

Section I. Project Information	
Project Title: “Khao Laem: Tiger Conservation Survey” 2020	
Grantee Organisation: Freeland	
Location of project: Khao Laem National Park, Kanchanaburi Province, Thailand	
<p>Size of project area</p> <p>Total area of PA: 1,497km²</p> <p>Total area of 2020/21 survey efforts: 905km²</p> <ul style="list-style-type: none"> - Approximately 140km² via ecological surveys - 333km² via Phase 1.1 SECR grid survey with a further 432km² SECR survey site initiated during early 2021 	<p>Number of tigers in project area, giving evidence & source:</p> <p>The focal site is part of a contiguous 18,000km² landscape in western Thailand, comprising of 17 PA's that allows free movement of tigers throughout. Population estimate (<i>redacted</i>) via (unpublished) camera trap data from the site over the previous 5 years.</p>
<p>Partners:</p> <p>Khao Laem National Park (KLNP); Department of National Parks Wildlife and Plant Conservation (DNP): In 2016 at the request of the KLNP Park Superintendent Freeland initiated low intensity tiger ecological monitoring activities, this remains on-going and supplements this year's Spatially Explicit Capture, Recapture Survey (SECR) survey. Khao Laem National Park directly shares all wildlife data with the DNP's Protected Area Regional Office in Ban Pong and tiger data with the Wildlife Conservation Division's Tiger Research Centre in Huai Kha Kheng WS. This DNP internal sharing process ensures all tiger records from the park are cross-referenced against a national database of identification images.</p> <p>Panthera/ZSL Thailand assisted until midway through 2020 by loaning survey equipment. This equipment was returned for use in adjoining protected areas where Panthera/ZSL are conducting parallel tiger surveys.</p> <p>Freeland field staff, Eric Ash is presently completing a DPhil (Zoology) relating to large carnivores in Thailand with WildCRU, University of Oxford. He assisted this project by directing students cataloguing Khao Laem survey data. A collaboration with WildCRU facilitates sharing of technical expertise to ensure surveys are conducted to appropriate scientific standards. This partnership between WildCRU and Freeland was (until covid) starting to provide intern opportunities for young biologists interested in conducting tiger conservation.</p> <p>Consultant senior biologist Saifon Sittimongkol PhD from Thailand's Prince of Songkhla University worked analysing data and joined survey teams overseeing SECR implementation. We are discussing ways to include Thai undergraduate students from her university in the project.</p> <p>Consultant biologist Jonathan Moore helped analysing project survey data and also joined surveys teams implementing the SECR survey.</p> <p>Work on the project is in collaboration with IUCN Thailand as part of the IUCN programme <i>Accelerating Tiger Recovery along the Thailand-Myanmar Border</i>. This new partnership increased resources available and allows an expansion of Khao Laem tiger survey efforts. These now encompass almost the entire terrestrial area of the park. Freeland as a member of IUCN Thailand National Committee has been able to synchronise conservation efforts with further domestic partner organisations, including the DNP (this is the state representation and chair of the Thailand NC).</p>	
<p>Project Contact Name: (main contact via email)</p> <p>Tim Redford, Surviving Together Programme Director</p>	
<p>Email: tim@freeland.org</p>	
<p>Actual start date of project: Started on time.</p>	
<p>Reporting period: For tiger surveys March 2020 to January 2021 (Feb 2020 in previous year's final report) and for SMART related support January 2020 to December 2020.</p>	

Section II. Project Progress

Summary of progress for the year:

Synopsis

Tiger monitoring at Khao Laem was conducted throughout 2020 and into early 2021 utilising two distinct formats. The on-going opportunistic ecological monitoring was supplemented with two Spatially Explicit Capture, Recapture (SECR) surveys. SECR Phase 1.1 ran between October 2020 to January 2021 and Phase 1.2 was initiated at the beginning of February 2021 to conclude in May 2021. During this last year a female tiger and two sub-adult cubs were recorded in one sector of the park and in January 2021 a further unknown female tiger was documented. By cross-referencing images with the Khao Nam Ram tiger centre in Huai Kha Kheng Wildlife Sanctuary, it was ascertained these were all previously unrecorded tigers new to the national database. Given various factors such as low intensity of previous years surveys, size and steep terrain of Khao Laem and its connectivity with Thung Yai Naresuan (West) Wildlife Sanctuary such 'new finds' are not necessarily unexpected, but are certainly welcome surprises. These additional records clearly demonstrate the value of continuing long-term ecological monitoring at the site, as the shorter term SECR grid surveys may miss such important events. Khao Laem experiences seasonal wildlife dispersals due to climatic changes and other anthropogenic ecological disturbances, such as forest fires and an influx of tourists during the opening of the popular San Nok Wua hiking trail which is the highest peak in Kanchanaburi province.

