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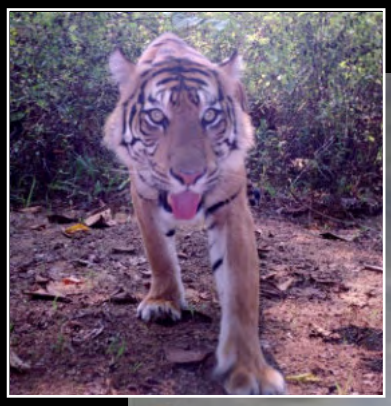
ZSL Wildlife Survey Report

Rapid survey for tigers and other large mammals

SM Bentayan and SM Dangku, South Sumatra



May 2007

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Contents

Acknowledgements

- This study was commissioned and hosted by BKSDA South Sumatra (SUMSEL)
- The study was generously funded by Conoco Phillips, with additional assistance provided by individual Environmental and GIS staff and the field staff at the Bentayan and Rebonjiro fields.
- Permission for expatriate Zoological Society of London (ZSL) staff to carry out research in Indonesia is provided by LIPI
- Funding for ZSL in Indonesia is provided by 21st Century Tiger
- Fieldwork was carried out by members of:
    - BKSDA Jambi
    - ZSL
    - Indonesian biology graduate volunteers
- With additional assistance from
    - Wildlife Conservation Society Indonesia Programme (WCS-IP)
- The cooperation of the people living around Bentayan and Dangku is gratefully acknowledged.

Executive summary

SM Bentayan and SM Dangku are two Suaka Margasatwa nature reserves in South Sumatra, Indonesia, administered by the BKSDA South Sumatra. In 2006 Conoco Phillips agreed to fund a rapid survey of each site to determine whether tigers still lived in the area. The Zoological Society of London (ZSL) was subcontracted to lead the survey, with fieldwork conducted by members of the BKSDA, ZSL and volunteer parties.

The surveys were conducted in March/April 2006 (Bentayan) and August/September 2006 (Dangku), with funding provided to operate for twenty days in each site. Although tigers were the focal subject, surveys were conducted to record all medium to large terrestrial mammals and threats. Each survey was conducted using three survey methods. Foot transects were walked in a sample of 29 4km2 cells in Bentayan and 28 4km2 cells in Dangku to measure species diversity, detection probabilities and thus occupancy values for key species, and to measure relative abundance through encounter rates. Camera traps were then set up in the same sampling framework, providing supplementary data on species diversity and relative abundance. 128 questionnaire surveys were conducted simultaneously with the wildlife surveys with respondents living inside the two reserves.

Bentayan and Dangku both retain an important role in species conservation. Of the two, Dangku has the highest conservation value, containing several critically endangered Sumatran tigers as well as several other species of high conservation importance including clouded leopard, marbled cat, sun bear and tapir. Dangku also shows the lower level of threat from human activity, with about one third to a half of the park consisting of reasonable wildlife habitat. However, Dangku also recorded the higher rates of threat encounters, with the largest concentrations on the four edges of the remaining forest block. On the northern and southern borders, there has been large scale clearing for oil palm. However, within the interior (and where the wildlife was at the highest concentrations) there were particularly high levels of 'pioneer' threats. Hunting, including tiger traps, was prevalent with no attempts made to hide these activities. Many small patches within the forest were being cleared ready for burning when sufficiently dry. If not checked, these pioneer activities will rapidly lead to large scale clearing and permanent settlement.

Bentayan contains very little good wildlife habitat following the fires of 1997 and the resulting influx of people. However, it does contain endangered Asian elephants which occupy a small area to the north of the reserve and probably range to the north east of the reserve. Tapir and sun bear are also present in the same areas. Much of Bentayan is already cleared and, in many cases, planted and settled, making solutions much harder to find. Threats were more or less constantly high throughout the reserve except for the small area where wildlife concentrations were highest. Bentayan may well represent what Dangku will look like in a few short years.

Potential for human-wildlife conflict is high in both reserves, with much evidence of crop raiding and even damage to buildings by elephants in Bentayan and two human deaths in Dangku shortly after the survey. Encounters with people and wildlife were frequently at the same points in both reserves, both on camera trap films and on foot transects.

The people living in both reserves tend to be newcomers to the area. Most are aware they live in protected areas, colonising only after they perceived the reserves to have lost their value (particularly Bentayan). Attitudes towards wildlife show little aesthetic or moral value attached – most are classed as pests, dangerous or unknown, although understanding of the laws that protect them appears to be widespread. Attitudes towards the forest vary depending on whether describing personal perceptions or 'official' functions. On a personal level most people see the forests as a site for opening new land and planting crops. On an official level, most understand the function of forests to be for conservation. There is little feeling of personal responsibility for conservation, with most seeing it as the role of the government, or unknown parties.

The key recommendations following the report are to take swift action in both reserves to counter the various threats recorded. In Dangku, pioneer threats can still be prevented from leading to permanent settlements. In Bentayan, the remaining habitat used by all wildlife needs to be secured as soon as possible. Action should be conducted within a larger framework, both looking at conservation in the landscape as a whole (neither Bentayan nor Dangku is large enough to support sustainable large mammal populations on their own) and conducting a range of activities to support protection measures, including setting up monitoring programmes and working with landscape stakeholders.

Ringkasan eksekutif

SM. Bentayan dan SM. Dangku merupakan dua suaka margasatwa di Sumatera Selatan, Indonesia, yang dIkelola oleh Balai Konservasi Sumber Daya Alam (BKSDA) Sumatera Selatan. Pada tahun 2006, Conoco Phillips sepakat untuk membiayai suatu survey cepat, untuk menetukan apakah harimau Sumatera masih ada di kedua suaka margasatwa tersebut. Zoological Society of London (ZSL) telah dipercaya untuk memimpin survey, selanjutnya kegiatan lapangan dilaksanakan oleh staf-staf dari BKSDA Sumsel dan ZSL, serta beberapa sukarelawan.

Survey telah dilaksanakan dalam bulan Maret/April 2006 (Bentayan) dan Agustus/September 2006 (Dangku), dengan dana yang tersedia untuk pelaksanaan survey selama 20 hari di masing-masing kawasan. Meskipun harimau merupakan subjek utama, survey dilakukan untuk mencatat semua mammalia berukuran sedang sampai besar serta ancaman-ancamannya. Setiap survey dilakukan dengan mrnggunakan tiga cara. Suatu transek jalan kaki telah dijalankan dalam satu sampel sel-sel yang luas totalnya 29 4km^2 di Bentayan dan 28 4km^2 di Dangku untuk mengukur kelimpahan spesies, probabilitas pendeteksian dan kemudian nilai-nilai okupansi untuk spesies-spesies kunci, serta untuk mengukur kelimpahan relatif spesies melalui laju perjumpaan. Kemudian perangkat kamera trap dipasang di dalam kerangka sampling yang sama, yang dapat menyediakan data tambahan dalam keragaman spesies serta kelimpahan relatif. Selain itu, 128 kuisioner juga dilakukan secara simultan dengan survey satwa liar dengan responden yang tinggal di dalam kedua suaka margasatwa tersebut.

Bentayan dan Dangku keduanya memiliki peran yang penting dalam konservasi spesies. Dari keduanya, Dangku memiliki nilai konservasi yang paling tinggi, mengandung beberapa ekor harimau Sumatra yang statusnya kritis juga beberapa spesies yang lain yang memiliki kepentingan konservasi tinggi termasuk macan dahan, kucing batu, beruang madu dan tapir. Dangku juga menunjukkan tingkat ancaman dari kegiatan manusia yang lebih rendah, dengan sepertiga sampai setengah dari luas kawasan terdiri dari habitat satwa liar yang layak. Namun, Dangku juga mencatat laju perjumpaan ancaman yang lebih tinggi, dengan konsentrasi tetinggi pada keempat sisi dari blok hutan yang masih tersisa. Pada batas-batas di sebelah utara dan selatan, pembukaan lahan berskala besar untuk perkebunan sawit sudah jelas. Tetapi, pada bagian dalam (dan dimana satwaliar pada konsentrasi yang paling tinggi) dimana disana terdapat terutama ancaman-ancaman pionir pada tingkat yang tinggi. Perburuan liar, termasuk jerat harimau telah umum dan dengan terang-terangan. Banyak bagian-bagian kecil di dalam hutan sedang dibuka dan siap untuk dibakar saat musim kering. Jika tidak dipantau, aktifitas-aktifitas pionir ini akan dengan cepat mengarah pada pembukaan lahan berskala besar dan pemukiman permanen.

Bentayan mengandung sangat sedikit habitat satwa liar yang baik setelah kebakaran hutan tahun 1997 yang lalu. Namun demikian, kawasan ini mengandung gajah Asia yang menempati suatu areal yang kecil di utara suaka margasatwa dan kemungkinan daerah jelajahnya ke timur laut dari suaka margasatwa. Tapir dan beruang madu juga terdapat pada areal yang sama. Banyak areal di dalam Bentayan sudah dibuka dan, pada banyak kasus, telah ditanami dan dihuni, membuat solusinya semakin sulit ditemukan. Ancaman-ancaman lebih kurang tetap tinggi di seluruh kawasan kecuali pada suatu kawasan kecil dimana konsentrasi satwaliar paling tinggi. Bentayan mungkin merupakan representasi yang baik pada Dangku seperti apa pada beberapa tahun mendatang.

Potensi konflik antara manusia dengan satwa liar tinggi di kedua kawasan, dengan banyak bukti kerusakan tanaman pertanian dan bahkan kerusakan rumah oleh gajah di Bentayan dan dua kematian manusia diterkam harimau di Dangku segera setelah survey dilakukan. Perjumpaan dengan manusia dan satwa liar acapkali terjadi di lokasi yang sama, baik melalui kamera trap atau transek jalan kaki.

Masyarakat yang tinggal di kedua suaka margasatwa cenderung sebagai pendatang baru di kawasan tersebut. Kebanyakan dari mereka sadar bahwa mereka tinggal di dalam kawasan lindung, mengkoloni hanya setelah percaya bahwa kawasan suaka margasatwa kehilangan nilainya (terutama Bentayan). Mereka tidak menunjukkan apresiasi terhadap keindahan satwa liar, terlebih terhadap nilai moralnya. Kebanyakan satwa liar digolongkan sebagai hama, berbahaya atau sesuatu yang tidak mereka ketahui, meskipun pemahaman tentang hukum-hukum yang melindungi satwa liar tersebut kelihatannya telah disebarluaskan. Sikap terhadap hutan bervariasi tergantung pada persepsi perorangan atau fungsi kedinasan. Pada tingkat perseorangan, umumnya masyarakt memandang hutan sebagai tempat untuk membuka lahan baru dan menanam tanaman pertanian. Pada tingkat kedinasan, umumnya masyarakat faham akan fungsi hutan untuk konservasi. Terdapat perasaan yang rendah akan tanggung jawab perorangan untuk konservasi, dengan kebanyakan dari mereka memandangnya sebagai peran pemerintah atau pihak-pihak yang tidak diketahui.

Rekomendasi-rekomendasi utama yang terlampir sesudah laporan ini adalah untuk mengambil aksi yang cepat di kedua kawasan suaka margasatwa untuk mengimbangi berbagai ancaman yang telah dicatat. Di Dangku, ancaman pionir masih dapat dicegah dari mengarah ke pemukiman permanen. Di Bentayan, habitat yang tersisa yang digunakan oleh satwa liar perlu untuk diamankan secepat mungkin. Aksi harus dilakukan dalam kerangka yang lebih besar, dengan melihat konservasi pada bentang alam secara keseluruhan (baik Bentayan atau Dangku tidak cukup besar untuk mendunkung populasi mammalia besar secara berkelanjutan dengan sendirinya) dan melakukan aktifitas-aktifitas untuk mendukung pengukuran perlindungan, termasuk merancang program-program pemantauan dan bekerjasama dengan para pihak yang ada pada bentang alam.

Aims and objectives

Aim

The aim of the survey was to identify whether tigers were still living in two protected areas and to provide recommendations on their conservation.

Objectives

- To determine species richness in each site
- To identify other large mammals of conservation importance present in the study area
- To identify the key threats to conservation in each area
- To identify the spatial extent and relative abundance of species living in each site
- To collect as much information as possible on any tigers detected in either site
- To investigate the role of local communities in conservation within each site
- To make recommendations on how conservation can be improved

Location

The survey was located at Bentayan and Dangku, two adjacent protected areas in Kabupaten Musi Banyu Asin, South Sumatra Province, Indonesia. Both areas are historically lowland rainforest and have been classified as “Suaka Margasatwa” (SM) or nature reserves, defined under Indonesian law (1990, no.5) as areas with an identified role in biodiversity, or unique species, conservation. As such, prohibited activities include hunting, logging and land clearance.

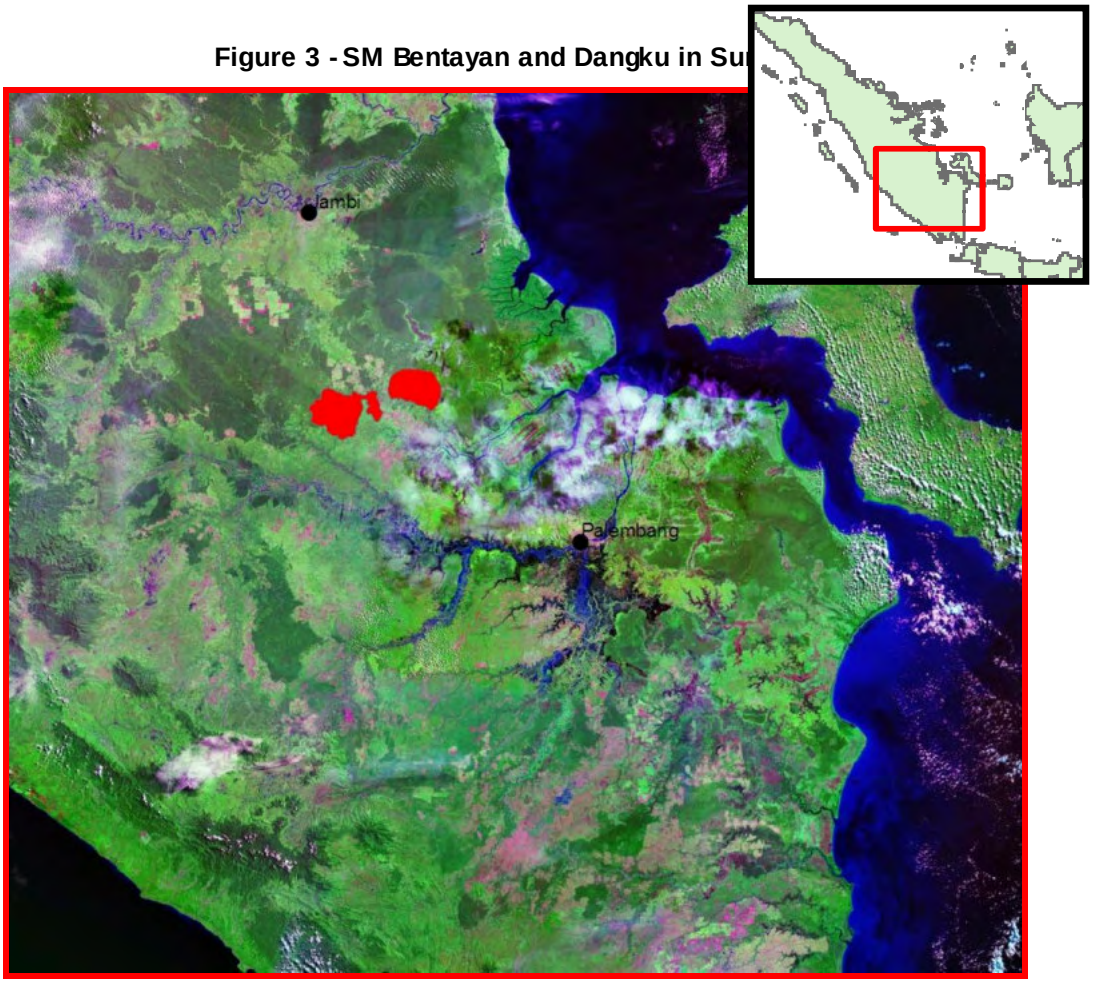
SM Bentayan is approximately 35,000 ha (350km2). In 2000, when the most recent satellite imagery available was taken, it was part of a large forest block extending eastwards and meeting with the protected forest within the National Park (Taman Nasional, TN) Sembilang and TN Berbak.

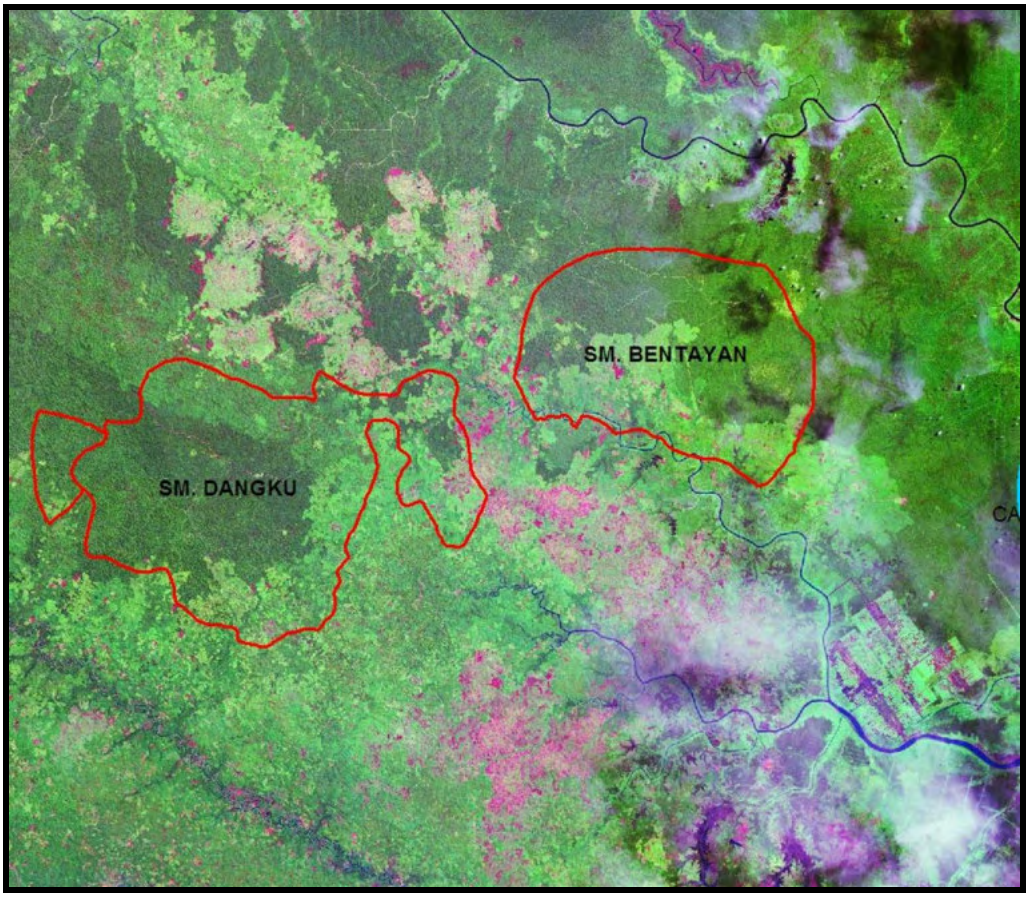
SM Dangku is approximately 40,000ha (400km2) although some maps of the border do not include 10,000ha in the eastern ‘pan handle’). In 1990 it was part of a forest block extending westwards and joining with the forest that is now classified as ‘restoration forest’ and administered by Birdlife Indonesia.

