project team that recently photographed the critically endangered and endemic Sumatran ground cuckoo, which has only been recorded once since 1916. This record gained wide exposure to the project and its donors being covered by over 26 media organizations, including The Sunday Times, The Independent, Channel 4 News, The Jakarta Post and Fox News. The project is now well established in KSNP and has consequently been able to respond to other conservation needs, such as implementing the first formal KSNP human-elephant conflict mitigation programme. As this diversification continues the tiger programme is developing a community component that is anticipated to begin in PY3.

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 past six 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 is being conducted under the following time scale (Table 1). This report covers all project activities conducted within Months 1-6.

Table 1: PY2 programme activities from Month 1 (1 July 2005) to 12 (30 June 2006)

Activity	**Month**											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1.1 Steering committee workshop												
1.2 Project personnel field training												
1.3 Detection/non-detection surveys												
1.4 Camera trap surveys												
2.1 Produce GIS/remote sensing tutorials												
2.2 Project personnel GIS, remote sensing and statistics training												
2.3 Estimate the abundance and population trends of tigers and prey												
3.1 Project information dissemination												
4.1 Project review												

First Term Activities

In this section we briefly described the activities that were conducted during the first term (Months 1 to 6) and detailed in our mid-term report (January 2006).

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 1.2-1.4, 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. Project personnel field survey training

As scheduled, during Month 1, 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.

Activity 1.3. Detection/non-detection field surveys

This project is continuing to develop a new detection/non-detection 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. 1). Detection/non-detection surveys then began in Block 4 during Month 4. It is 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.

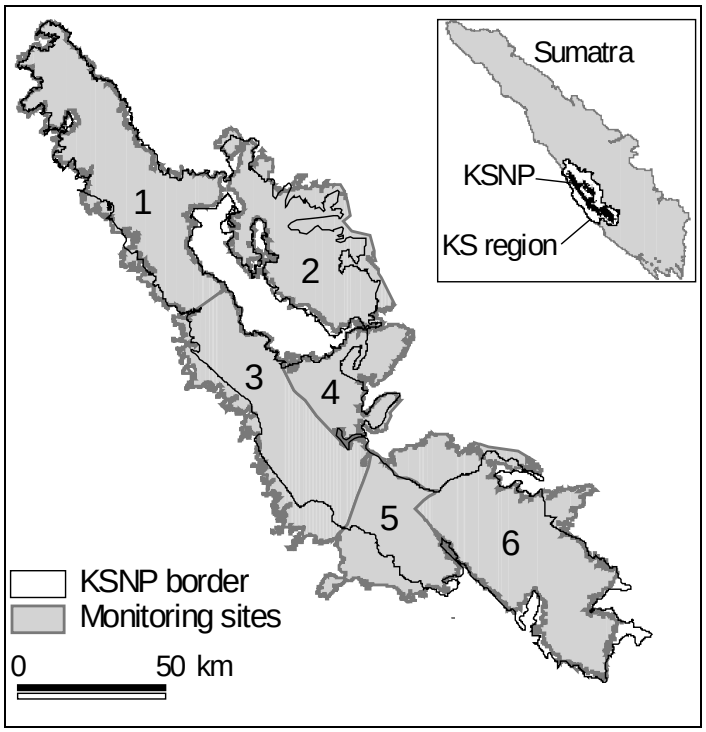

Fig. 1. Proposed monitoring blocks for detection/non-detection surveys

Activity 1.4. Camera trap surveys

Camera trapping within a capture-recapture framework began in PY1 (Month 7) and was completed during PY2 (Month 1). A fully operation camera trapping campaign was conducted in an area of hill-submontane forest, Sipurak, that included part of a former logging

concession that has been recently repatriated into KSNP (Fig. 2). From camera trapping over six months, a total of 89 tiger photographs were obtained (Table 2).