Throughout the year the known tigers continued to be recorded, as did several Indochinese leopards that co-inhabit the same areas. In March 2020, a female leopard was recorded with a single cub. This is exciting, as it demonstrates the prey base in the area is rich enough to simultaneously support two species of large carnivores, even when these are caring for cubs. The SECR surveys conducted in areas previously unsurveyed, are revealing a rich diversity of carnivores, including; tigers, leopards, clouded leopards, golden cats, marbled cats and leopard cats. Other carnivores sharing the same habitat are; two species of bear, dhole, jackal, hog badger, ferret badger, civets, mongoose and marten.

Background of 2020 project developments

During the first half of 2020 proposed tiger monitoring activities were slightly revised, mostly because of domestic travel restrictions related to covid-19. However, this proved only a temporary constraint, and by May the Thai government lifted the travel ban and staff could continue the surveys. Originally we proposed to conduct a small scale SECR grid survey between May to August, but partner Panthera requested a delay in the grid survey conduct until the dry season, as their surveys (in conjunction with ZSL Thailand) occur in adjacent protected areas only during the dry season. By postponing an amalgamation of similar season survey data from throughout the landscape will enable larger and more comprehensive analysis. This will lead to a better understanding of tiger ecology across most of South WEFCOM, and perhaps beyond.

During mid-2020 we received news from IUCN Thailand that a proposal seeking support to expand the scale the Khao Laem grid survey to the **Accelerating Tiger Recovery along the Thailand-Myanmar Border** programme was successful. This increased the proposed survey area from twenty 3km x 3km grids to eighty-five, now encompassing almost the entire terrestrial area of Khao Laem. The eastern grid survey was started in October 2020, utilising 42 rangers in 6 teams each led by Freeland staff. We engaged two additional local employs to assist with training, survey implementation, data cataloguing and analysis. These two additional staff are Ms. Atcharee Sangrawee and Dr. Saifon Sittimongkol (as senior project biologist). A further two consultants (J. Moore and L. Stokes) were temporarily hired as experienced technicians to ensure cameras were placed at optimum locations and to conduct on-job-training to rangers during the camera deployment. This approach ensures sustainability as now officials are trained in camera use and data collection.

Long term monitoring for tigers was conducted every two months throughout the year utilising a further 25 opportunistically placed cameras. Totally four separate sectors of the park were surveyed, including an area on the western side of the Vajiralongkorn dam. In 2019 we conducted recce surveys to two additional sites there, but with disappointing results, as the area demonstrated low species richness and high levels of illegal cattle grazing. This led to the formulation of a sub-project to help the Khao Laem management engage cattle grazers and find a way to remove the cattle. We have previously achieved a successful outcome removing cattle in another site in Thailand and we believe the process developed there can be utilised in a similar manner at Khao

Laem. We also recorded images of cattle grazers carrying weapons to poach wildlife as they graze their cattle. There is no excuse for this, as it is totally illegal for anyone except law enforcement officials to carry a weapon in a protected area. The combined poaching and ecological disturbance by cattle are probably two reasons why wildlife species richness is so low in some areas. Monitoring cattle and measures to remove them are now in place at Khao Laem, but may take two to three years before a full consensus is agreed with the cattle owners and their phased removal of cattle concluded. During February 2021 we became aware that a number of owners have responded to awareness visits and already started removing their cattle. A new 2019 protected area law forbids the free roaming of any domestic animals in a national park. This aspect of the law was explained to cattle owners during surveys and may have contributed to this (anecdotal) relocation of cattle from the park.