Figure 1 - Bentayan is a mixture of secondary forest in the east and large areas of burnt grassland

Figure 2 - Dangku is more heavily forested than Bentayan, but the edges are heavily encroached

Figure 3 - SM Bentayan and Dangku in Su





Methods

Survey framework

The survey was meant to be a rapid snapshot of each reserve, primarily to establish if tigers were present or not. Each survey was allocated funds for 20 days for completion, with ten BKSDA scouts available at any one time. ZSL survey teams stayed in the field for the duration of the survey. BKSDA survey teams operated on a ten day rota.

- 23-26 November 2005 – Pre-survey, SM. Bentayan
- 13-16 December 2005 – Pre-survey, SM. Dangku
- 06 March 2006 – KSDA SUMSEL training
- 07-28 March 2006 – Transect and interview survey, SM Bentayan south
- 15-25 March 2006 – Camera trap survey SM. Bentayan south, transect and interview survey in SM Bentayan north
- 26 Mar-22 Apr 2006 – Camera trap survey in SM. Bentayan north
- 15-16 August 2006 –KSDA SUMSEL training
- 22-26 August 2006 – ZSL preparation, Dangku
- 31 August - 20 September 2006 – Transect and interview survey, Dangku
- 08 September -02 October 2006 – Camera trap survey, Dangku
- November 2006 – April 2007 – Analysis

Figure 4 - Survey team comprising BKSDA, ZSL, WCS and volunteers, Dangku, phase I

Figure 5 - Survey camp

Survey training

Survey training on survey theory and principles, survey equipment, wildlife sign identification and camera trapping was carried out for all BKSDA staff joining the surveys during training days in Palembang, and at the start of each field session. Training was carried out by Dr. Tom Maddox, Dolly Priatna and Adnun Salampessy.

Figure 6 - Survey training

Pre-surveys

Pre-surveys by ZSL were important to ensure the primary survey period progressed smoothly. During pre-surveys the following activities were carried out:

- Obtaining all existing mapping and satellite imagery data for the area
- Holding a meeting at the survey site informing local people of the survey plan, objectives and reasons and, if required, seeking permission / approval to work there.
- Mapping existing access routes, potential campsites, settlements etc. at the survey site with a GPS
- Making paper and digital maps as detailed and up to date as possible for each survey cell.

Analytical framework

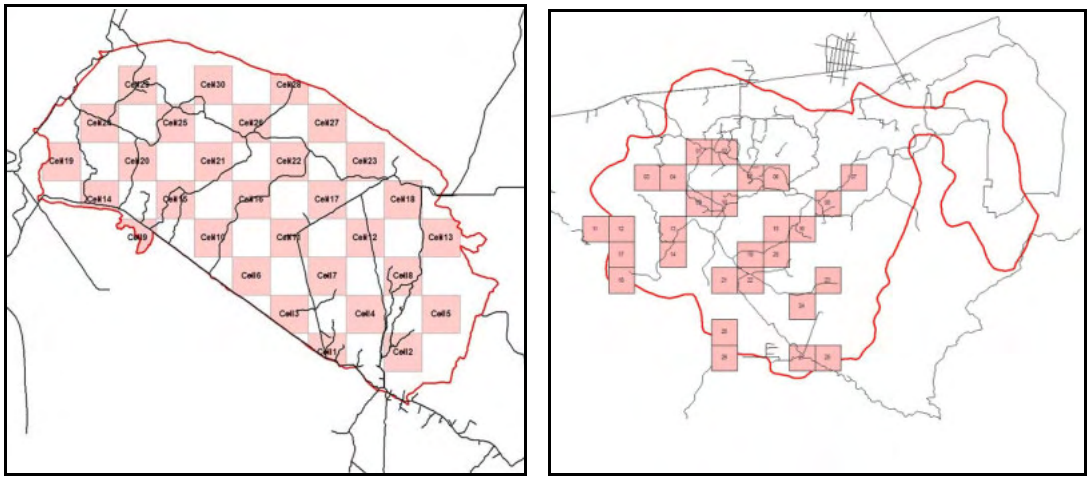
Rapid surveys can rarely achieve much more than determining presence or absence of key species. However, one of the most common problems when trying to determine whether a species is present in a given area is establishing how reliable negative results are. Finding evidence of a species means it is definitely present; not finding any evidence might mean the species is not present, or it might mean it was present but the survey did not pick it up. Because of this problem it is extremely difficult to know how reliable a survey of presence / absence is and thus it is also difficult to compare surveys. Recently various analytical techniques based on repeated sampling have been put forward to solve this problem. All rely on the same basic principle. By repeating surveys they enable a 'detectability' value to be calculated for each species. For example, an elephant is usually fairly easy to detect when present; so almost all repeat surveys of a transect where elephants exist would be expected to record their presence, giving a probability of detection (p) close to 1 or 100%. A clouded leopard on the other hand is a much harder species to detect and repeated surveys of a given transect might show that they are missed more than half of the time, giving a probability of detection (p) below 0.5. This detection value will vary from case to case dependent on the species, habitat, weather, survey type, surveyor skill etc. Without knowledge of detection probabilities a survey will produce

simple 'naïve' estimates of species occupancy. For example, if 30% of areas revealed presence of tigers, the naïve occupancy estimate for tigers is 0.3 but with no measure of how accurate this is. However, if repeats of surveys show that in fact tigers are only detected 70% of the time when they are present, the naïve occupancy estimate can be adjusted to give a final probability of occupancy (Psi) that accounts for tigers that probably were present but were missed together with confidence levels that show how accurate the estimate is. This not only improves the value of the estimates but also allows comparison with other surveys. Estimates can then be improved further by modelling the effect of various covariates, if data are sufficient. The number of samples and repeats required to get confident estimates is a matter of debate and varies by species, however, as a general rule of thumb, there should be over 60 samples and at least four replicates of each.

Sampling protocol

The sampling units chosen were cells measuring 2x2km (4km2). Habitat stratification was not possible since no up to date information on the sites was available before the survey (Figure 7). Replicates were temporal, meaning that each cell had to be surveyed independently by four different teams on successive days.

Figure 7 - Placement of 2x2km transect cells in Bentayan (left) and Dangku (right)



Foot transects

Survey cells were searched successively for tiger, threat and other species evidence by four teams of two people searching for three hours in each cell. Team leaders were equipped with simple maps of each cell to provide details of the major trails, rivers and areas of potential wildlife habitat. The primary role of each team was to establish whether tigers were present in each cell, therefore search effort was directed towards the areas of the cell most likely to yield results. However, all independent encounters of species of the size of a mongoose and larger were recorded, as well as all encounters of threat. Independent sightings were defined as being at least 100 metres from the next closest encounter of the same type. However, this rule was only a guideline – if common sense declared a new finding was likely to be different from the last, it was recorded.

For every sighting the following details were recorded:

- Time
- Species
- Sign (footprint / sighting / faeces etc.)
- ID confidence (1-3)
- Total number of individuals present
- GPS position
- Age
- Habitat (see appendix)
- Photo taken?
- Notes (including measurements for tiger pug marks)

Each team operated independently within a given cell and each team visited each cell only once, providing repeated independent samples. Every effort was made to keep team leaders constant throughout the survey period to control for differences in observer ability.

Figure 8 - Transects could be conducted by motorbike, foot (or air!) to maximise the chances of encountering tiger sign

Camera trapping

Cameras were set up directly following ten days of foot transects. During this time, potential sites were marked enabling camera set up to proceed quickly. A mixture of Camtrakker, Photoscout and Deercam brands were used, all of which rely on passive infrared sensors. Two cameras were placed in every cell at locations and heights thought to be the most likely to get tiger photographs (Figure 9). Cameras were tested before leaving with a 'test card' giving information on location and date. Cameras were ostensibly left for 20 trap nights (1 trap night = 24 hours) but due to logistical problems, some cameras were left longer.

Figure 9 - Placement of camera traps in Bentayan and Dangku

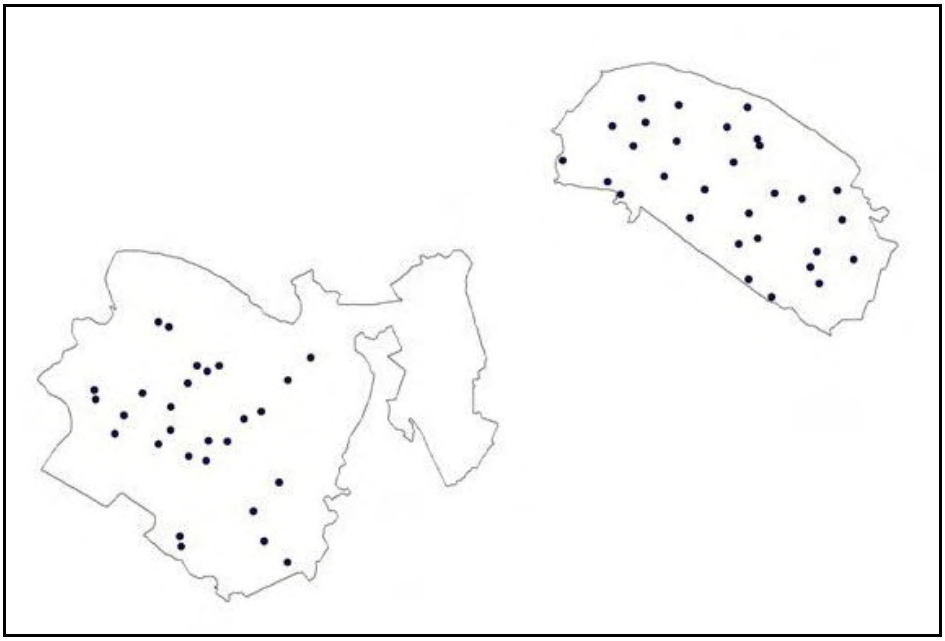


Figure 10- Setting camera traps

Interviews

Interviews were conducted by a separate team with anyone found inside the reserves. In general, household heads were targeted. Questions were asked to determine the respondent's approximate wealth, attitudes towards conservation and wildlife and to the authorities that run it.

Figure 11 - Interviewing reserve residents

Survey effort

In total, 1392 hours of search effort were conducted, resulting in 1660 encounters with wildlife, threats or signs, nearly 50% of which were wildlife tracks. 43 camera traps were also set up in 58 locations, resulting in 886 photographs, 526 of which were wildlife. The interview survey questioned 128 respondents.

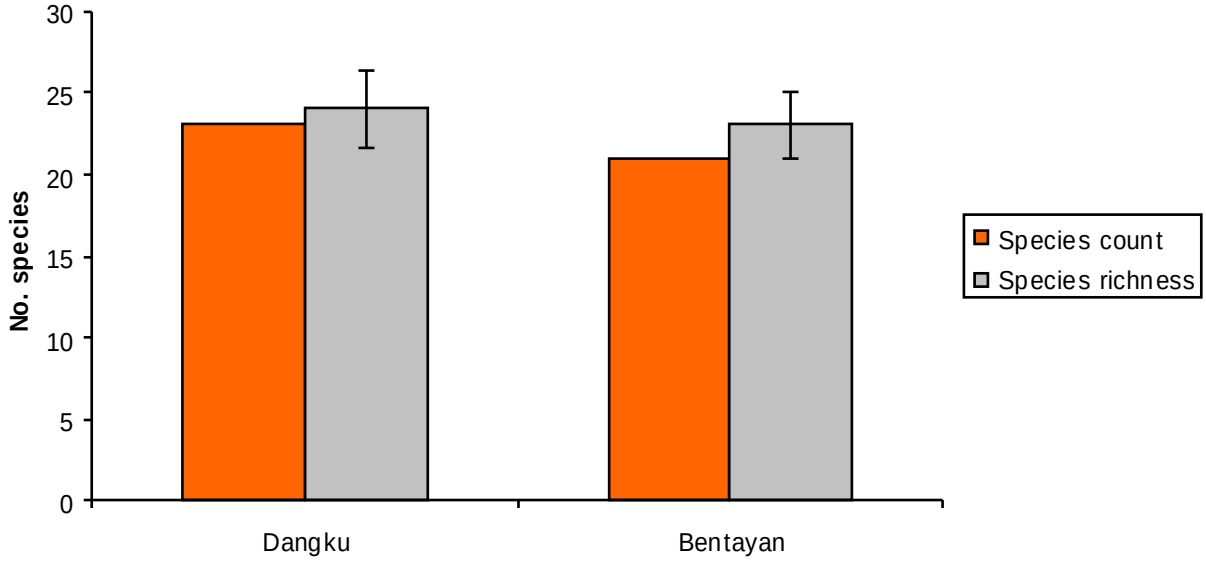
Results

Species richness

Species richness was calculated from the walked transect results based on all encounters of wild mammal species. The species count refers to the actual number of individual species detected. The species richness is an estimated value, calculated by looking at the pattern of new species detections over time and thereby accounting for the number of species that were likely to be undetected. For full details of the methods used, please see 'Calculating adjusted species richness', p.50). The results show that roughly the same number of different species exist in both Bentayan and Dangku (Figure 12).

Figure 12 - The number of species in Bentayan and Dangku

	Species count	*Species richness*	*Standard Error*
Dangku	23	24	2.36
Bentayan	21	23	2.05



Species composition

Species richness only describes the total number of species detected. Species composition describes exactly which species are present and their conservation importance. Figure 15 shows all species detected in each area, either through transects or camera traps, ordered by conservation priority. For species lists ordered by taxon please refer to 'Species lists', p.56. Camera trap photographs (where available) are shown in Figure 16 and Figure 16.

The results show that both areas had several species of conservation importance. In Bentayan, elephants were the most important species, listed as 'Endangered' by the IUCN, although tapir and sun bear are also of high conservation concern and listed as 'Vulnerable' and requiring conservation action. In Dangku, tigers were recorded – listed as 'Critically Endangered' by the IUCN and the most threatened species recorded on the survey. Sun bear and tapir were also recorded, as were several other Vulnerable species of note including clouded leopard and marbled cat, of which very little is known in South East Asia.

Figure 13 – Asian elephants (dung, left) and Sumatran tigers (pug marks, right) were the most endangered species identified in the study area.

Figure 14 - Marbled cat, tapir and sun bear are all endangered species living in the study sites

Figure 15 - Species detected in Bentayan and Dangku ordered by conservation priority

Latin name	*Common name*	*IUCN Red list category*	*Indonesian status*	*CITES Appendix*	*Bentayan*		*Dangku*	
					Transects	Photos	Transects	Photos
Panthera tigris ssp. Sumatrae	Tiger	Critically Endangered	Protected	I			Y	Y
Elephas maximus	Asian elephant	Endangered	Protected	I	Y		N	N
Cuon alpinus	Dhole	Endangered	Protected	II			Y	N
Neofelis nebulosa	Clouded leopard	Vulnerable	Protected	I	Y	N	Y	N
Pardofelis marmorata	Marbled cat	Vulnerable	Protected	I	N	N	N	Y
Tapirus indicus	Malayan tapir	Vulnerable	Protected	I	Y	Y	Y	Y
Helarctos malayanus	Sun bear	Vulnerable*	Protected	I / II	Y	Y	Y	Y
Macaca nemestrina	Pig tailed macaque	Vulnerable	Protected	II	Y	Y	Y	Y
Hystrix brachyura	East Asian porcupine	Vulnerable	Protected	Not listed	Y	Y	Y	N
Hylobates agilis	Agile gibbon	Near threatened	Protected	I	Y	N	Y	N
Symphalangus syndactylus	Siamang	Near threatened	Protected	I	Y	N	Y	N
Manis javanica	Pangolin	Near threatened	Protected	II	Y	N	N	N
Presbytis melalophos	Banded langur	Near threatened	Protected	II	N	N	Y	N
Macaca fascicularis	Long tailed macaque	Near threatened	Not protected	II	Y	Y	Y	Y
Prionailurus bengalensis	Leopard cat	Least concern	Protected	II	Y	Y	Y	Y
Cervus unicolor	Sambar	Least concern	Protected	Not listed	Y	Y	Y	Y
Muntiacus muntjak	Muntjac	Least concern	Protected	Not listed	Y	Y	Y	Y
Tragulus napu	Greater mouse deer	Least concern	Protected	Not listed	Y	N	Y	N
Martes flavigula	Yellow throated marten	Least concern	Not protected	III	Y	N	Y	N
Paradoxurus hermaphroditus	Common palm civet	Least concern	Not protected	III	Y	N	Y	Y
Sus barbatus	Bearded pig	Least concern	Not protected	Not listed	Y	Y	N	N
Sus scrofa	Pig (wild)	Least concern	Not protected	Not listed	Y	Y	Y	Y
Trichys fasciculate	Long tailed porcupine	Least concern	Not protected	Not listed	Y	N	N	N
Viverra tangalunga	Malay Civet	Least concern	Not protected	Not listed	Y	N	Y	N

Figure 16 - Photographs of species detected in Bentayan: A) Bearded pig, B) Elephant (photographed in Palembang), C) Muntjac, D) Pig-tailed macaques, E) East Asian Porcupine F) Sambar, G) Sun bear H) Tapir, I) Wild pig

Figure 17 - Photographs of species detected in Dangku: A) Leopard cat, B) Marbled cat, C) Muntjac, D) Pig-tailed macaque, E) Sambar, F) Sun bear, G) Tapir, H) Tiger, I) Wild pig

Occupancy estimates

Detection probability

Before occupancy estimates were made, the detection probability of each species was calculated based upon the pattern of encounters between transect replicates. The results show that, for wildlife, elephant were the most visible species if present in a cell. On average, only 1 in 4 teams failed to detect elephant sign if present during their three hours of searching. Tigers were the next most detectable, although this result will at least partly be a function of the fact that teams were specifically searching for tigers. Clouded leopards were one of the least detectable species and usually only encountered by one of the four teams. This is likely to be due to the fact clouded leopards are primarily arboreal therefore the quantity of sign that is available to find will be very low (Figure 18 and Figure 19).