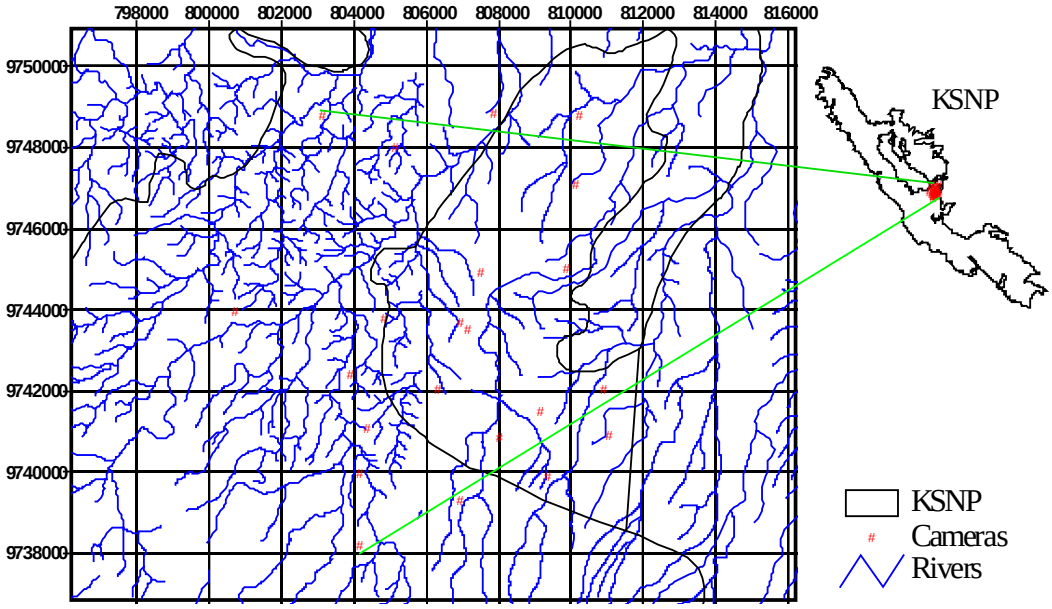

Fig. 2. Camera trap location in the hill forests of Sipurak, KSNP.

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.).

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

Activities 2.1 and 2.2. 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.

Additional activities conducted during the first term

There have been some significant additional activities conducted during the first term of PY2, which are summarised here.

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 4. 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 3).

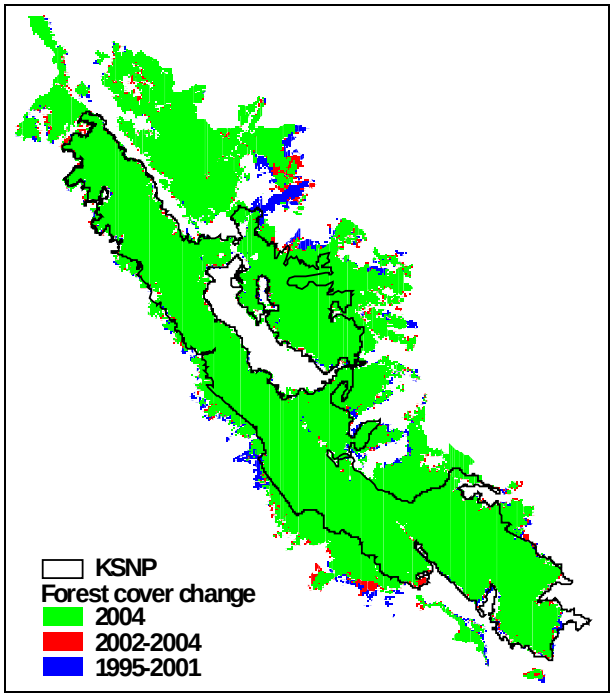

Fig. 4. Forest cover in 2001 and forest loss between 1995 and 2001 in the KS region

Table 3. 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 4). 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 4. 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

Mid-term 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 6 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.

World Bank and UNESCO meetings

During Month 6, 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 6. 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 2, 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 PY2.

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 1. 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.

Second Term Activities

Here we detail project activities that were completed during the second term of Months 7-12 (February-July 2006). We then detail the numerous additional activities conducted during the second project term that were not part of the original proposal. Overall, the project is running on schedule and continuing to expand (such as working with seven Indonesian universities now).

Activity 1.3. Detection/non-detection surveys

During the first term, a total of 36 grid cells (2 km^2) were each surveyed independently by at four teams one day intervals. On schedule, during Months 7-12, these surveys continued until the 80 cell target, as recommended by Darryl MacKenzie, had been achieved. The project is

continuing to refine the detection/non-detection sampling protocol to obtain on-going information on the occupancy of tigers and their prey across KSNP. This emerging field method has attracted the attention of other projects in Sumatra (WCS, ZSL, WWF-US) that are now using these surveys on tiger and prey. This is encouraging because as all projects should be producing comparable data from different study areas across the island.

Activity 1.4. Camera trap surveys

A second period of camera trapping, using 21 cameras within a capture-recapture framework, began in Month 8 and is due for completion one month after the end of this project period. A fully operation camera trapping campaign was conducted in Ulu Batang Ule, a mosaic habitat that covered primary forest in KSNP and adjacent forest in a commercial logging concession that had been degraded through selective logging activities (Fig. 2).