However, we expect to see a rapid rehabilitation of the area as it borders Thong Pha Phum National Park with contiguous forest to the Myanmar border - if these ecological disturbances are mitigated, or stopped altogether. In this area Thong Pha Phum National Park (adjoining Khao Laem) and is contiguous with the Tanintharyi Nature Reserve in Myanmar. This is where gas pipelines run through the forest from the Andaman Sea to power stations and storage depots in Thailand and is controversial¹ due to the previous eviction of Karen indigenous people who lived there for eons.

This year in Khao Laem two rangers died conducting their duties, one while participating in a wildlife survey. The first fatality in June occurred soon after a ranger returned from an anti-poaching patrol. He and two further rangers contracted leptospirosis from drinking stagnant water in the forest. The bacteria spread through his blood system, entering his brain at which time he was rushed to a local hospital unconscious, but he never recovered and died. The other two sick rangers responded well to antibiotics and both made quick recoveries. They were forced to drink the stagnant water as it was the peak of the dry season and no clean or running stream water was available. Potable water is the most challenging problems for Khao Laem and all rangers in Thailand during dry season patrols. As Khao Laem is very steep and mostly limestone rainwater seeps quickly into the ground and there are very few springs. To rectify this we were able to buy a few water filters to support rangers during surveys, but these systems are not available domestically and expensive. More are required to ensure all patrol teams have them and can access clean water to drink. Sometimes water is impossible to find during patrols in some sections of the park and consequently these areas are not patrolled during the dry season. Wildlife from such areas even moves to more hospitable places and despite the lack of patrols the arid areas are not prone to increased poaching pressure, as the poachers cannot find water either and avoid them.

A second ranger fatality occurred in August, during monitoring trip KL23. One of the two survey teams had their route obstructed by a flash flood and a river in full spate. Being late in the day, low on supplies and wanting to return home the team decided to risk a crossing, but the current was too strong and the lead ranger taking a guide rope across was swept away, and dragged underwater by the flow. He was found further downstream, but had already drowned. CPR was administered, but failed to revive him and then rangers still had to travel a further day downstream before they could find a phone signal to call for help. The team with their dead colleague were recovered by boat on the shore of the reservoir. This was a very tragic and traumatic event for the rangers. Following the funeral, as is tradition in Thailand, several rangers and one Freeland staff member were ordained as monks in respect for their friend. We were able to facilitate some compensation to the ranger's family from the Thin Green Line Foundation and from our own organisation. Both deceased rangers leave families with young children.

We have been able to re-establish operational status of two satellite phones for assistance during emergencies. We have two more satellite phones and are looking for support to get these working again too. Further safety can be introduced by ensuring all team members have walkie-talkies, in case any become lost or separated.

Prior to the start of the SECR survey in October we were able to conduct safety and first aid training, navigation, camera trap use and SMART reporting. During the Phase 1.1 SECR survey there were no accidents or mishaps and the grids were surveyed effectively and safely. In much of the western sector mobile phones work and even simple VHF radios work near the reservoir. So, although more remote, communications with the west are easier than the mountainous east and in the event of a problem rapid assistance can be given by the park's patrol speedboat.

¹ <https://ejatlas.org/conflict/tanintharyi-nature-reserve-tanintharyi-region-myanmar>

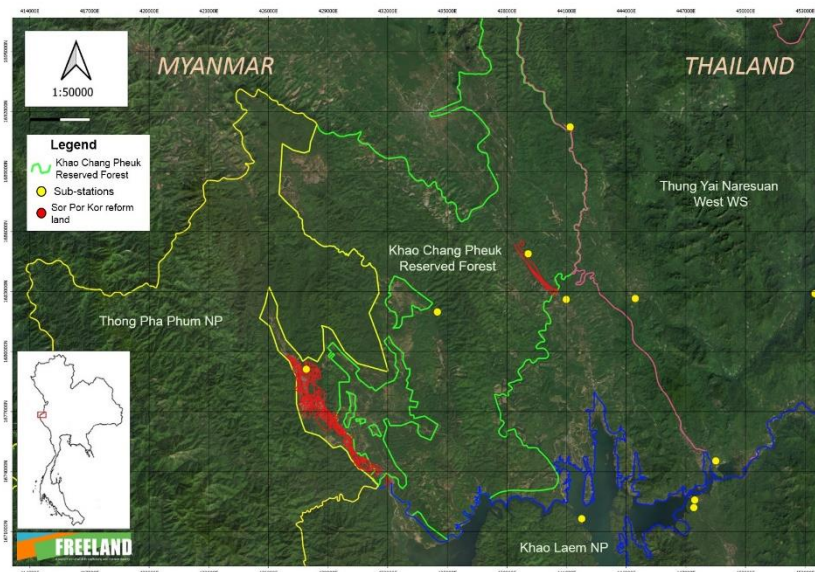
Details of activities and results to date:

The main impact sought by this project is to secure a (safe) future for tigers at Khao Laem. To arrive at that point we have two target outcomes; firstly improved site management and secondly the use of evidence-led protection strategies to enable safer tiger dispersal within the Southern WEFCON landscape. A work plan and logframe guides implementation and provides indicators for project evaluation. Two main objectives help foster the outcomes, namely; Objective 1. Improving knowledge of tigers, prey and threats in KLNP and Objective 2. Building capacity for officials to manage, interpret and analyse survey and SMART data on-site. To further improve tiger protection we have additional cost-share support that allows ecological wildlife surveys, SMART patrolling and our input interpreting effectiveness of patrolling results.

Throughout this year we sustained on-going regular camera trap² based tiger ecological monitoring while implementing an SECR grid survey over the last quarter of 2020 and into 2021. As data analysis is completed in March 2021 we will have the first density estimate per 100km² for tigers in Khao Laem- see later in report. These surveys have yielded good results and the number of tigers identified at Khao Laem continues to increase. Previously recorded tigers are still being photographed, including females which tend not to have such extensive territories as males and their continued presence bodes well for population restoration. So, although wildlife poaching is occurring in Khao Laem, as proven more by camera captures of armed poachers in the forest, it appears tigers (or other large carnivores) are currently not the main quarry.

The first Spatially Explicit Capture Recapture (SECR) grid survey ran from October 2020 to January 2021 with cataloguing occurring as the data is recovered from the field. In February 2021 the cameras were relocated to a different site (for another 4 months) to survey another section of the park. From previous opportunistic camera surveys there in 2019 and 2020 we suspected this site would not yield much tiger or prey data, due to a high level of anthropogenic disturbance in that area (fires, cattle grazing, poaching and illegal logging). The status of the area will be clearly defined by the results from this second phase by May 2021. Initial reports back from Phase 1.2 camera deployment suggests our assumption that the area is empty of wildlife may be incorrect. Three survey teams found faeces of large carnivores, either tiger or leopard. These were however too deteriorated to conclusively ascertain which species they were from. The SECR surveys will provide information leading to prey abundance figures. Previously, we were aware of just four ungulate species that tigers prey upon, wild boar, muntjak, serow and gaur. There was a noticeable absence of sambar deer, however at several sites we finally recorded sambar and the rangers stated they regularly see sambar in other areas also. Unfortunately, some areas of Khao Laem are heavily impacted by domestic cattle grazing, but surprisingly there are no recent records of predation on domestic cattle by large carnivores. It might be that cattle are simply avoided, due to armed cattle grazers accompanying them, or because of the noise created by the cattle and cowbells provides protection. Tigers in Thailand are generally weary of all human activities and actively stay away from people and the disturbance they create.

Now we are more familiar with Khao Laem and its immediate environs we have become aware of a wildlife corridor that links Thung Yai Naresuan (West) Wildlife Sanctuary with Thong Pha Phum National Park. This forest reserve area adjoins Khao Laem and has a village and roads through it, but remains fairly intact because it receives (low level) protection by the Royal Forest Department (RFD).



Map showing a Reserved Forest, north of Khao Laem. This may be an important wildlife corridor linking WEFCON with Thong Pha Phum NP and Myanmar

² Equipment used during the ecological surveys; Browning and Bushnell brand digital trail cameras

We plan to engage the RFD to request permission to conduct low intensity wildlife surveys in this reserved forest to determine if it is utilised by migrating wildlife. We expect to find high levels of poaching as RFD resources to implement anti-poaching efforts are very limited. However, if the site proves significant, then further measures could be implemented to increase its status and protection. For example lobbying to upgrade its designation from forest reserve to a Non-Hunting Area (NHA) will increase its available resources, including; rangers, patrols and budgetary support.