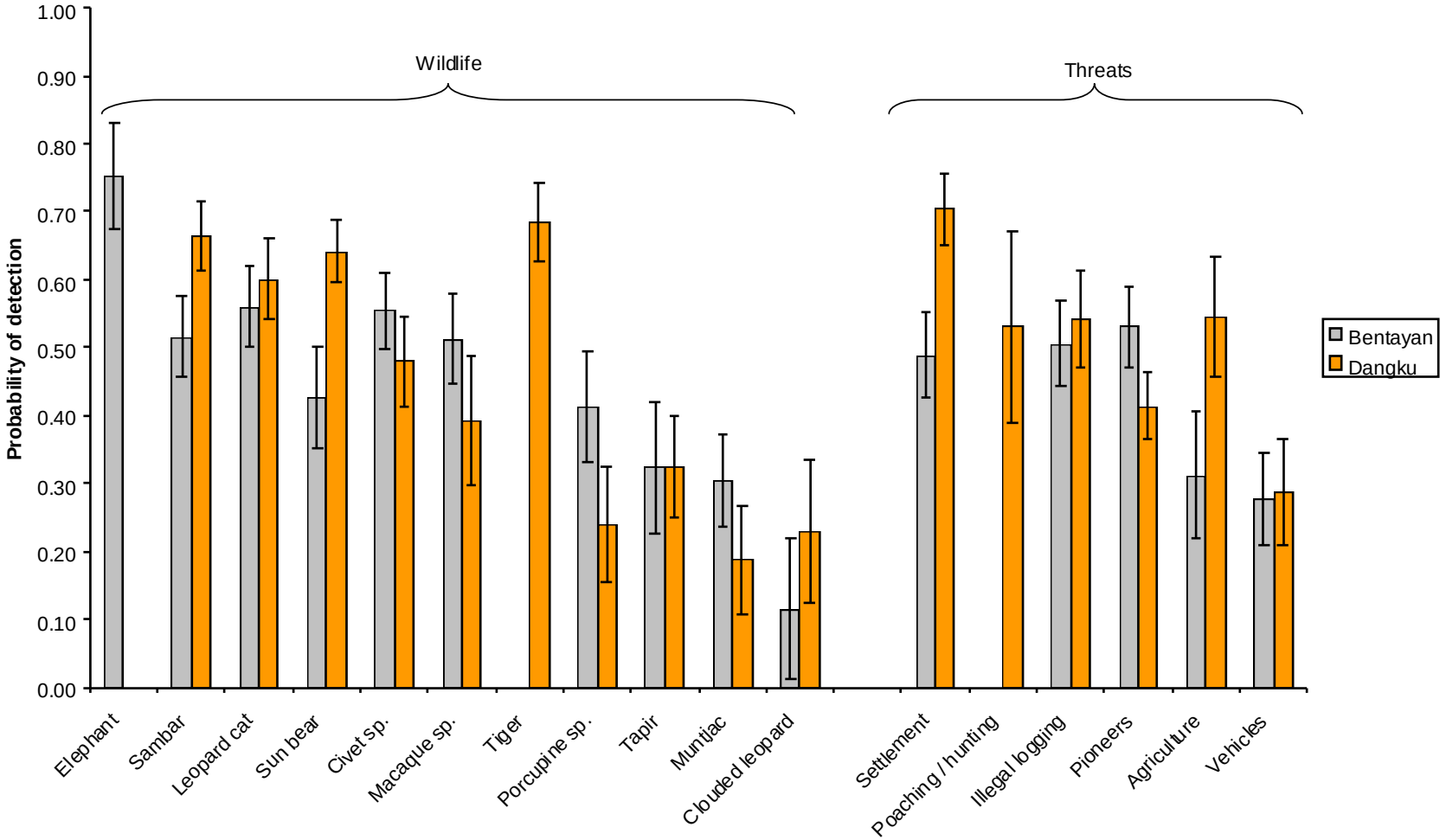
Detectability estimates for the threat categories were much higher, with the exception of vehicles which are mobile. Most threats were detected at least 50% of the time when present, which may suggest that patrols to detect threats should consist of two teams per 2x2km2, or a single team that spends a whole day in a single cell.

Figure 18 - Detection probabilities for key wildlife and threats

		Bentayan		***Dangku***	
Category	Encounter	P	SE	P	SE
Wildlife	Elephant	0.75	0.08	0.00	0.00
	Sambar	0.52	0.06	0.66	0.05
	Leopard cat	0.56	0.06	0.60	0.06
	Sun bear	0.43	0.07	0.64	0.05
	Civet sp.	0.56	0.06	0.48	0.07
	Macaque sp.	0.51	0.07	0.39	0.09
	Tiger	0.00	0.00	0.69	0.06
	Porcupine sp.	0.41	0.08	0.24	0.09
	Tapir	0.32	0.10	0.32	0.07
	Muntjac	0.30	0.07	0.19	0.08
	Clouded leopard	0.12	0.10	0.23	0.11
Threats	Settlement	0.49	0.06	0.70	0.05
	Poaching / hunting	0.00	0.00	0.53	0.14
	Illegal logging	0.51	0.06	0.54	0.07
	Pioneers	0.53	0.06	0.42	0.05
	Agriculture	0.31	0.09	0.54	0.09
	Vehicles	0.28	0.07	0.29	0.08

When present, elephant evidence is the easiest wildlife to detect. Traps are also highly visible. The above sign reads 'Beware, tiger trap'

Figure 19 - Probability of detection compared between encounter types and sites



Probability of occurrence

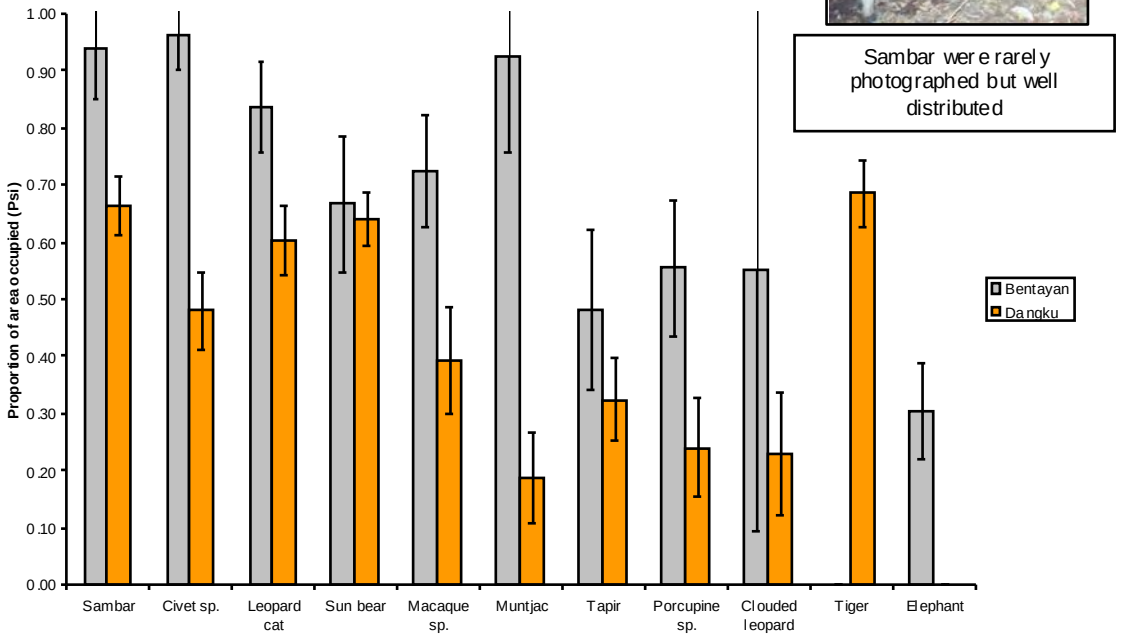
Based upon detection probabilities calculated from transect repeats, the naïve psi (proportion of cells in which a species or threat was actually detected by the four teams) can be adjusted to give an estimated 'true' proportion of area occupied (psi) (Figure 20). This effectively shows the distribution of that species during the study period. The results show that sambar, civets and muntjac were the most widespread species in Bentayan, with area occupancy estimates (psi) of 94%, 96% and 92% respectively. In Dangku, tiger, sambar and sun bear have the highest probabilities of occurrence and occupy 69%, 66% and 64% of the area respectively. Threats were present in most cells in both areas. In most cases, threats covered a greater proportion of Bentayan, with the exception of 'pioneer' threats which were more widespread in Dangku (Figure 21).

Figure 20 - Proportion of cells occupied and estimated proportion of area occupied for key species

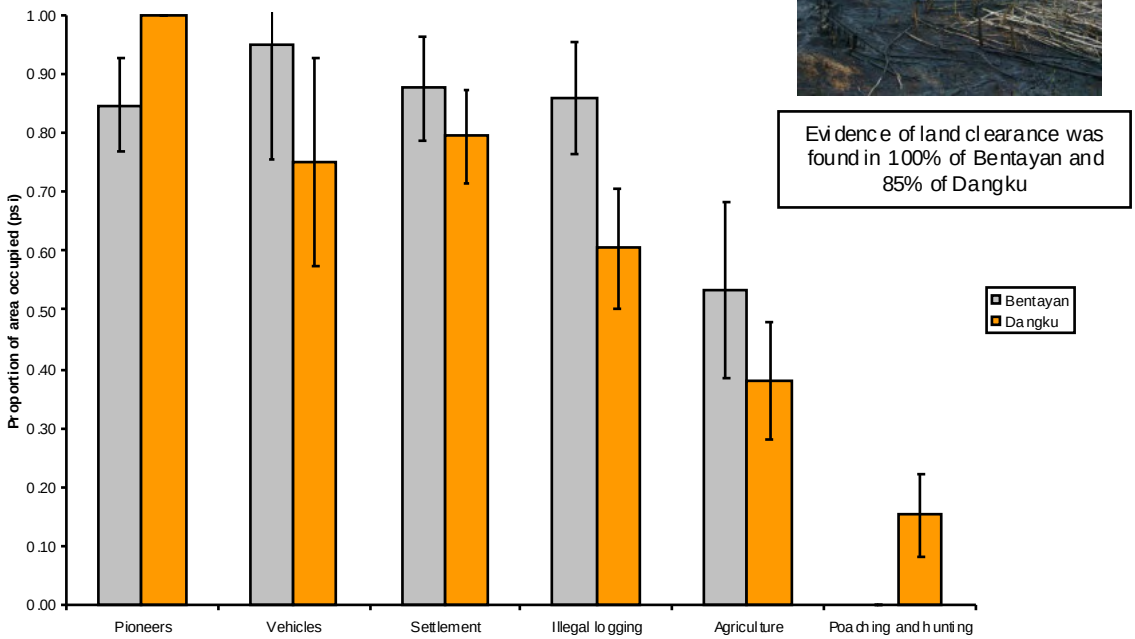
		Bentayan			***Dangku***		
Category	Species	Naïve psi	psi	SE	Naïve psi	psi	SE
Wildlife	Sambar	0.83	0.94	0.09	0.05	0.66	0.05
	Civet sp.	0.90	0.96	0.06	0.10	0.48	0.07
	Leopard cat	0.80	0.84	0.08	0.09	0.60	0.06
	Sun bear	0.57	0.67	0.12	0.00	0.64	0.05
	Macaque sp.	0.67	0.72	0.10	0.12	0.39	0.09
	Muntjac	0.67	0.92	0.17	0.30	0.19	0.08
	Tapir	0.37	0.48	0.14	0.15	0.32	0.07
	Porcupine sp.	0.47	0.55	0.12	0.21	0.24	0.09
	Clouded leopard	0.20	0.55	0.46	0.19	0.23	0.11
	Tiger	0.00	0.00	0.00	0.09	0.69	0.06
	Elephant	0.30	0.30	0.08	0.00	0.00	0.00
Threats	Pioneers	0.80	0.85	0.08	0.89	1.00	0.00
	Vehicles	0.63	0.95	0.20	0.54	0.75	0.18
	Settlement	0.80	0.88	0.09	0.79	0.79	0.08
	Illegal logging	0.77	0.86	0.10	0.57	0.61	0.10
	Agriculture	0.40	0.53	0.15	0.36	0.38	0.10
	Poaching and hunting	0.17	0.00	0.00	0.14	0.15	0.07

Figure 21 – Estimated proportion of area occupied (psi) by key wildlife species (top graph) and threats (bottom graph)

Sambar were rarely photographed but well distributed



Evidence of land clearance was found in 100% of Bentayan and 85% of Dangku



Relative abundance

Relative abundance could be measured to some degree for key wildlife species using transect encounter rates and photo trapping rates, whilst threats could be measured using encounter rates only. Both methods assume rates reflect abundance to some degree and this may be quite an assumption; transect encounter rates may be as dependent on the transect team as the species abundance whilst photo trapping rates will vary by camera set up and trap shyness as well as abundance. Nevertheless, results should show general and broad patterns for abundance.

The results for each method varied. Encounter rates (Figure 22) showed leopard cats and sambar to be the most commonly encountered signs (although pig sign were so common they could not be recorded using this method). Sun bear and tiger were very high in Dangku, although this will naturally reflect the survey focus on searching for tiger sign (Figure 24). The most commonly encountered threats were illegal logging and settlement in both areas, although hunting was common in Dangku and encounters with people very common in Bentayan . Photographic rates on the other hand (Figure 23), showed both species of macaques to be common, although these results will be biased by the fact that both tended to move in groups of many individuals. Sun bear were also photographed fairly frequently, supporting transect suggestions that sun bears are fairly common locally. Sambar, on the other hand, were rarely photographed, perhaps a consequence of setting cameras in areas specifically for tigers (Figure 24) .

Figure 22 – Mean encounter rates for species and threats recorded on transects

Category	*Species*	*Bentayan*	*Dangku*	*Std. Error*	*Std. Error*
Wildlife	Agile gibbon	0.02	0.04	0.01	0.01
	Clouded leopard	0.01	0.04	0.01	0.01
	Common palm civet	0.06	0.06	0.02	0.02
	Domestic cow	0.09	0.00	0.03	0.00
	Domestic dog	0.18	0.03	0.05	0.02
	East Asian porcupine	0.02	0.02	0.01	0.01
	Elephant	0.19	0.00	0.07	0.00
	Jungle fowl	0.01	0.01	0.01	0.01
	Langur sp.	0.00	0.03	0.00	0.01
	Leopard cat	0.39	0.40	0.09	0.08
	Long tailed macaque	0.06	0.07	0.02	0.02
	Malay civet	0.03	0.07	0.02	0.02
	Mouse deer sp.	0.02	0.01	0.01	0.01
	Muntjac	0.14	0.07	0.03	0.02
	Pig-tailed macaque	0.10	0.01	0.02	0.01
	Sambar	0.30	0.43	0.05	0.05
	Sun bear	0.17	0.61	0.04	0.09
	Tapir	0.09	0.13	0.03	0.03
	Tiger	0.00	0.44	0.00	0.09
	Water buffalo	0.08	0.01	0.03	0.01
Threats	Agriculture	0.10	0.167	0.060	0.03
	Hunting	0.01	0.281	0.095	0.01
	Logging	0.32	0.315	0.047	0.07
	People	0.26	0.051	0.025	0.04
	Settlements / clearing	0.28	0.284	0.041	0.05
	Vehicles	0.19	0.148	0.050	0.05

Figure 23 - Photo trapping rates for species photographed in Bentayan and Dangku

	Bentayan (495 trap nights)	*Dangku (573 trap nights)*	*Average*
Banded langur	0.00	0.17	0.09
Common palm civet	0.00	0.17	0.09
Marbled cat	0.00	0.17	0.09
Jungle fowl	0.20	0.00	0.10
Leopard cat	0.20	0.52	0.36
Motorbike	0.20	0.70	0.45
Sambar	0.40	0.52	0.46
Tiger	0.00	1.22	0.61
Malayan tapir	1.41	0.87	1.14
Muntjac	0.61	1.75	1.18
East Asian porcupine	2.42	0.00	1.21
Sun bear	1.01	1.57	1.29
Person(unknown)	2.42	3.14	2.78
Long-tailed macaque	3.23	2.97	3.10
Pigs (wild and bearded)	11.72	6.63	9.17
Pig-tailed macaque	25.66	19.72	22.69