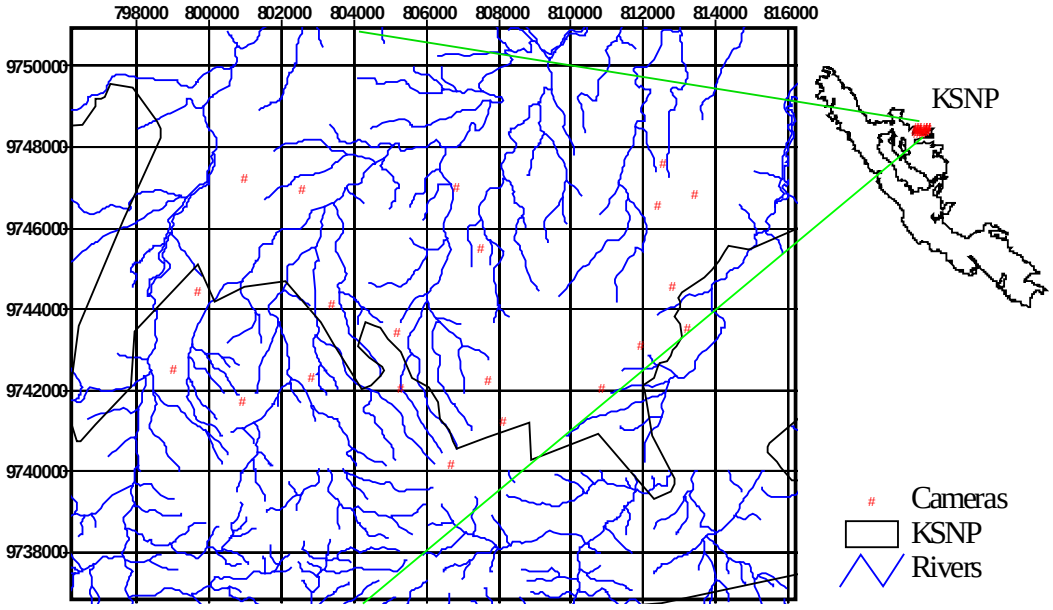

Fig. 2. Camera trap location in the hill forests of Ulu Batang Ule, bordering KSNP.

Activities 2.1 and 2.2. Produce GIS/remote sensing tutorials and Project personnel GIS, remote sensing and statistics training

A series of GIS and remote sensing tutorials were completed in the first term of the project. This then allowed project staff to be trained earlier than originally anticipated. A measure of the success of this training is illustrated by the project staff taking over all GIS duties from the Project Manager. The Project Manager has continued to check all GIS work conducted within the project, but it is quite clear that staff GIS capacity has been increased to an intermediate

level. The next step will be to train these staff in more complex algorithms to enable them to spatially analyse project field data.

Activity 2.3. Estimate the abundance and population trends of tigers and prey

The detection/non-detection surveys were conducted in a patch of forest 1154.5 km^2 in the central-eastern side of KSNP. Applying a constant occupancy model, i.e. one that assumes occupancy and detection probability to be constant across the four surveys and 80 sites, found a high occupancy of tiger and their prey in the study site (Table 5). Tigers had an occupancy estimate of 0.8052 or approximately 80% of the study area was occupied by tigers. These results highlight the importance of this block of forest for tiger survival and verify reports by the KSNP-FFI Tiger Protection and Conservation Units of the importance of this area. Further analyses are being conducted to investigate the influence of environmental covariates, such as distance to roads, on tiger and prey occupancy and detection probabilities.

Table 5. Preliminary occupancy estimates for tiger and key prey species in KSNP, using the constant model.

Species common name	Proportion of area occupied (±S.E.)
Tiger	0.8052 (0.0520)
Muntjac	0.9698 (0.0257)
Sambar	0.9212 (0.0320)
Wild pig *Sus* sp.	0.9635 (0.0213)
Tapir	0.9544 (0.0281)
Serow	0.7248 (0.2643)

From a total of 1277 identified photographs, 20 species of wildlife were recorded from Ulu Batang Ule (Table 6). This included a substantial number of tiger records and all the main prey species.

Table 6. Camera trap photographs from Ulu Batang Ule

No	Species	Records	No	Species	Records
1	Tiger	80	11	Clouded leopard	15
2	Bearded pig	22	12	Wild Boar	6
3	Pig-tailed macaque	134	13	Sambar	1
4	Great Argus pheasant	46	14	Asian wild dog	6
5	Porcupine	55	15	Sumatran ground pheasant	10

6	Muntjac	49	16	Marbled cat	4
7	Sunbear	52	17	Pangolin	4
8	Tapir	71	18	Masked palm-civet	3
9	Golden cat	10	19	Unknown/blank	10
10	Mouse deer	2	20		

Plate 1. Sumatran tiger on a ridge trial.

Activity 3.1. Project information dissemination

This activity was originally planned for Month 12. However, as already mentioned in the first term project report, 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 6 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. The next meeting has been scheduled for January 2007.