As mentioned, cattle grazing in areas of Khao Laem is severe with a presently undetermined number of cattle freely roaming the forest. This figure could be as high as 10,000 head, but more feasibly around 6,000. We are collaborating with Khao Laem management and a university to introduce measures to assess the problem and to engage cattle owners. We suspect a large majority of these owners are not locals, but businessmen from large provincial towns, who simply employ Burmese and Karen migrant workers as labourers to watch the cattle. In which case solving the illegal grazing problem will be easier, as releasing domestic animals in the park is clearly breaking the new national park act. By removing the cattle (and the grazers) we believe we will see a decline in poaching and an increase in wildlife species richness as displaced wildlife rebounds. Local opposition to the removal of the cattle is not expected, as it appears only migrant labour is employed to watch the cattle rather than local community members. We assume the migrant to simply move elsewhere looking for work when the cattle are moved out. Any loss of earnings should not impact local communities, or lead to increased subsistence poaching as most local villagers have fruit farms as their main income generating vocation. This cattle grazing mitigation process may take as much as three years to conclude, due to the various processes and stakeholders engagements involved. These include; updating the understanding the scale of the problem, implementing stakeholder workshops to explain the new protected area law, persuading owners to sign cattle removal agreements and finally monitoring the relocation of cattle out from within the park boundary. By taking this cautious and measured approach it will be less confrontational and although the new law clearly states such grazing of livestock is illegal, the scaled phase-out is the safest option rather than strict law enforcement as which could lead to all manner of reprisals from upset cattle owners.

SMART patrolling

Our aim is to increase the number of DNP officials with capacity to implement proficient surveys, monitoring and patrolling. During every survey rangers accompanying the survey staff receive supplementary on-job-training in map, compass and GPS use, all aimed to increase their SMART reporting ability. They are encouraged to record every piece of relevant data, which is then entered into Khao Laem's growing violation and wildlife data base. This is supplementary to SMART patrol based reporting and has increased the amount of information in the database enormously.

Patrols (unaccompanied) occurred for an average of 16 days per month per team. An additional team was introduced this year, bringing the number of patrol teams to nine. Totally, these nine teams patrolled 455 times, over 1,494 days covering a combined distance of 19,377.20kms (as recorded by SMART).

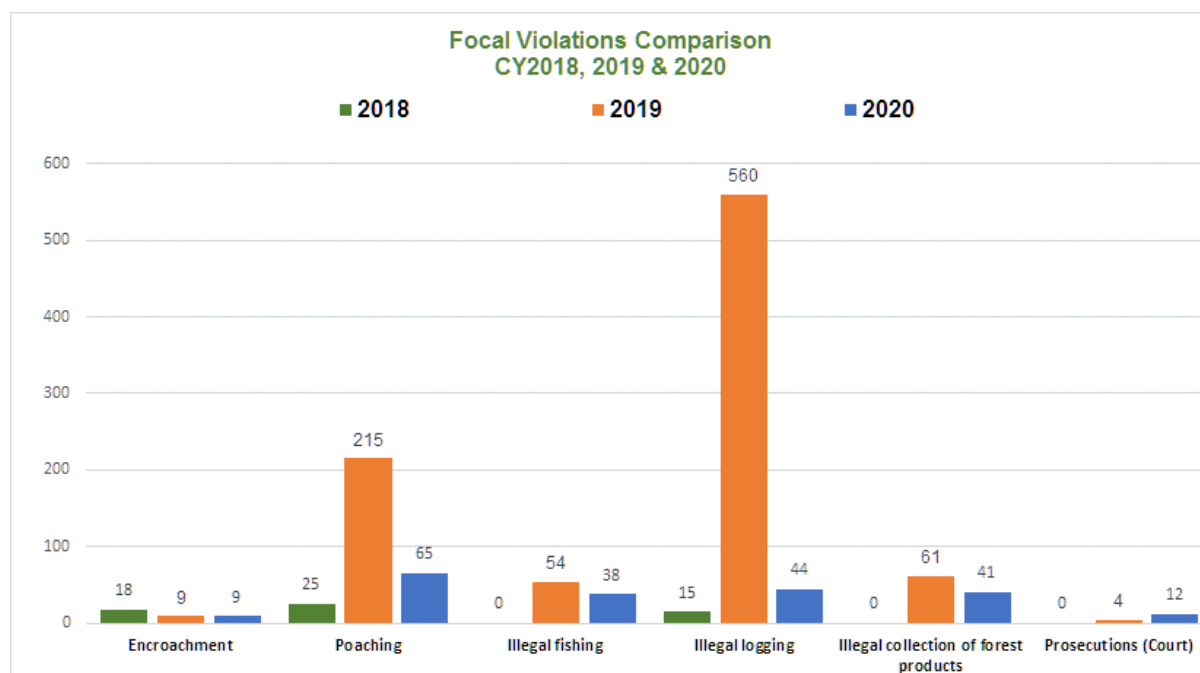
The quality of patrolling and reporting has increased measurably since we started this project. We feel this is largely down to the patrol provisioning support we provide, as much as increased reporting capacity. During discussions rangers clearly described their previous lack of motivation was caused the fact that they were required to conduct un-provisioned patrols and expected to buy their own food and expendables (including batteries for their GPS and bullets for weapons). This patrol provisioning challenge is typical for most PA's in Thailand. We know our support is making it to the rangers though as they have reported receiving the funds.