Figure 24 – Mean encounter rates for key wildlife species

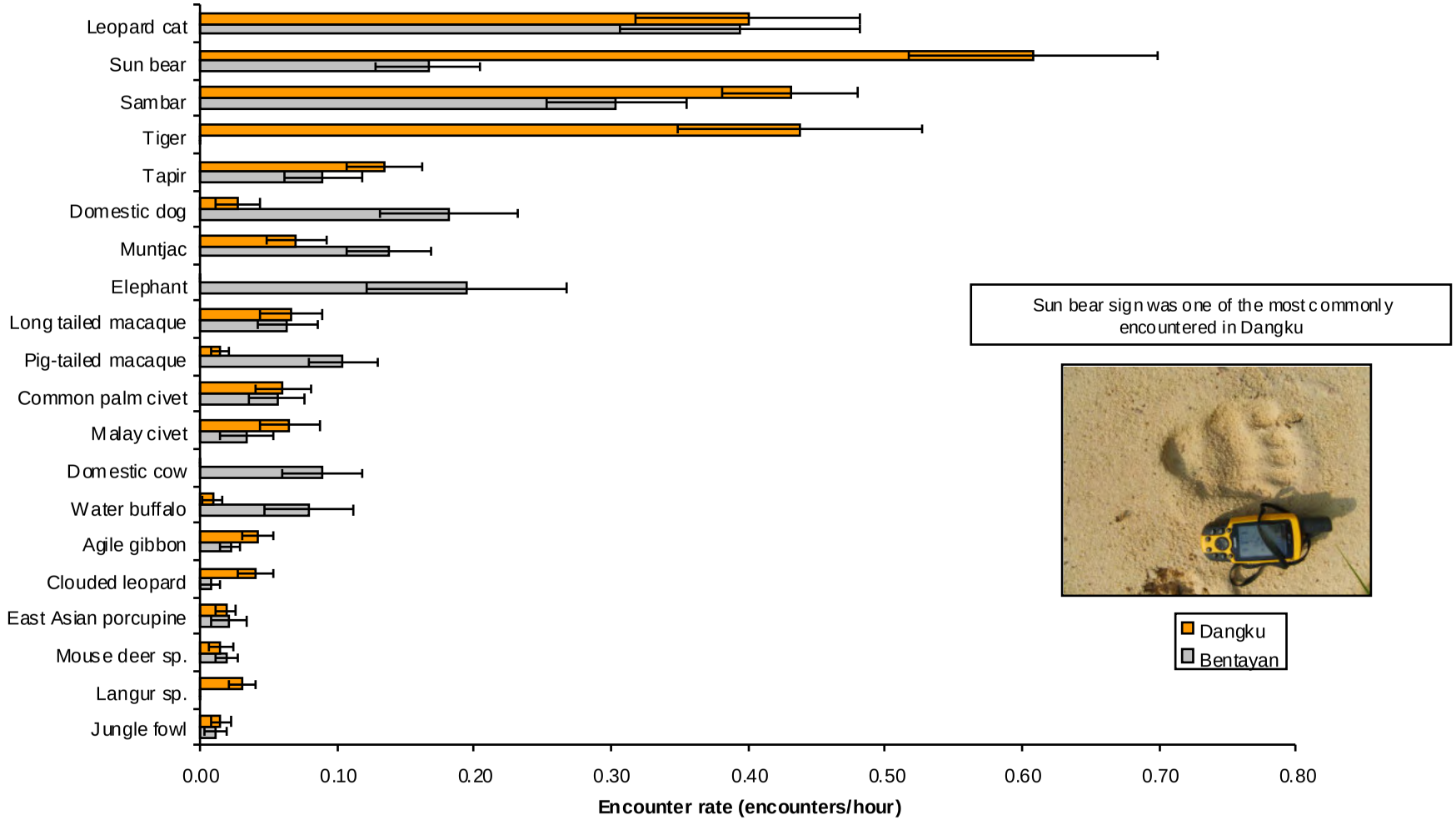


Figure 25 – Mean encounter rates for threats recorded on transects

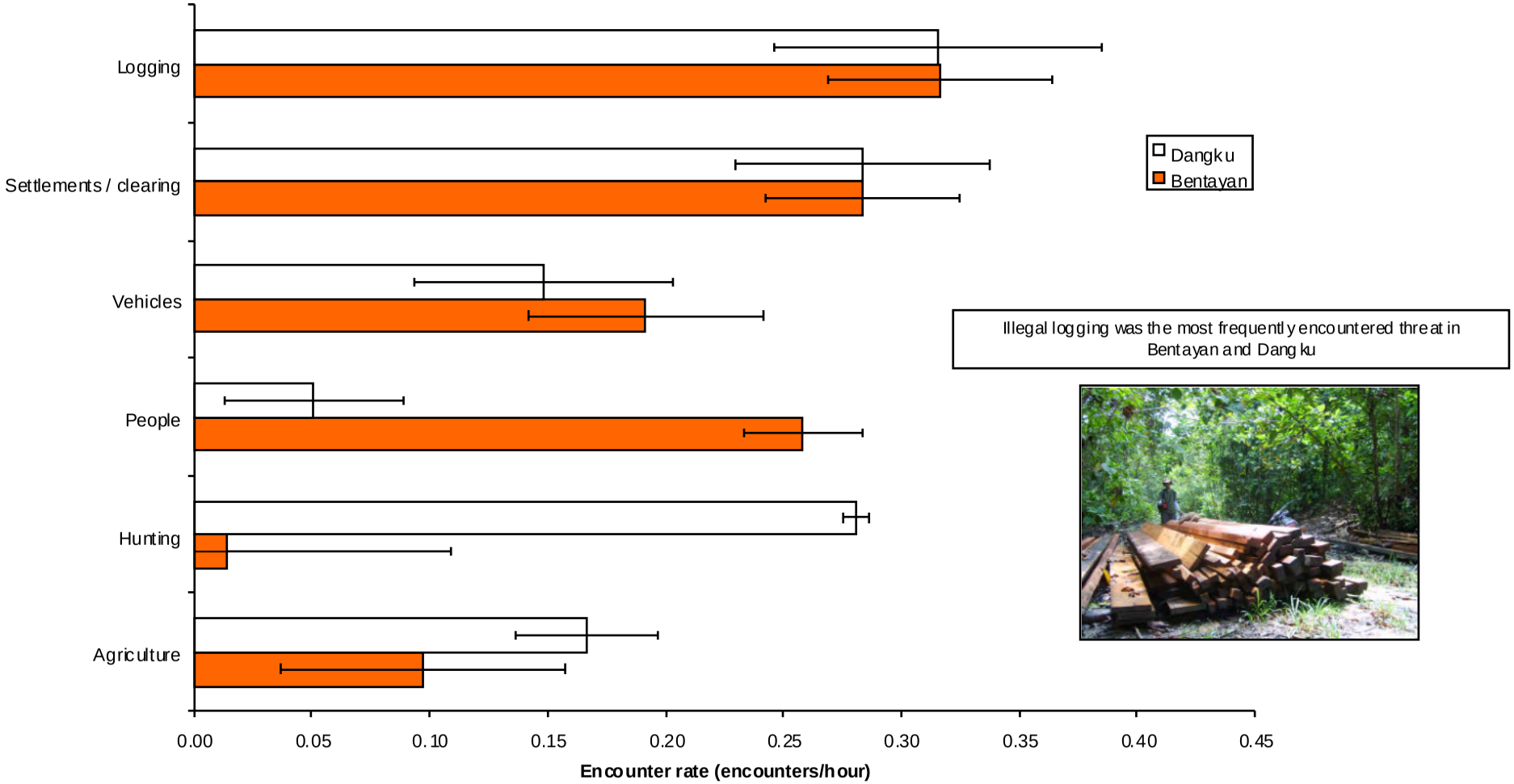
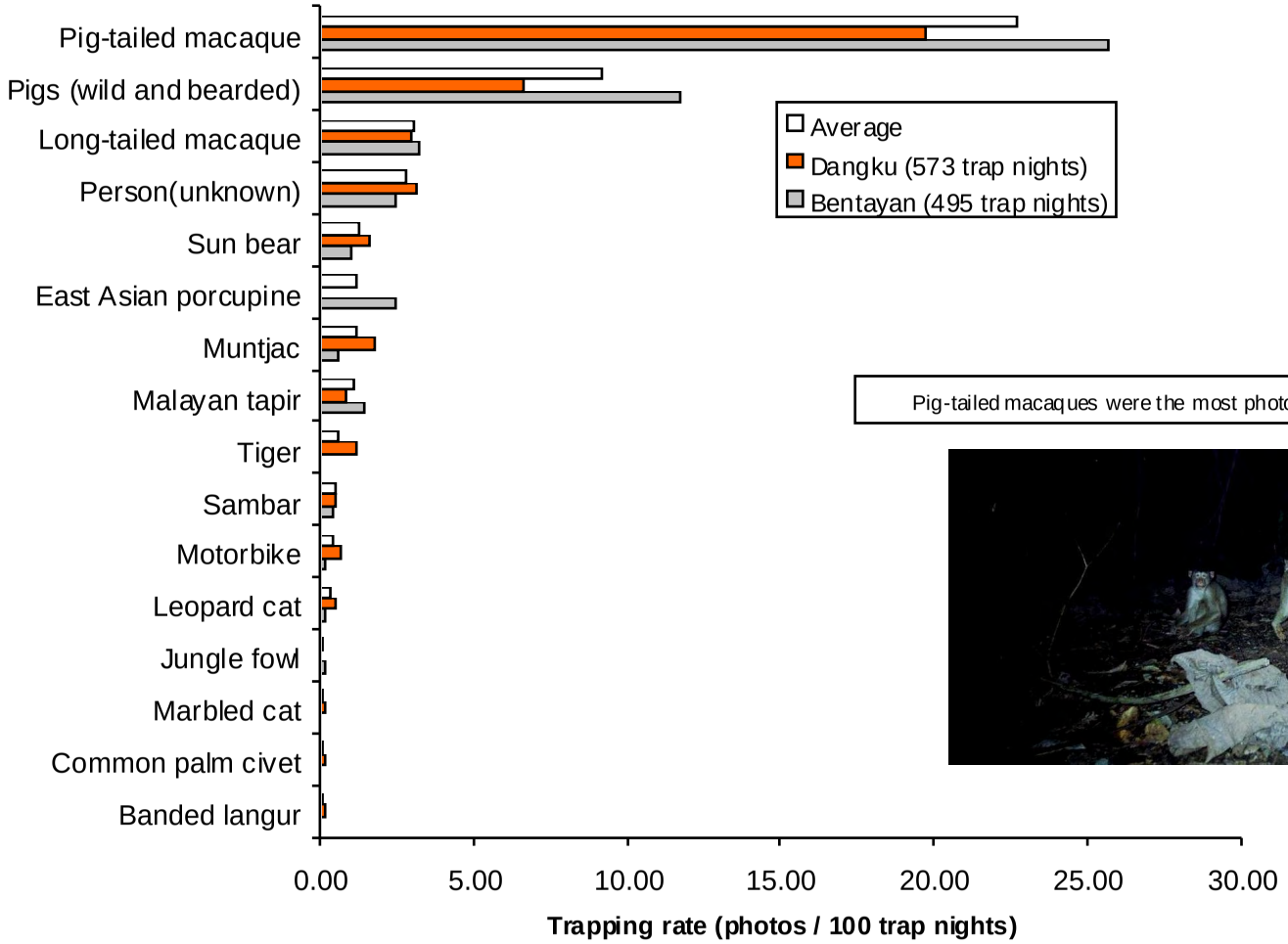


Figure 26 - Relative abundance of species based on overall photo trapping rates



Pig-tailed macaques were the most photographed species in both sites

Distribution

Habitat variability

Analysis of wildlife habitat preference is difficult with such a short survey, and without up to date satellite imagery to map overall habitat coverage. However, the number of species detected was compared between different habitat classes in each site (Figure 27). The results show that the forested areas in both site held the majority of species detected. The cleared 'scrub' habitats in Dangku had a third of the species present in the forest whilst the Bentayan grasslands had barely a quarter of the total species present. Bentayan scrub habitat, on the other hand, was comparatively species-rich.

Figure 27 - Species richness in different habitat classes

Habitat	*Species count*	*Species richness*	*SE*
Bentayan forest	23	28	3.6
Bentayan grass	6	7	1.6
Bentayan scrub	27	28	2.4
Dangku forest	29	32	3.1
Dangku scrub	9	10	2.3

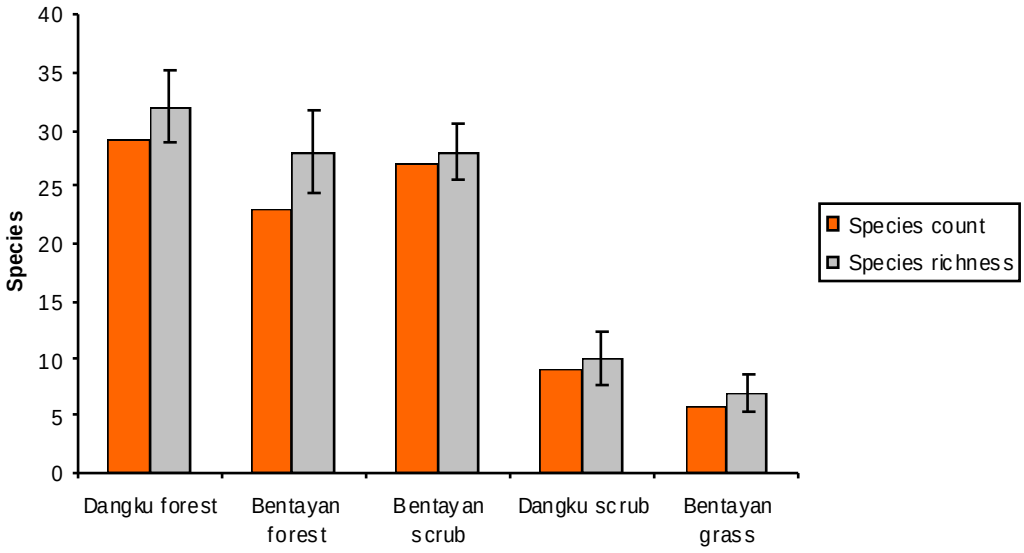


Figure 28 - Bentayan grasslands are very low in species richness

Spatial distribution

Spatial distribution of key species and threats was mapped using encounter rates (independent encounters / hour) calculated for each cell. The results were then interpolated using standard kriging methods to produce contour maps of distribution (Figure 29 to Figure 33). Whilst encounter rates can only be an approximation for abundance, the maps do show key areas within each reserve that should be prioritised in any conservation effort. For species maps, a relative measure of threat level was also overlaid. This was calculated by plotting the average of encounter rates for all threat activities (logging, settlement, hunting etc.) for each cell and plotting using proportional symbology.

For elephants in Bentayan, encounters were restricted to a small area in the north of the reserve. Relating distribution to threat levels in Bentayan is difficult since threats were fairly uniformly high across the reserve, however it should be noted that the areas elephants were detected was one of few areas with relatively lower threats. In addition to this, elephants were known to have caused damage in villages to the north west and also to the south of the park outside the survey period. With the north west of the reserve bordered by commercial oil palm, the expectation is that the elephants are ranging out of the reserve to the north east where, historically, there was forest extending to the coast (Figure 29).

For tigers in Dangku, the areas with the highest encounter rates were all centred in the area that appears as forest on the latest satellite imagery. The area to the south where threat levels were high (primarily due to land clearing and oil palm) was completely devoid of tigers. The distribution closely matched the threat levels, with higher threats closing in from all directions and compressing the remaining tigers into a small area. Conflict with humans in such circumstances would not be surprising.

For bears and tapirs, encounter rates showed similar patterns to tigers and elephants, with the north / north eastern section of Bentayan with lower threat levels showing the highest levels of activity for both, and the central, forested part of Dangku also showing more signs than the fringes. The only exception was sun bear distribution in Dangku which was more uniform across the reserve, leading to an unclear interpolation. This could indicate sun bears are more resilient to disturbance than tigers and tapirs (Figure 31, Figure 32).

Threats were widespread in Bentayan, leading to a fairly uniform interpolation. However, in Dangku, the main concentrations of threat sign were to the east and south of the main forest block (Figure 33).

Figure 29 - Distribution of elephant sign in Bentayan mapped with relative average threat values

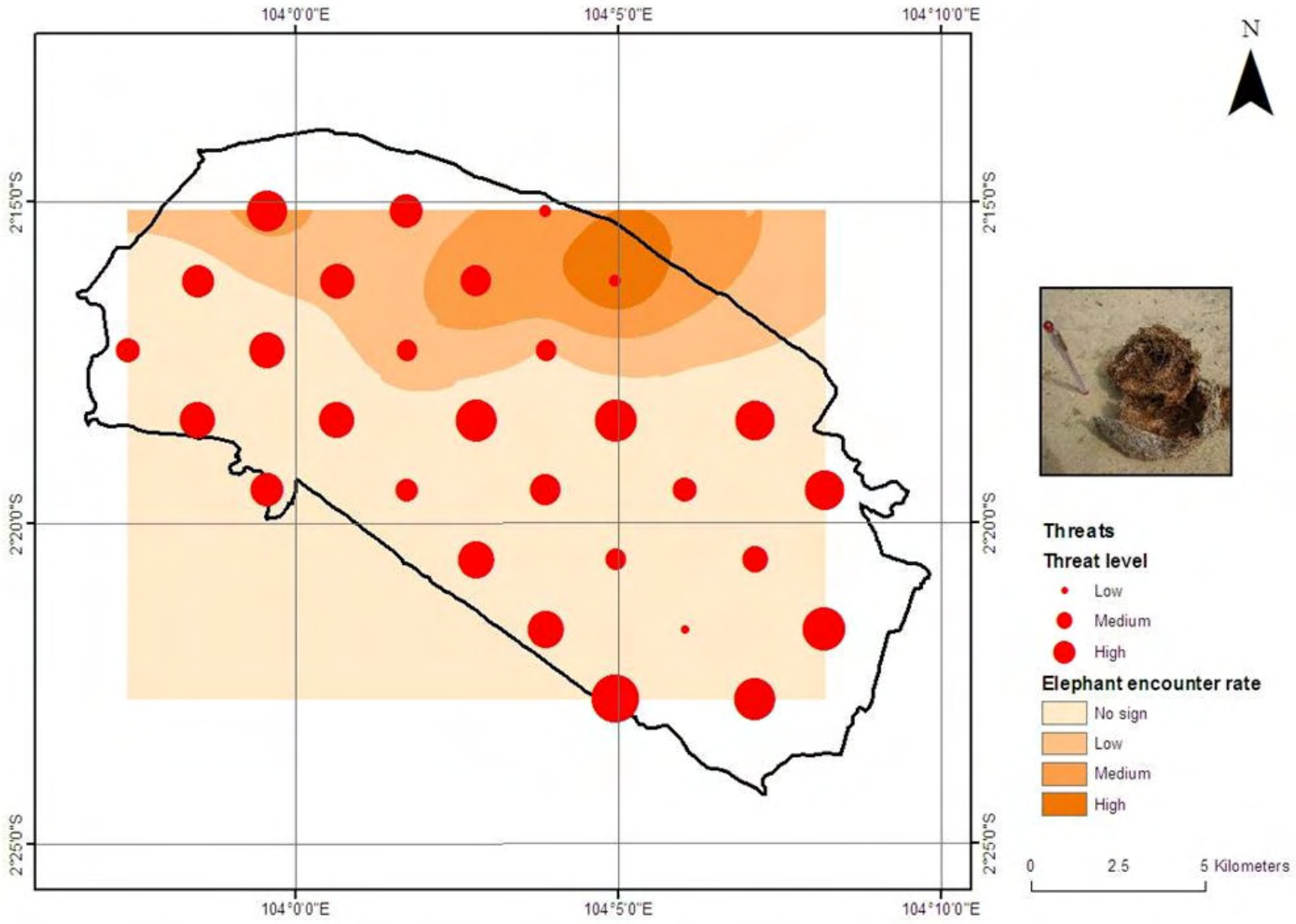


Figure 30 - Distribution of tiger sign in Dangku mapped with relative average threat values