Activity 4.1. Project review

The project was reviewed during Month 12 by FFI and DICE. The project manager and field team leader then discussed the 2005/06 timetable implementation, staff appraisals and future developments. The project has made significant progress over the course of PY2 and has successfully adhered to the timetable and achieved all milestones. Numerous additional

activities have been completed, such as the deforestation mapping, and these have been important for KSNP management.

Second Term Additional Activities

Rediscovery of the Sumatran Ground Cuckoo

Until now, the endemic Sumatran Ground Cuckoo *Carpococcyx viridis* has only been recorded once since 1916, and then only from southern Sumatra in 1997. Re-finding this critically endangered species close to KSNP is especially exciting because it was photographed in disturbed forest that has been left to recover near KSNP, and because our project has built capacity among young Indonesian scientists to lead camera trapping teams that undertake routine monitoring. This finding also shows the important role of the tiger as a flagship and umbrella species that can be used to raise funds that also serve to conserve the biodiversity living with the tigers' distribution. A press release issued by the University of Kent received wide coverage including, Fox News, The Discovery Channel, The Sunday Times, The Independent, The Jakarta Post and 26 other websites and newspapers.

Plates 2a and 2b. Sumatran ground cuckoo, *Carpococcyx viridis*, recorded on 18th May 2006.

Non-tiger and Prey Tropical Mammal Studies

Two additional studies on poorly known tropical mammals have been conducted during PY2. Neneng Susanti, an M.Sc. student from University of Indonesia, conducted the first scientific serow study in Asia. Neneng successfully applied the detection/non-detection method developed by this project to estimate the occupancy of serow (*Nemorhaedus sumatraensis*) in a hill forest habitat. Serow occupancy was recorded at 0.7248 (±0.2643, 1 S.E.) or 72.48% of the area surveyed was occupied by serow.

This project applied a mark-recapture method to assess the status of sun bear (*Helarctos malayanus*) populations in the KS region. We focused on the sun bear because it is categorized by the IUCN/SSC Red List as a being Data Deficient and the highest priority for bear conservation research. Like most tropical mammals, sun bears are difficult to study because they are cryptic and difficult to detect. In this study, we applied a detection/non-detection sampling technique using camera trap data on sun bears to estimate site occupancy from two tropical forest study sites. To summarize, sun bear occupancy was found to be higher in primary hill forest than primary submontane forest (Table 7).

Table 7. Camera trap study site used for estimating sun bear occupancy in and around KSNP

Study area	Project year surveyed	Forest type	Protection status	Occupancy (±S.E.)
Renah Kayu Embun	Year 1	Primary submontane	Inside KSNP	0.4433(0.1025)
Sipurak	Year 2	Primary hill	Inside KSNP	0.5704(0.0981)

Presentation – Padang State University,

During Month 10, project staff gave a joint presentation to two local universities, Padang State University and the University of Andalas. During this time project progress and research opportunities were presented and discussed to maintain on-going collaboration between the project and these universities.

Expansion Plans for Project Year 3

In PY3, two community questionnaire surveys are planned across the three main ethnic groups (Minang, Kerincinese and transmigrant Sundanese/Javanese). The first questionnaire aims to understand how community outreach programmes can be designed for different ethnic groups with different experiences, perceptions and attitudes towards tigers. More specifically, this survey aims to investigate: i) community tolerance to living in close proximity to tigers; and, ii) whether community experiences with human-tiger conflict and/or their spiritual connection with tigers influences their attitudes and perceptions towards tigers and their conservation management.

The second questionnaire aims to understand how deforestation (tiger habitat loss) is influenced by different management regimes around KSNP. More specifically, this survey

aims to understand: i) how the different natural resource management systems operate in local communities surrounding KSNP; ii) local community conservation knowledge and conservation attitudes; and, iii) whether greater conservation knowledge is linked with a more positive conservation attitude, and if positive attitudes result in more positive conservation actions (as measured through observed village level deforestation rates).

A human-elephant conflict will be implemented during PY3. Sumatran elephants live in fragmented populations across human-dominated landscapes where they compete with humans for space and resources. As human populations continue to convert forest to farmland, they reduce elephant habitat and increase the likelihood of crop-raiding. This represents one of the most severe forms of conflict as it threatens local livelihoods and can lead to loss of both human and elephant life, which impedes elephant conservation. Through wide national and international collaboration, this project will implement the first human-elephant conflict mitigation programme in farmland outside of Kerinci Seblat National Park (KSNP) and the first monitoring programme for inside KSNP. Thus, this project proposes to conserve the threatened elephant populations in and around the KSNP through six main objectives, which are,

- Increase capacity within KSNP staff, local communities and project staff to monitor and mitigate HEC outside of the KSNP
- Increase capacity within KSNP staff and project staff to monitor elephant populations inside the KSNP
- Raise local awareness of HEC mitigation methods
- Disseminate project information to project partners and policy makers
- Monitor and evaluate project results and effectiveness

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