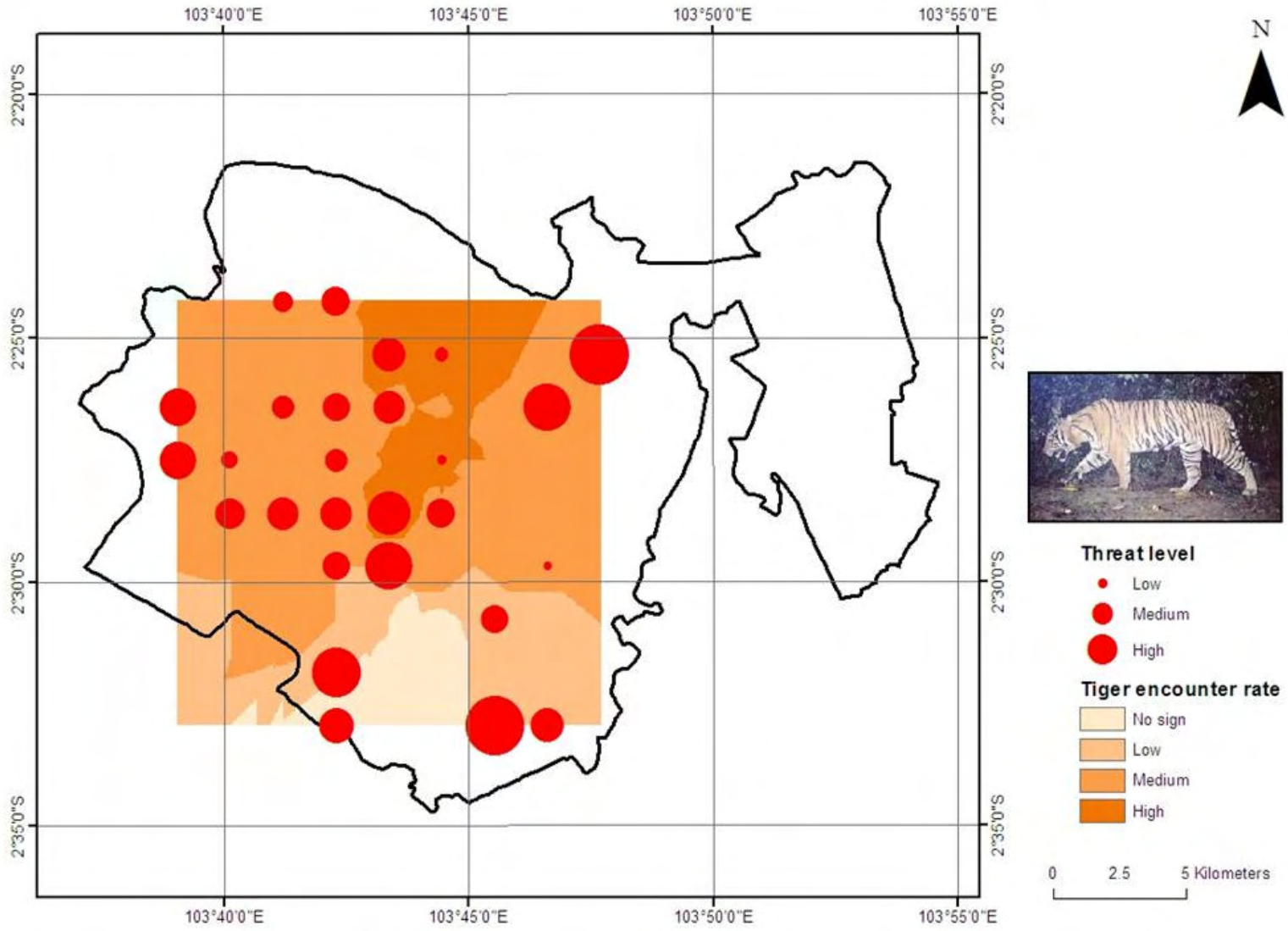


Figure 31 - Distribution of sun bear sign in Bentayan and Dangku mapped with relative average threat values

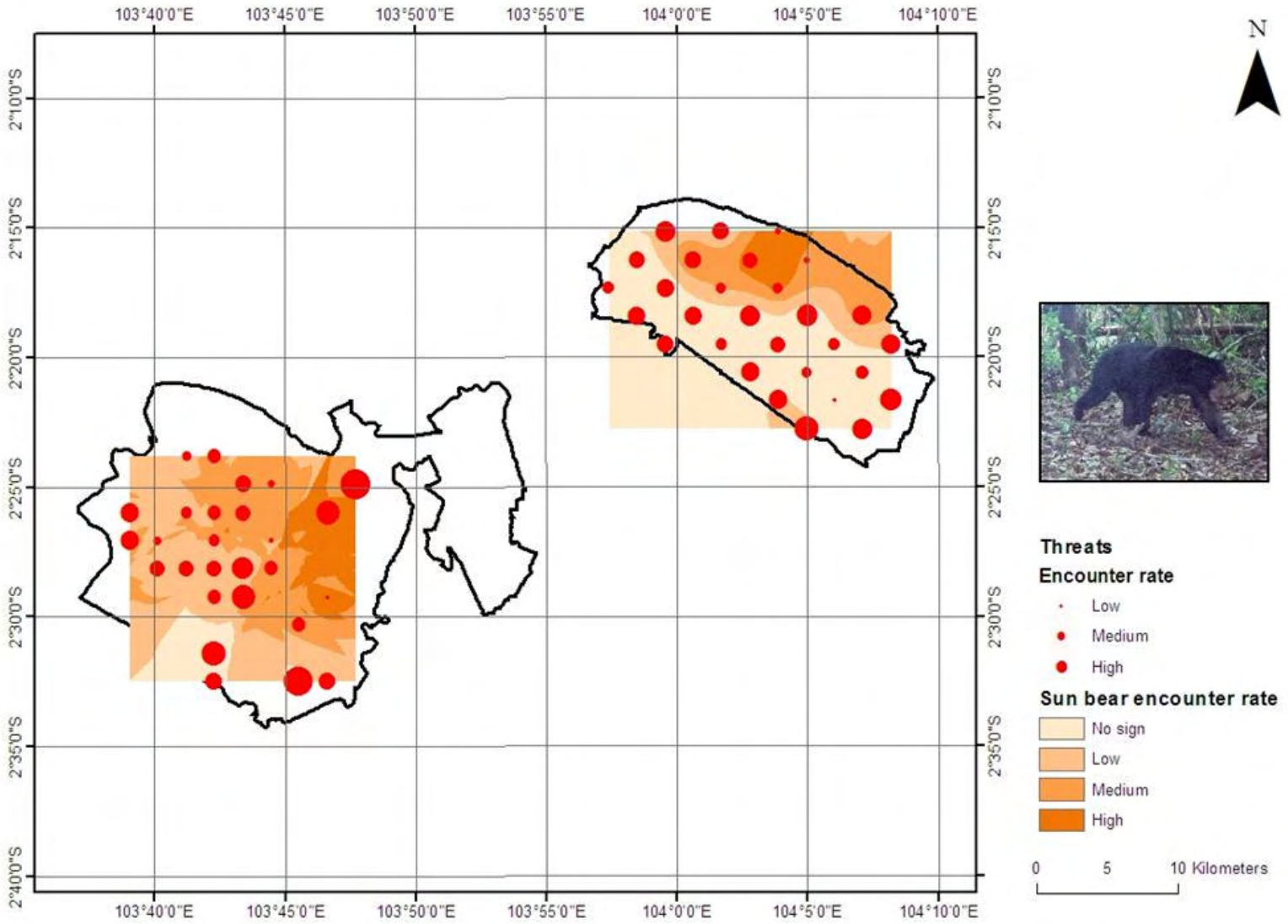


Figure 32 - Distribution of tapir sign in Bentayan and Dangku mapped with relative average threat values

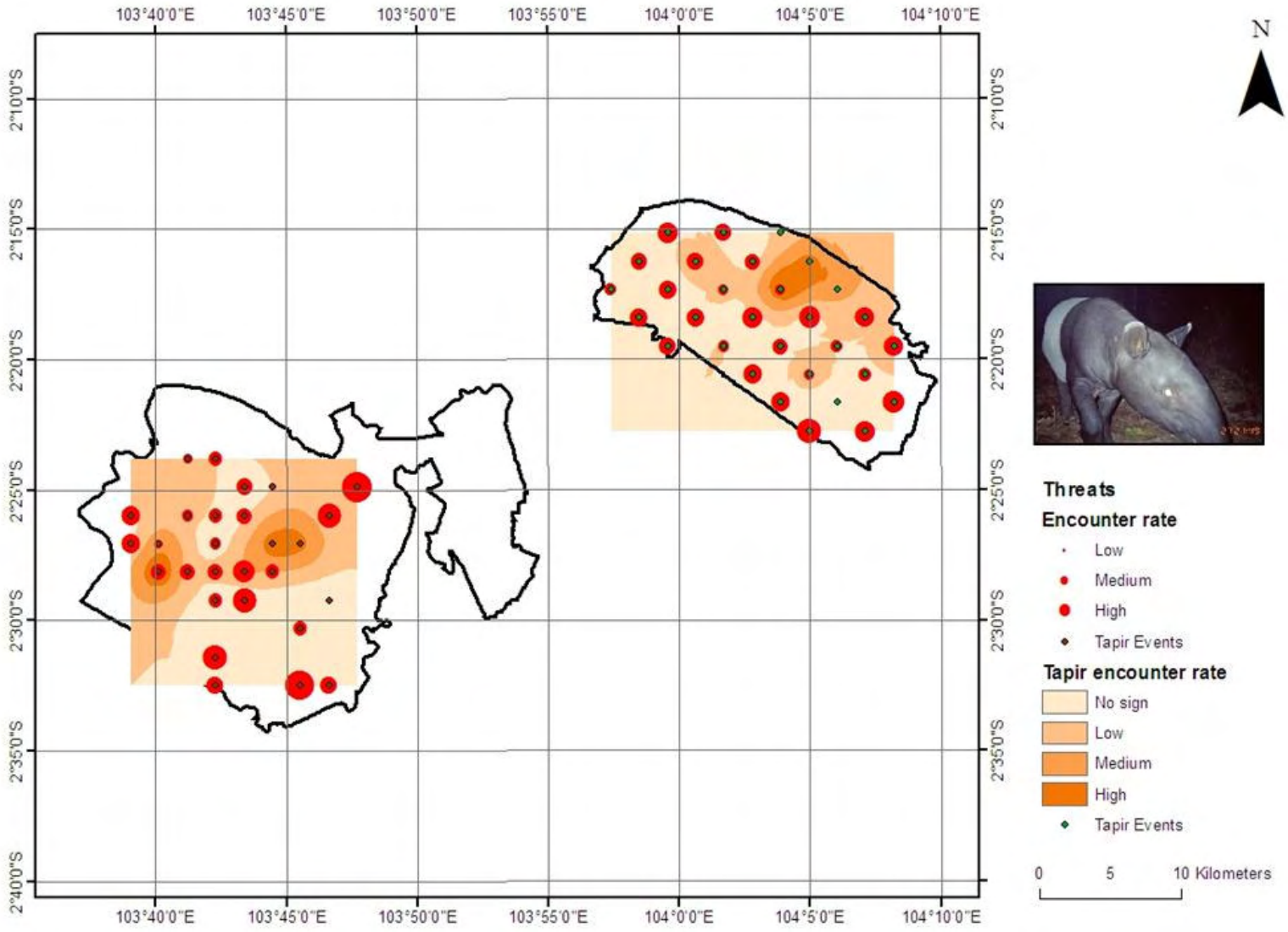
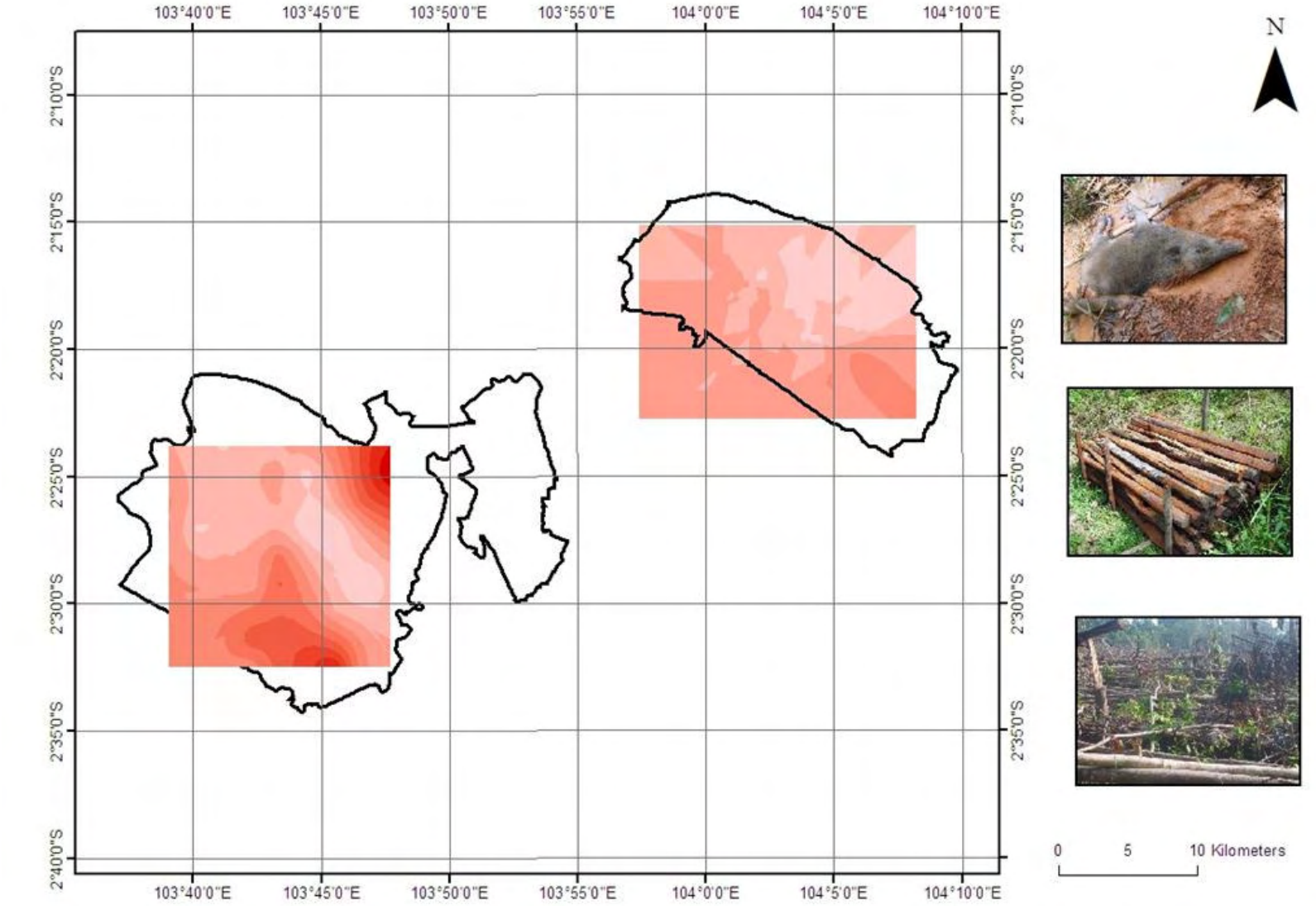


Figure 33 - Distribution of threat signs in Bentayan and Dangku



The Tiger Population

Tiger abundance

To properly research a tiger population, an intensive camera trapping study needs to be carried out over 2-3 months with paired cameras and a sufficient area to obtain sufficient trapping rates for capture mark recapture analysis. Since this option was not available for a restricted rapid survey, a robust estimate of the tiger population is not possible.

However, using the photographs obtained, several conclusions can be made. Firstly, tigers can be individually identified by their stripe patterns. This allows photographs of the same side to be matched (see tiger summary below) and thus the absolute minimum of tigers recorded to be calculated. Based upon the seven photos obtained during the Dangku survey, we can therefore confidently state that at least three different tigers were identified (one male, two females) based upon left sided photos. The right sided photo of a male was taken very close to the left sided photo, therefore it is likely this is the same individual (males are territorial and two are not generally found in the same area). The final front-sided photo could not be matched to the other photos, although it looks like a young animal, probably female. We can therefore say that three, possibly four tigers are definitely present in Dangku. For an area the size of Dangku there are unlikely to be many more that we did not photograph within the reserve, however it is strongly suspected that the population is contiguous with tigers living outside the park to the west and north west.

The trapping rate for tigers in Dangku (1.2 photos / 100 trap nights) is fairly high – approximately double the rate recorded in a survey in the same year of the Birdlife Harapan restoration area, although whether trapping rates are indicative of densities is a discussion fraught with controversy.

Based on this very limited information we would guess that a proper study of the tiger population would reveal a density in the region of 2-3 tigers / 100km2.

Threats

Tigers generally suffer from three primary threats: direct persecution, prey availability and habitat availability. In Dangku direct threats to tigers were very high, including the discovery of a clearly marked deadfall tiger trap. Even snares not designed for tigers can still be lethal, since they can become entangled and the snare continues to tighten even if broken away from its anchor. Indirect threats through limited prey abundance were of a lesser concern; sambar, a key prey item, appeared fairly well distributed across the area and pigs were very abundant. Habitat clearance was the greatest longer term threat. As the distribution maps clearly show, the area of habitat still used by tigers and other species in Dangku is restricted to a portion of forest in the middle, with high threat encroachment on all sides. Tigers are fairly adaptable species and do not need pristine forest to survive, but they cannot live in completely cleared areas or oil palm.

Human conflict

Shortly after the survey was completed, two reports of tigers killing people were reported around Dangku. This was not a surprising outcome. The tiger habitat is extremely restricted and human activity within the reserve is very high. Decreasing habitat availability will be forcing humans and tigers closer together and dispersing tigers, particularly young males, have very few options of where they can go.

Figure 34 - People and a tiger, photographed by the same camera on the same day at the same location within Dangku

Male 1 – 8/9/06
23:54

Male 1? /
New male?
16/9/06
21:13

Female 2 –
24/9/06 19:42

Female 1 – 25/9/06
06:52

Female 2 – 24/9/06 05:18

Female
1/2? New?
21/9/06
13:46

Male 1 –
16/9/06
05:54

Questionnaire survey

Background

Since wealth is a difficult question to ask directly, respondents were asked about possessions and livestock to get a general view of the local economy. The results show that in general, respondents in and around Bentayan and Dangku are very poor, with almost no one owning a car and only a third able to afford a motorbike. Most people do own livestock but it is overwhelmingly small stock, with only 6% owning cows or buffalo (Figure 35).

Most people interviewed were newcomers to the area, with nearly 70% arriving in the last five years. Many stated they had moved to the area following the fires in the late 1990s which cleared lots of land.

In an effort to understand why people were living inside protected areas, but without directly challenging people, respondents were asked to describe the status of the land they lived on. Surprisingly nearly half stated it was a protected area. Another quarter claimed it belonged to family, the village or the government and the final quarter stated they did not know. Pushing respondents further, they explained that although they knew it was a protected area in name, the fires in the late 1990s had destroyed its value as a reserve and so therefore they were only occupying unproductive land.

Figure 35 - Approximate measures of wealth across respondents from Dangku and Bentayan (top) and time spent living in the area (bottom)

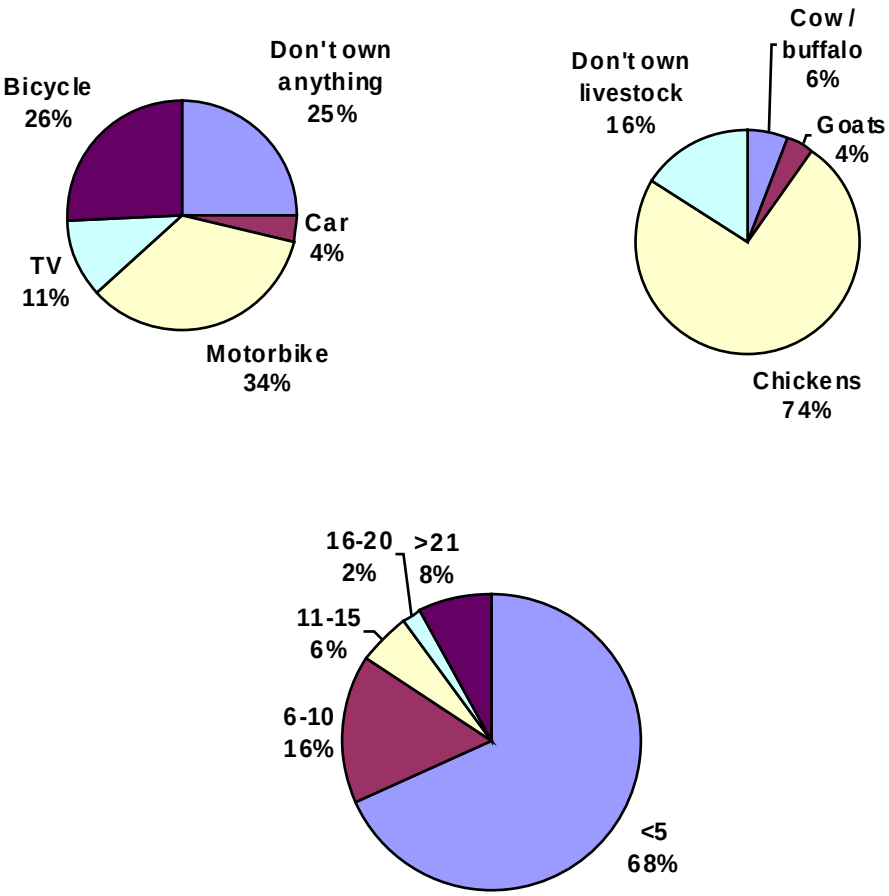
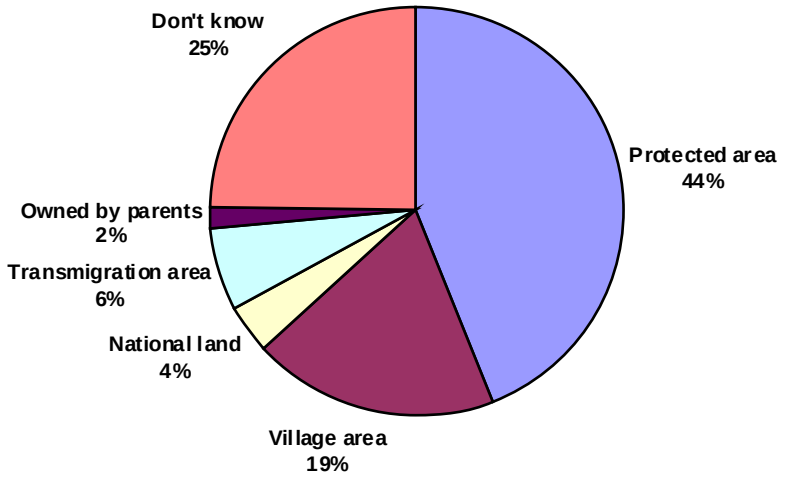


Figure 36 - Respondents inside the reserves describing the status of the land they lived on



Attitudes towards wildlife

Direct contact with wildlife does not appear to be very common. When asked if they had ever seen any sign of the key wildlife in the area, most responded they had not for all species except wild pig, of which 99% had seen them, and porcupines, of which 60%, had encountered them. Almost all other species were recorded to have been encountered in some form by 20-30% of respondents.

Attitudes towards wildlife were assessed with flash cards of different species and asking respondents to describe what each species was like. Responses were then classified into eight general categories (Figure 37). The results show that tigers and bears are the most feared species. Interestingly, elephants are not feared but classed as both a pest or no problem in almost equal amounts, perhaps reflecting the fact that elephant conflict is either localised, or only affects certain types of people (e.g. those with crops). Aesthetic attitudes towards wildlife were rare, with only the elephant or tiger ever described as charismatic. Knowledge of protection status was also low, with only elephants ever described as protected or endangered. Tigers were never described in this way. However, when specifically asked if different species were protected, most recognised the protected species (Figure 38). Pigs were overwhelmingly regarded as pests and only sambar, muntjac and porcupine were considered as huntable species. Tapir and clouded leopard were simply unknown to many respondents. This is surprising for tapir, which is fairly widespread in the area and also fairly detectable when present (from its large and distinctive footprints).

Figure 37 – Attitudes towards wildlife

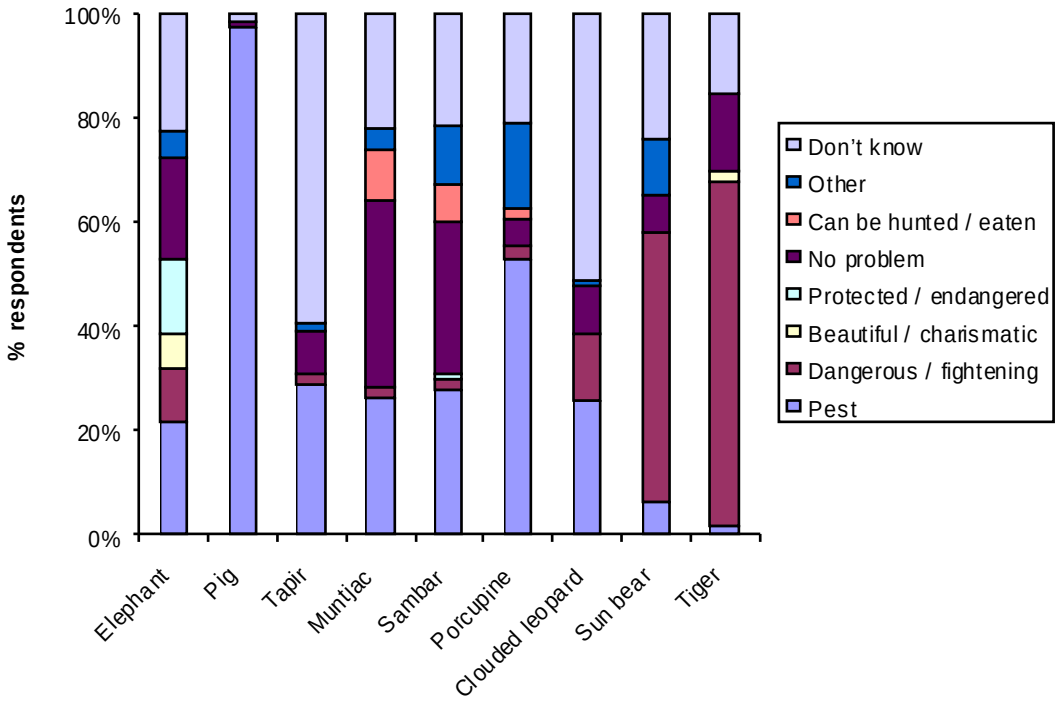
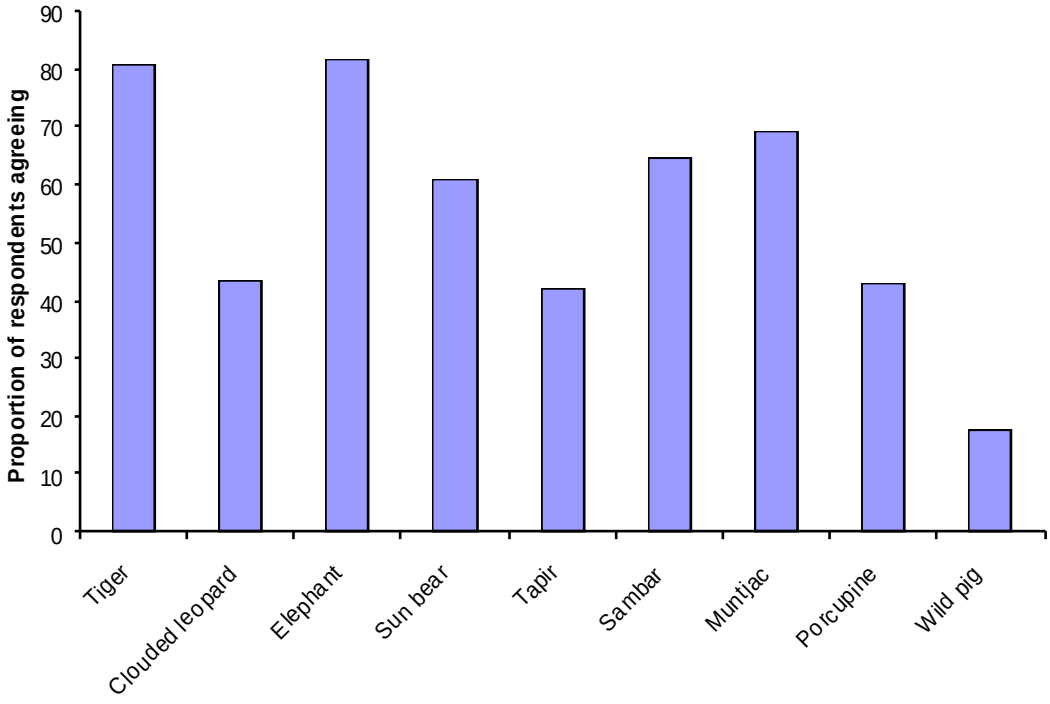


Figure 38 – Proportion of respondents believing different species are protected

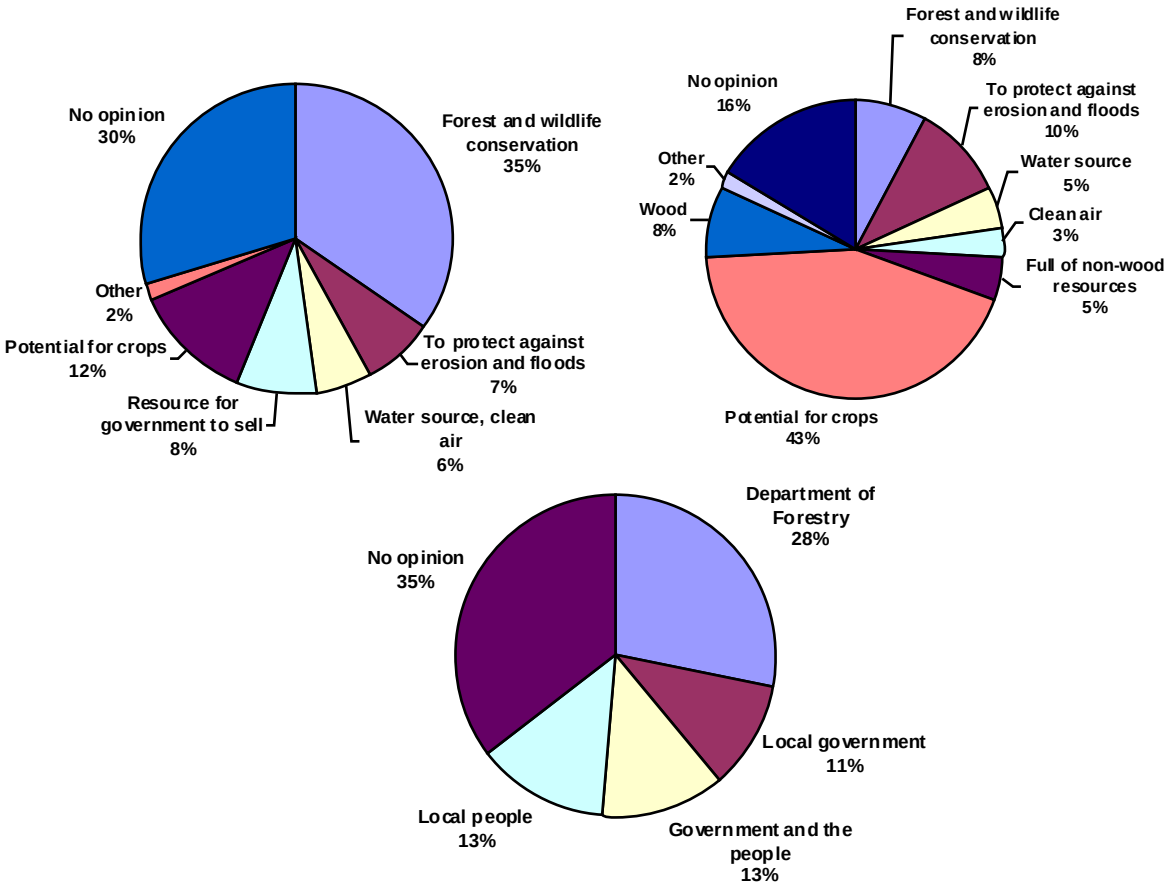


Attitudes towards conservation and the environment

People's personal opinions on how the forest should be used varied quite substantially from what they thought to be its official function. When asked to describe the advantages and disadvantages of forest, most people stated its main role should be for planting with crops. Less than 10% thought it should have a role in conservation (Figure 39). However, when asked what the function of the forest was, nearly half thought it had a role in protecting the environment, although a third of people did not know.

Finally, respondents were asked who should have the responsibility for caring for the forest. One quarter saw their own community has having a role, but three quarters thought it was purely the responsibility of the government, or did not have an answer.

Figure 39 - Varying opinions when asked on the advantages and disadvantages of forests (top left) the function of forests (top right) and on who has responsibility to run forests (bottom)



Recommendations

A framework for conservation

The importance of a general framework

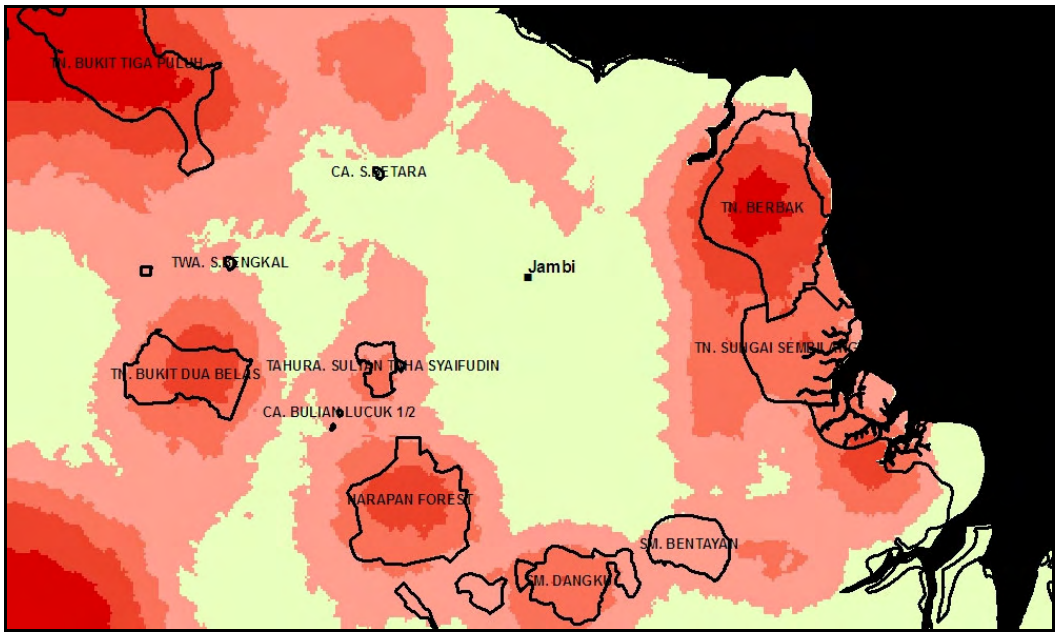
The conservation issues in Bentayan and Dangku are complex with no single, simple solution. Whilst there are several key actions that should be taken immediately (see 'Priority actions', p50), it is important that a general framework for tackling conservation programmes is developed first, with the priority steps contributing to the overall goals. A general approach to conservation around Bentayan and Dangku should take two factors into consideration:

1. Conservation has to be approached at a landscape level. It is not enough to consider only the conservation areas in isolation.
2. The whole range of activities relevant to conservation must be considered. A traditional, protection-based approach has its value, but results are only sustainable if part of a wider programme.

The importance of a landscape perspective

The species of key conservation importance (tigers, elephants) are wide ranging species requiring large areas. Bentayan and Dangku are very small protected areas. Even under ideal conditions, neither could be expected to support a viable population of tigers or elephants within their boundaries. However, Bentayan and Dangku are likely to have important roles as species refuges within a larger landscape, with wildlife populations concentrated in core protected areas such as Bentayan and Dangku but 'over spilling' into surrounding areas. This concept is illustrated in Figure 40, with conservation areas acting as stepping stones across the landscape, allowing core populations in protected areas to remain connected and thus retaining high survival chances. The tigers in Dangku and the elephants in Bentayan are very likely to be fragments of larger populations. The tigers, for example, are likely to be a contiguous population with tigers previously studied by ZSL in the Harapan Restoration Forest. The elephants, on the other hand, are likely to range to the north and east of the reserve. Any action taken inside Bentayan or Dangku will be therefore be of limited value unless supported by action outside the reserves as well.

Figure 40 – Predicted wildlife concentrations across eastern Sumatra. Bentayan and Dangku are likely to be essential stepping stones for landscape conservation



The importance of a holistic approach

The survey shows various immediate threats to wildlife in the reserves and it is tempting to think the best approach to conservation is simply to preserve what is left. However, confusing conservation and preservation is a common mistake. ***Preservation*** is the process of protecting remaining species or resources. ***Conservation*** is a long term, sustainable approach to ensuring species and resources remain for the future.

Preservation is an important component of conservation, but a robust conservation framework needs a more holistic approach than just concentrating on preserving what is left. A good conservation strategy should therefore cover the following three arenas:

- **Information**: Identifying the ecological and sociological issues at the root of the problems and thus priorities, as well as monitoring change and evaluating success
- **Stakeholder influence**: Working with anyone who has an interest or influence on the area (local communities, local business, government) in order to reduce impacts and support change.
- **Protection**: Protecting the remaining habitat and wildlife and breaking the chain of encroachment:

Information-based action

Extend wildlife / threat surveys beyond the conservation areas

- Surveys have been carried out within the conservation areas but nothing is known of conservation status outside the reserves.
- It is almost definite that the larger species – tigers and elephants in particular – also live outside the conservation areas.
- Identifying the species occurring outside the reserves, and the habitats they occupy is vital for designing a landscape level conservation plan.

Extend wildlife surveys to other taxa

- Medium to large mammals and key threats occupying the conservation areas have been identified in this report.
- It would also be valuable to carry out surveys of other taxa, including plants, birds, reptiles, amphibians, small and arboreal mammals and insects.

Identify how much wildlife remains / Quantify threats

- The surveys carried out thus far identified presence / absence of key species and threats, with some measures of relative abundance
- Identifying densities of key species would be more difficult, and take more time, but for selected species would be very valuable
- Tigers and elephants, for example, will be living in small numbers. Identifying all individuals would allow detailed monitoring of population changes, and also be a valuable tool against hunting.

Identify the key environmental factors allowing survival or associated with threats

- Whilst wildlife surveys identify where species exist they don't necessarily identify why. Often wildlife distribution is not clear to explain and does not necessarily follow the most pristine habitats.
- Modelling wildlife values against a range of potential explanatory variables will allow key landscape features to be identified and protected. It will also allow wildlife presence in un-surveyed areas to be predicted.

Identify how habitats can be managed to encourage conservation

- Changing habitats to facilitate conservation is a poorly understood field. In many cases just leaving areas to rehabilitate naturally is the best and cheapest option.
- However, outside conservation areas more effort is required to manage habitats for conservation.
- Information is therefore required on how to make corridors to retain connectivity across the landscape – how wide should they be, which species benefit, how they should be managed?

Identify wildlife behavioural traits facilitating survival

- As well as environmental factors, wildlife behaviour may also be important to explain distribution across the landscape. For example, detailed knowledge on tiger behaviour may show positive or negative associations with human activity, unusual feeding patterns or other factors that will be too small to be picked up by general surveys.
- Wildlife behaviour, especially for cryptic species such as tigers and elephants, generally needs complicated and expensive equipment such as radio collars, although some research can be done with camera traps and other methods.

Monitor changes in wildlife / threat patterns over time

- Monitoring both wildlife and threats is essential both to shift priorities as conditions change but also to monitor the effects of any actions taken
- Proving successful intervention justifies the effort and enables further fundraising. Identifying failures allow plans to be adjusted until success is achieved
- Monitoring can be carried out continuously at a low level e.g. patrols can record wildlife signs and monitor relative abundance, or camera traps can be installed at low density and photo trapping rates monitored.
- Monitoring can also be carried out less frequently but more intensively, for example it would be recommended to repeat the survey described in this report every year using the same methods to get a series of detailed snapshots.

Figure 41 - Surveys need to be repeated annually by the BKSDA, using methods as similar as possible to this report to ensure comparability

Stakeholder-based action

Identify local stakeholders

- Identifying who the key stakeholders are (local communities, companies controlling commercial concessions, government planning and protection bodies) is a vital first step.
- Theoretically stakeholders will primarily be those influencing land outside the reserves, however, local communities will probably be an important stakeholder within the reserves too if they enter for resources or are affected by wildlife coming out.
- The primary source of information will be governmental maps of concession holders, village locations and statistics and regional plans.

Target governmental stakeholders

- Governmental stakeholders are a crucial group to obtain support from.
- Regional government is particularly important, and needs to be shown the results of the surveys and persuaded that Bentayan and Dangku are important areas with a future, and that their future depends on appropriate action in the surrounding landscape.
- The police are another important body for supporting protection activities and law enforcement.

Target commercial stakeholders

- Depending on the land use type, company policy and management decisions, commercial concession holders can have a highly negative, neutral, or positive impact on local conservation.
- A priority step is to identify companies that are having a negative impact, particularly those that are doing so by breaching the law, such as companies that encroach into the conservation areas, or use outlawed methods such as burning for land clearance.
- After this, concentration can be turned to turning poor or neutral companies into companies that can have a positive effect on conservation.
- This is feasible because:
    - Commercial groups often hold concessions covering large amounts of land controlled by relatively few people, therefore relatively few decisions are required to make large changes.
    - Not all businesses necessarily have a large negative impact on the environment. Forestry and extraction industries can have a relatively small 'environmental footprint' if managed

well. Even those with a large footprint, such as oil palm, have options available for reducing this.
    - Most large companies already have an ethical code of practice in place, and growing public awareness of environmental issues means that companies are increasingly considering environmental impacts in their business plans.
    - Businesses have a strong potential for making a difference. Often budgets are higher than those available to the authorities with the responsibility for conservation and businesses can also use experience on efficient project planning and implementation to ensure resources are used well.
- With a growing will to take action, the primary stumbling block is often lack of information about what needs to be done.

Figure 42 - Different industries can play different roles in maintaining conservation at a landscape level

Target local communities

- Compared to industry, local communities can be a harder group to work with since they are more amorphous and insensitive to political pressure, therefore rapid change is very difficult.
- Nevertheless, local communities are generally responsible for many of the threats that occur within conservation areas, and also are the stakeholders most likely to suffer negative consequences from wildlife conservation through conflict with wildlife or other environmental problems.
- Influencing the impact of local communities on conservation is therefore best carried out by boosting education and awareness of environmental issues and how damage can affect them, together with an enforcement of the laws.
- In Dangku, immediate stakeholder action is required amongst the local communities suffering two tiger-related deaths shortly following the survey. Human-wildlife conflict on this scale needs immediate attention if more lives are not to be lost and more tigers killed in retribution or self defence.
- Elephants represent an equally charismatic and dangerous focal point for community-based action around Bentayan.
- Such a programmes could be based upon:
    - Advising people on wildlife conflict issues – how to deal with tigers / elephants
    - Informing people on the area and species status and the laws and penalties governing them
    - Encouraging conservation enthusiasm
    - Recruiting people to work in the conservation programme

Figure 43 - Tigers (in Dangku) and elephants (in Bentayan) are ideal flagship species around which conservation awareness and action campaigns can be focussed

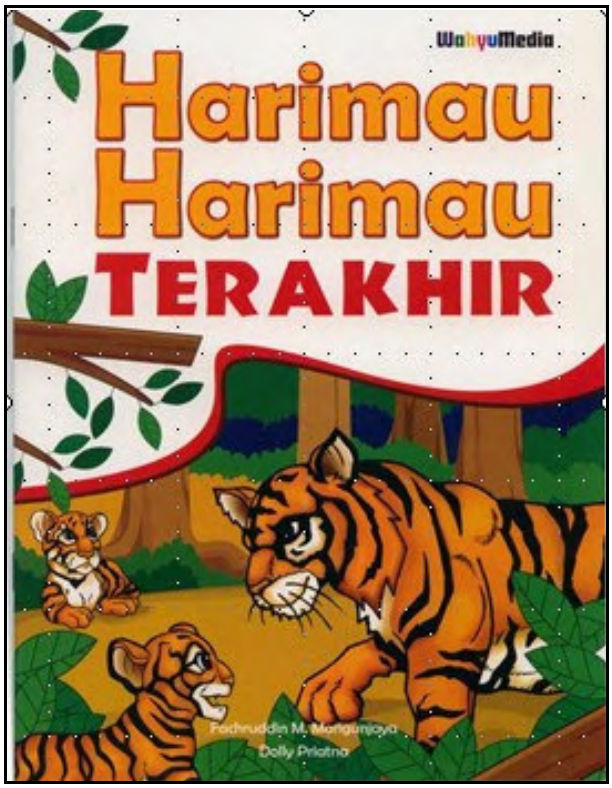


Figure 44 - Woman with store house destroyed by elephants in Bentayan. Help and advice on wildlife conflict is essential

Protection-based action

- Protection-based action is generally based upon identifying and stopping the chain of threats that lead to permanent settlement:
    - Pioneer threats: (illegal logging, poaching, opening roads)
    - Temporary settlement (land claims, land bought/sold, clearing and burning for individual ladangs)
    - Permanent settlement (communities established, agriculture on a commercial scale)
- Protection inside the conservation areas should be a priority and also easier, with clear legal support. Protection outside protected areas is far harder since the laws are weaker and the areas larger. However, protected, endangered species are still protected by law wherever they live.
- Protection in the conservation areas should be based upon:
    - Restricting access to the conservation areas
    - Removing and prosecuting pioneer threats
    - Reversing temporary settlements by dismantling and replanting
    - Starting legal action to remove permanently settled communities and/or moving park boundaries to compensate for the losses.
- Protection outside the conservation areas should be based upon:
    - Stopping and prosecuting hunting of protected species
    - Stopping and prosecuting other illegal activities
- It is ***vital*** that protection is strong from the field to the court. If the effort is made to stop illegal activities, equivalent effort is required after conviction to prosecute and punish guilty parties. If not, protection in the field will be ineffective.
- In all cases, protection should be carried out in coordination with community work, explaining the laws and assisting with conflicts at the same time as enforcing the rules.

Figure 45 - Stopping pioneer illegal activities such as illegal logging (left) and snares (right) is a priority in Dangku. Regular patrols are essential (bottom)

Required capacity for implementation

Planning a framework for conservation and identifying priority steps is pointless if the agency responsible for implementation does not have the required capacity for implementation. At present, the BKSDA South Sumatra is the organisation responsible for conservation inside and outside the reserves of Bentayan and Dangku, as well as across every other non-national park site in the province. Staff quality at BKSDA is good, as evidenced by staff conducting surveys, but the BKSDA does not have the full resources required to implement the recommendations in this report. The key areas where BKSDA requires additional capacity building are:

Field capacity

- At present, funding is not available for efficient protection of either reserve.
- Infrastructure is urgently required at both sites, improving the central base station and installing manned portals at every access point within the reserves.
- Guard posts also require back up, therefore sufficient staff need to be on stand by at the base for responses to border disputes.
- Sufficient capacity is also required for regular patrolling and monitoring of both reserves. A recommended minimum would be three teams of four for each reserve, each fully field equipped, with two within the field at any one time.

Survey equipment

- Patrolling and monitoring can be much more efficient with just a few small items of equipment
- GPS are essential for navigation and accurate recording of findings.
- Camera traps are cheap ($100 to buy, $10/month to run) and just a small number can be permanently installed to allow long term monitoring.

Technical training

- Surveys are not technically demanding but if not done correctly the information gathered can be useless
- Complete technical training for conducting surveys and using camera traps should be conducted annually at least.

Mapping

- One of the major restrictions at present is the lack of any up to date maps or imagery
- Furthermore, the BKSDA has little facility to deal with this information if it were available
- Setting up a small GIS lab, with at least two trained members of staff, and regularly updated imagery of sufficient scale (at least 30m resolution) will facilitate many of the research, monitoring and protection activities.

Law enforcement

- At present the BKSDA do not have the resources to deal with significant threats, such as organised illegal logging. Building law enforcement capacity is essential if such threats are to be countered.
- This requires teams that are sufficiently informed on their rights and powers, together with back-up from a field and head office if required.
- This also requires capacity building for the process after arrests are made, to ensure that prosecutions to lead to convictions.

Priority actions

Once a broad framework for conservation in the region has been outlined, and the required capacity to implement identified, the priority steps for action should be identified for immediate action. Ideally actions should be implemented in Dangku and Bentayan together. Of the two areas, Dangku has the strongest conservation potential, and was the only site with tigers. However, Bentayan is more strongly threatened and was the only site with elephant evidence. Furthermore, it provides a useful illustration of what Dangku will look like in three to five years. As explained in the general recommendations, isolated action in one area is unlikely to be effective. Therefore, the priority recommendations have been selected from each conservation approach.

Information-based actions

1. Obtain up to date imagery

One of the key limitations of this survey was that the satellite imagery available was several years out of date which, with rapid clearance rates, meant they did not represent the situation on the ground. Although the surveys identified areas where wildlife were definitely present, there is little power to extrapolate these results to predict other areas of importance within and around the conservation areas without up to date habitat information. Obtaining recent (<1 year) satellite (or equivalent) imagery of at least 30m resolution and using it to identify further likely areas of value should therefore be a priority.

2. Wildlife and threat surveys outside Bentayan and Dangku

This report contains most of the information required for immediate action within the conservation areas. However, the surveys did not cover any of the areas outside the conservation areas. Rapid surveys for habitat, wildlife and threats to the north east of Bentayan and west of Dangku in particular should be carried out as soon as possible, ideally using new imagery to identify priority areas for surveying.

3. Establish monitoring programme

As a 'snapshot' survey, this report can give no information on rates of change. However, the extent of threats recorded would indicate that change was happening quickly. Establishing a monitoring programme would quickly establish baseline information for the sites and highlight any changes, either highlighting areas where further action is needed or showing the success of other measures introduced. The monitoring programme should be based on continuous, recording of wildlife and threats from camera traps and combined protection / monitoring patrols. However, it should also entail repeating the intensive survey described in this report on an annual basis to ensure there is an annual benchmark for comparison.

Stakeholder influence–based actions

4. Establish community conservation education and awareness scheme

One of the findings of the report was that public awareness of conservation awareness issues was low. Many people encroached into the conservation areas because they did not believe the areas still had value, whilst wildlife poaching in Dangku was conducted openly and without fear of prosecution. At the same time, serious human-wildlife conflict was recorded in both areas. An education and awareness scheme could be used to tackle both issues, firstly informing

5. Identify key stakeholders around the conservation areas

If conservation is to be identified beyond the boundaries of the conservation areas, the key stakeholders need to be identified. This will include villages, but also industry holding concessions in the area. Once key stakeholders have been identified then a plan can be made for approaching them and forming conservation partnerships.

6. Raise conservation area profile

At present, Dangku and Bentayan are little known conservation areas. Many people in the wider area have never heard of them. The results of this survey have shown both areas are of high interest for conservation and include a number of good photographs of high profile species. These results should be publicised widely in local and national press to establish the importance of the areas and increase support in protecting them for the future.

Protection–based actions

7. Set up portals and posts

At present there are only a small number of unmanned posts in either conservation area. This means access to the area for illegal activities is unrestricted. Portals need to be set up on every accessible entry point. Any entry points without a portal should be closed for access to vehicles with a trench or similar measure. Portals should be manned 24 hours a day and access has to be restricted. In the case of illegal logging and other activities with major support, this will be a dangerous activity and needs to be supported with sufficient resources (see below).

8. Define and mark boundaries

One of they key features lacking in both Bentayan and Dangku is a clear demarcation of where the conservation areas are, both on maps and on the ground. Several alternative outlines are available for both areas. This allows for encroachment on the basis that the borders are not clear. It also gives the impression that the borders are fluid and the area is not important. An official boundary has to be recognised by the BKSDA and marked out on the ground, using clear signposts (ideally with information from the community conservation awareness programme) and markers in addition to the portals (see above). In the longer term, modifications to the boundaries should also be looked at, replacing areas already settled and protecting remaining areas of habitat outside the existing conservation boundaries.

9. Start regular and frequent patrolling

Patrols should be used both to look for, and stop, illegal activities, to monitor wildlife (see above) and to ensure a visible conservation presence in the conservation areas to reinforce the conservation status. Patrols should be carried out by teams of no less than four people (so that if a team has to divide no one is working or travelling alone) and could be a combination of motorbike, foot patrols and fly camps when visiting inaccessible areas. Ideally patrols should consist of a mixture of BKSDA staff, local people and NGOs and combine stopping illegal activity with monitoring and community conservation (see above). Regular routes and times can be followed, but irregular patrols are also required to ensure people do not just predict when a patrol is due. Night patrols for hunting should be included. Ideally, the entire area should be covered at least once per month. At the minimum, this would require two teams operating for twenty days per month.

10. Remove pioneer threats

Pioneer threats (hunting, illegal logging, initial land clearance) are the most important activities requiring action because they can be stopped quickly and because they can lead to permanent clearing and settlement which is much harder to deal with. The law needs to be stated clearly in the education campaign (see above) but it also needs to be enforced when necessary. Besides stopping and arresting culprits caught in the act, results can also be achieved by destroying traps, destroying wood piles and re-planting cleared areas, making it difficult and uneconomic for people to persist. High profile, intensive action often has the best results, for example regular patrols for traps can be supported by a major snare sweep with accompanying publicity to ensure local communities know it is occurring and media publicity given to the results. Operations have to be carried out jointly with police or other relevant authorities.

Much of Bentayan is now permanently settled grasslands. Urgent action is required in Dangku to ensure it does not head the same way

Rekomendasi yang diprioritaskan

Ketika kerangka kerja konservasi yang lebih luas pada level bentang alam sedang direncanakan, maka langkah-langkah prioritas untuk aksi harus diidentifikasi. Seperti yang telah dijelaskan dalam rekomendasi umum, aksi terpisah yang hanya dilakukan dalam satu kawasan sepertinya tidak akan efektif. Oleh karenanya, rekomendasi-rekomendasi proiritas telah dipilih dari setiap pendekatan konservasi yang ada.

Kegiatan yang didasarkan pada informasi

1. Mendapatkan citra satelit terkini

Salah satu keterbatasan dari survey ini adalah usia citra satelit yang tersedia telah usang beberapa tahun, yang mana dengan laju pembukaan lahan yang cepat, maka citra satelit tersebut tidak mewakili situasi terkini di lapangan. Meskipun dari survey telah teridentifikasi areal-areal dimana satwa liar pasti berada, namun tanpa informasi habitat yang terkini tidak ada kekuatan untuk mengekstrapolasi hasil survey, untuk dapat memprediksi kawasan-kawasan penting lainnya di dalam dan sekitar kawasan konservasi. Jadi, mendapatkan citra satelit (atau yang setara) terkini (<1 tahun) dengan resolusi paling tidak 30m, serta menggunakannya dalam mengidentifikasi nilai kawasan lebih lanjut harus diproiritaskan.

2. Survey satwa liar dan ancamannya di luar Bentayan dan Dangku

Laporan ini memuat informasi yang paling diinginkan untuk aksi segera di dalam kawasan konservasi. Namun, survey ini tidak mencakup kawasan-kawasan di luar kawasan konservasi. Survey cepat khususnya di kawasan-kawasan sebelah timur laut Bentayan dan sebelah barat Dangku untuk mengetahui kondisi habitat, satwa liar serta ancaman-ancamannya harus dilakukan secepat mungkin, yang idealnya menggunakan citra satelit yang baru untuk mengidentifikasi areal prioritas untuk disurvey.

3. Mendirikan program pemantauan

Sebagai hasil survey permukaan saja, laporan ini tidak dapat memberikan informasi tentang laju perubahan. Namun demikian, ancaman-ancaman yang luas yang tercatat dapat mengindikasikan bahwa perubahan terjadi dengan sangat cepat. Mendirikan satu program pemantauan akan dengan cepat membentuk informasi dasar bagi kawasan-kawasan tersebut, serta menggaris-bawahi setiap perubahan, baik itu areal-areal dimana aksi lebih lanjut diperlukan atau menunjukkan kesuksesan dari kegitan-kegiatan lain yang telah dilaksanakan. Program pemantauan harus dilaksanakan secara kontinyu, mencatat satwa liar dan ancamannya melalui kamera trap serta dikomboinasikan dengan patroli perlindungan /pemantauan. Namun demikian, harus juga melakukan pengulangan survey intensif setiap tahun yang telah dijelaskan dalam laporan ini, untuk memastikan bahwa didapat hasil tahunan untuk dibandingkan.

Kegiatan yang didasarkan pada kerja sama dengan masyarakat

4. Mendirikan pendidikan konservasi kemasyarakatan dan skema penyadartahuan

Salah satu temuan dalam laporan adalah bahwa isu kesadartahuan masyarakat tentang konservasi rendah. Banyak orang merambah ke dalam kawasan konservasi karena mereka tidak percaya bahwa kawasan masih memiliki nilai, bahkan perburuan liar di dalam kawasan Dangku dilakukan secara terang-terangan dan tidak takut terhadap tuntutan. Pada saat yang sama, konflik antara satwa liar dengan manusia yang serius tercatat terdapat di dalam kedua kawasan. Satu skema pendidikan dan penyadartahuan dapat digunakan untuk mengatasi kedua isu tersebut.

5. Mengidentifikasi pihak kunci di sekitar kawasan konservasi

Apabila konservasi akan dilaksanakan di luar batas-batas kawasan konservasi, maka pihak-pihak kunci perlu diidentifikasi. Ini akan termasuk desa-desa, tetapi juga industri yang memiliki konsesi kawasan. Ketika pihak-pihak kunci telah diidentifikasi kemudian satu rencana dapat dibuat untuk mendekatinya serta membentuk suatu kemitraan konservasi.

6. Meningkatkan profil kawasan konservasi

Saat ini, sebagai kawasan konservasi Dangku dan Bentayan kurang dikenal, dan umumnya masyarakat luas belum mengetahuinya. Hasil dari survey ini telah menunjukkan bahwa kedua kawasan memiliki ketertarikan yang tinggi bagi konservasi, dan menghasilkan sejumlah foto species kharismatik. Hasil-hasil tersebut layaknya harus dipublikasikan secara luas melalui media lokal dan nasional, untuk menginformasikan bahwa

kedua kawasan memiliki kepentingan, serta meningkatkan dukungan untuk perlindungan kedua kawasan di masa yang akan datang.

Kegiatan yang didasarkan pada perlindungan

7. Membangun portal dan pos jaga

Saat ini hanya ada sedikit pos jaga yang tidak terawat di kedua kawasan konservasi. Ini artinya akses aktifitas illegal ke dalam kawasan tidak terbatasi. Portal-portal perlu dibangun pada setiap jalan masuk ke dalam kawasan. Setiap jalan masuk yang tidak berportal harus ditutup bagi akses kendaraan dengan menggunakan parit atau sejenisnya. Portal harus dijaga 24 jam setiap hari dan akses harus terbatas. Dalam kasus penebangan liar dan kegiatan illegal lainnya yang memiliki dukungan kuat, hal ini akan menjadi aktifitas yang berbahaya dan perlu didukung oleh sumber daya yang memadai (lihat di bawah).

8. Membatasi dan menandai batas

Salah satu satu kelemahan utama di kawasan Bentayan dan Dangku adalah tidak jelasnya tanda-tanda batas kawasan konservasi, baik di atas peta maupun di lapangan. Terdapat beberapa peta yang berbeda untuk kedua kawasan. Hal ini memungkinkan bagi para perambah berdalih bahwa batas kawasan tidak jelas. Hal ini juga memberikan kesan bahwa batas kawasan berubah-ubah dan tidak penting. Suatu batas resmi harus ditentukan/dikenali oleh BKSDA dan harus ditandai di lapangan, menggunakan papan nama-papan nama yang jelas (idealnya dengan informasi dari program penyadartahuan konservasi kemasyarakatan), serta penanda sebagai tambahan pada portal (lihat di atas). Dalam jangka waktu yang lebih panjang, modifikasi pada batas harus juga dilihat, yaitu dengan mengganti areal yang sudah dimukimi masyarakat serta melindungi kawasan habitat yang tersisa di luar batas kawasan konservasi yang ada.

9. Memulai patroli rutin dan sering

Patroli harus digunakan baik untuk mencari dan menghentikan aktifitas-aktifitas illegal, untuk memantau satwa liar (lihat di atas) dan untuk memastikan keberadaan kegiatan konservasi di kedua kawasan untuk menegakkan status konservasi. Patroli harus dilakukan oleh tim yang tidak kurang dari empat orang (sehingga apabila anggota tim harus dibagi tidak seorangpun bekerja atau berjalan sendirian) dan dapat mengkombinasikan antara patroli jalan kaki, menggunakan motor, dan berkemah apabila sedang berpatroli di daerah yang tidak ada akses. Idealnya patroli harus terdiri dari gabungan antara staf BKSDA, masyarakat lokal dan LSM, serta mengkombinasikan antara menghentikan aktifitas illegal dengan pemantauan dan konservasi kemasyarakatan (lihat di atas). Jalur-jalur dan waktu yang reguler dapat dikuti, tetapi patroli yang sifatnya dadakan juga diharapkan untuk memastikan masyarakat tidak dapat memprediksi kapan patroli dilakukan. Patroli terhadap perburuan liar di malam hari juga harus dilaksanakan. Idealnya, seluruh kawasan harus dilewati sedikitnya satu kali setiap bulan. Pada tahap minimal, maka akan dibutuhkan dua tim yang beroperasi selama 20 hari setiap bulam.

10. Memberantas ancaman-ancaman pionir

Ancaman-ancaman pionir (perburuan, penebangan liar, pembukaan lahan awal) merupakan aktifitas-aktifitas paling penting yang mengharapkan aksi, karena aktifitas-aktifitas tersebut dapat dihentikan dengan cepat dan karena aktifitas-aktifitas tersebut juga dapat mengarah pada pembukaan lahan permanen serta pemukiman, yang mana akan lebih sulit untuk mengatasinya. Hukum harus dinyatakan dengan jelas dalam kampanye pendidikan (lihat di atas) tetapi juga perlu ditegakkan bila diperlukan. Selain menghentikan dan menahan para dalang yang tertangkap dalam operasi, hasil juga dapat dicapai dengan menghancurkan jerat-jerat, menghancurkan balok-balok kayu dan menanam kembali kawasan yang gundul, akan membuat sulit dan tidak ekonomis bagi masyarakat yang tetap melakukannya. Aksi yang intensif dan berwibawa sering membuahkan hasil yang terbaik, sebagai contoh patroli rutin untuk mencari jerat satwa dapat didukung oleh penyisiran jerat dengan didampingi oleh publisitas untuk memastikan komunitas lokal mengetahuinya bahwa hal ini ada, dan pubikasi media diberikan hasilnya. Operasi harus dilaksanakan bersama dengan polisi dan pihak yang berkepentingan lainnya.

Sebagian besar Bentayan sudah jadi alang alang. Dangku harus dilindungi. Kalau tidak, hal yang sama akan terjadi

Appendices

Measuring habitat structure

Habitat structure was recorded using the Land Cover Classification System (LCCS). This is carried out by moving off the track into a representative sample of the surrounding habitat and recording the dominant vegetation of the upper storey and under-storey (if present) within a 10m radius using a hierarchical key to give a final binomial habitat classification (Figure 46) Classifications are always written hierarchically, thus an area with an upper storey of dense, tall trees and a lower storey of scattered ferns would be classed as 'A/I', not I/A. A shrubby area with no clear under-storey would be classed as just 'E'.

Figure 46 - Land Cover Classification System (LCCS)

Step 1 (Vegetation type)	Step 2 (Vegetation type)	Step 3 (Cover estimation)		Key
Woody	Trees (>5m)	closed	>70%	A
		open	20 - 70%	B
		sparse	1 - 20%	C
	Shrubs (<5m)	closed	>70%	D
		open	20 - 70%	E
		sparse	1 - 20%	F
Herbaceous	Forbs (fern-like)	closed	>70%	G
		open	20 - 70%	H
		sparse	1 - 20%	I
	Graminoids (grass-like)	closed	>70%	J
		open	20 - 70%	K
		sparse	1 - 20%	L

Calculating adjusted species richness

In the species richness tests a Jacknife estimator (Burnham and Overton, 1979) of the M(h) model (Otis et al., 1978; White et al., 1982; Rexstad and Burnham, 1991), as implemented in the program SPECRICH2 (Hines, 1999), was used to estimate species richness for the overall site and for each of the three dominant land cover classes. Model, M(h), was developed for capture-recapture data derived from closed animal populations and is one of a suite of models implemented in programme CAPTURE (Otis et al., 1978; Rexstad and Burnham, 1991). Species richness can be computed using any appropriate model, but the use of M(h) follows (Boulinier et al., 1998a) and (Cam et al., 2000) and fits with the heterogeneity in species detection probability reported here (Table 5).

Species detection histories were compiled from the walked transects conducted in each of the 400 hectare survey cells. The number of species observed on exactly 1, 2. 3,...K survey cells provide the observed frequencies required to estimate species richness with the jacknife estimator for model M(h) (Burnham and Overton, 1979; Cam et al., 2000).

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Species lists

Figure 47 - Species (not including domestic species) detected in Bentayan

Order	*Latin name*	*Common name*	*Red list*	*Indonesian status*	*CITES*	*Recorded on transect*	*Photographed*
Artiodactyla	Cervus unicolor	Sambar	Least concern	Protected	Not listed	Y	Y
	Muntiacus muntjak	Muntjac	Least concern	Protected	Not listed	Y	Y
	Sus barbatus	Bearded pig	Least concern	Not protected	Not listed	Y	Y
	Sus scrofa	Pig (wild)	Least concern	Not protected	Not listed	Y	Y
	Tragulus napu	Greater mouse deer	Least concern	Protected	Not listed	Y	N
Carnivora	Helarctos malayanus	Sun bear	Vulnerable*	Protected	I / II	Y	Y
	Martes flavigula	Yellow throated marten	Least concern	Not protected	III	Y	N
	Neofelis nebulosa	Clouded leopard	Vulnerable	Protected	I	Y	N
	Paradoxurus hermaphroditus	Common palm civet	Least concern	Not protected	III	Y	N
	Prionailurus bengalensis	Leopard cat	Least concern	Protected	II	Y	Y
	Viverra tangalunga	Malay Civet	Least concern	Not protected	Not listed	Y	N
Perissodactyla	Tapirus indicus	Malayan tapir	Vulnerable	Protected	I	Y	Y
Pholidota	Manis javanica	Pangolin	Near threatened	Protected	II	Y	N
Primates	Hylobates agilis	Agile gibbon	Near threatened	Protected	I	Y	N
	Macaca fascicularis	Long tailed macaque	Near threatened	Not protected	II	Y	Y
	Macaca nemestrina	Pig tailed macaque	Vulnerable	Protected	II	Y	Y
	Symphalangus syndactylus	Siamang	Near threatened	Protected	I	Y	N
Proboscidea	Elephas maximus	Asian elephant	Endangered	Protected	I	Y	N
Rodentia	Hystrix brachyura	East Asian porcupine	Vulnerable	Protected	Not listed	Y	Y
	Trichys fasciculata	Long tailed porcupine	Least concern	Not protected	Not listed	Y	N

Figure 48 - Species (not including domestic species) detected in Dangku

Order	*Latin name*	*Common name*	*Red list*	*Indonesian status*	*CITES*	*Transects*	*Photos*
Artiodactyla	Cervus unicolor	Sambar	Least concern	Protected	Not listed	Y	Y
	Muntiacus muntjak	Muntjac	Least concern	Protected	Not listed	Y	Y
	Sus scrofa	Pig (wild)	Least concern	Not protected	Not listed	Y	Y
	Tragulus napu	Greater mouse deer	Least concern	Protected	Not listed	Y	N
Carnivora	Cuon alpinus	Dhole	Endangered	Protected	II	Y	N
	Helarctos malayanus	Sun bear	Vulnerable*	Protected	I / II	Y	Y
	Martes flavigula	Yellow throated marten	Least concern	Not protected	III	Y	N
	Neofelis nebulosa	Clouded leopard	Vulnerable	Protected	I	Y	N
	Panthera tigris	Tiger	Critically Endangered	Protected	I	Y	Y
	Paradoxurus hermaphroditus	Common palm civet	Least concern	Not protected	III	Y	Y
	Pardofelis marmorata	Marbled cat	Vulnerable	Protected	I	N	Y
	Prionailurus bengalensis	Leopard cat	Least concern	Protected	II	Y	Y
	Viverra tangalunga	Malay Civet	Least concern	Not protected	Not listed	Y	N
Perissodactyla	Tapirus indicus	Malayan tapir	Vulnerable	Protected	I	Y	Y
Primates	Hylobates agilis	Agile gibbon	Near threatened	Protected	I	Y	N
	Macaca fascicularis	Long tailed macaque	Near threatened	Not protected	II	Y	Y
	Macaca nemestrina	Pig tailed macaque	Vulnerable	Protected	II	Y	Y
	Presbytis melalophos	Banded langur	Near threatened	Protected	II	Y	N
	Symphalangus syndactylus	Siamang	Near threatened	Protected	I	Y	N
Rodentia	Hystrix brachyura	East Asian porcupine	Vulnerable	Protected	Not listed	Y	N

Questionnaire

Nama Dusun:	Desa:	Kec./Kab:
GPS:	Pewawancara:	Tanggal:

INFORMASI UMUM

Jenis Kelamin: L-P	Umur:	Pendidikan:
Pekerjaan:	Status: Kawin/Belum Kawin	Jumlah anak:
Berasal dari:	Berapa lama tinggal disini:	Berapa luas ladang:
Punya: TV/Motor/Mobil		

1. Binatang ternak apa saja yang Bapak/Ibu Miliki?

A. Kerbau:…….ekor B. Sapi:…….ekor C. Kambing:…..ekor

D. Babi:……..ekor E. Ayam:……..ekor F Dll…

2. Jika tinggal disini kurang dari 5 th, alasannya pindah apa?

Komentar:

3. Bagaimana caranya Bapak/Ibu bisa mendapatkan lahan untuk berladang di daerah ini?

Komentar:

4. Apakah Bapak/Ibu tahu bahwa kawasan ini bagian dari kawasan hutan lindung?

(a) ya (b) tidak

5. Jika Ya, Alasan apa yang membuat Bapak/Ibu masih tetap berladang disini?

Komentar:

PERSEPSI TENTANG HUTAN LINDUNG DAN KONSERVASI

1. Apakah Bapak/Ibu tahu apa yang dimaksud dengan menjaga dan melindungi hutan sekaligus dengan isinya? (A) tahu (B) tidak tahu

2. Kalau tahu, coba jelaskan apa yang dimaksud dengan menjaga dan melindungi hutan dengan isinya?

Komentar:

3. Menurut pendapat Bapak/Ibu siapakah yang seharusnya bertanggung jawab untuk menjaga dan melindungi hutan serta isinya?

Komentar:

4. Sebutkan 3 keuntungan yang dirasakan dengan adanya hutan?

Komentar:
A.
B.
C.

5. Sebutkan 3 kerugian yang dirasakan dengan adanya hutan?

Komentar:
A.
B.
C.

6. Menurut Bapak/ibu, apakah perlu ada hutan lindung/SM di lingkungan kampong ini?
(A) perlu (B) tidak perlu

7. menurut Bapak/Ibu untuk Apa hutan lindung/SM ini ada?

Komentar:

PERSEPSI TERHADAP KSDA DAN CONOCO PHILIPS

1.Apa pekerjaan petugas Kehutanan?

Komentar:

2.Menurut Bapak/Ibu, apakah di daerah ini perlu ada petugas kehutanan?
(A) perlu (B) tidak perlu

3. Perusahaan apa saja yang Bapak/Ibu ketahui yang ada disekitar sini?

Komentar:
A.
B.
C.
D.

4. Keuntungan apa saja yang diperoleh dengan adanya perusahaan yang beroperasi di desa sekitar sini ?

Komentar:
A.
B.
C.

5. Kerugian apa saja yang diperoleh dengan adanya perusahaan yang beroperasi di desa sekitar sini ?

Komentar:
A.
B.
C.

4. Apa keuntungan bagi kampong/dusun dengan adanya perusahaan minyak?

Komentar A. B. C.

5. Apa kerugian bagi kampong/dusun dengan adanya perusahaan minyak?

Komentar A. B. C.

SATWA LIAR

1.Menurut Bapak/Ibu ketahui, hewan liar apa saja yang ada di hutan sekitar kampong ini?

Komentar:

2. Tolong kelompokan gambar-gambar hewan berdasarkan kesamaaannya (terserah Bapak/Ibu dalam mengelompokan kesamaan tersebut) misalnya; buah yang rasanya asam satu kelompok atau makanan yang manis satu kelompok.

3. Menurut yang Bapak/Ibu ketahui, hewan liar apa saja yang ada di hutan sekitar kampong ini yang dilindungi undang-undang (tidak boleh ditangkap/diburu)?

Photo	Nama	Apa yang Bapak/Ibu ketahui tentang photo tersebut	Dilindungi?	Kapan terakhir kali lihat langsung/Jejak?

INTERAKSI DENGAN HUTAN DAN PERBURUAN

1.Seberapa sering Bapak/Ibu pergi ke hutan?
(A) sering (B) jarang (C) kadang-kadang (D) tidak pernah

2. Untuk tujuan apa Bapak/Ibu pergi ke hutan?

Komentar: A B C

3.Pernahkah Bapak/Ibu berburu (A)ya (B) tidak

4. Kalau Ya, kenapa?

Komentar :

5. Kalau tidak, kenapa?

Komentar :

4. Jenis satwa apa saja yang Bapak/Ibu buru?

Komentar: A. B. C.

5. Biasanya Bapak/Ibu menggunakan cara apa saja untuk berburu?

A. Senapan angina B. kecepek
C. jerat D. Dan lain-lain

6. Apa yang Bapak/Ibu lakukan dengan hasil buruan?

A. untuk dimakan sendiri B. Sebagian dimakan sebagian dijual
C untuk dijual ke tetangga/pasar desa D. untuk dijual ke penadah/toke

KONFLIK DENGAN SATWA LIAR

1. Apakah Bapak/Ibu punya masalah dengan satwa liar disekitar kampong/dusun ini?

Jenis satwa	Apa masalahnya	Kapan terjadinya	Tindakan apa yang Bapak/Ibu lakukan?