As we examine the Khao Laem patrol coverage maps we can observe during the first half of 2020 almost the entire park was patrolled at least once. Gaps in coverage are mostly due to inhospitable terrain, such as steep limestone mountains. Generally, we are very happy to see this level of coverage and during a DNP audit of SMART implementation at Khao Laem – it was the only park that satisfied the DNP's own patrolling standards within this Southern section of WEFCON.

During these patrols a lot of data is gathered and our staff regularly participate in monthly SMART meetings, updating survey information. Understanding trends in data from the field not only facilitates a better awareness of wildlife presence and threats, it also provides information needed to gauge the safety and security for survey teams as they conduct the tiger monitoring work.

By using SMART to accumulate and manage patrol and wildlife information it is easy to produce reports inclusive of relevant data. It should be noted that sign of poaching (in the maps) does not necessarily mean poachers were interdicted, it can include records of snares, shotgun cases, poacher camps, wildlife remains, or a myriad of other types of information encountered. All is documented, photographed, written into SMART reports and finally entered into the database.

We have also been monitoring several focal violation types over the last few years and following their trends. We utilise these as indicators to evaluate patrolling effectiveness, unfortunately figures do not reflect post-arrest efficacy of the local judicial system. Some cases never make it to court as police issue (minimal) on-the-spot fines.



Focal violations over 3 years

Interdicted focal crimes are extremely low this year. No certain cause is available, as the level of effort for patrols (see following table) is only slightly less than 2019. Some assumptions suggest the new protected area law with its increased penalties may have become more of a deterrent (doubtful), or that the DNP's policy of patrolling the entire area of parks during the year has decreased the quality of patrolling. Rangers are now under a lot of pressure to cover greater distances, which is audited by the department, rather than taking time and focussing on poaching interdictions. Consequently, this burden to go as far as possible and 'fill the gaps' on the map rather than conducting planned adaptive management patrols reduces patrol effectiveness. This is something we will be discussing with contacts in the DNP to explore if more qualitative patrol methods can be utilised.

Relating to violations in the graph above the table below concludes details from each year showing comparisons over three years

Year	Encroachment			Logging			Poaching		
	Cases	Offenders	Area (Rai)	Cases	Offenders	Timber m3	Cases	Offenders	Kg
2018	18	5	215.1.60	15	10	4.83	25	2	13.8
2019	9	-	365.8	560	2	2.82	215	6	1
2020	9	6	214.3.75	44	1	2.01	65	1	6.6

Note 2.45 rai = 1 acre and 10 acres = 4.04686 Ha

During this year there was a concerted effort to investigate and reduce encroachment. At least two major encroachment cases were concluded, one with the demolition of a high end tourist resort valued at 40 Million Baht (approximately £1 Million) see link to this news later in report. Numerous incidents were stopped before squatters could gain hold of land, during most violators fled before they were caught.

While conducting surveys to areas previously not visited we became aware of a huge amount of non-timber forest product collection during the rainy season. Items collected mostly by migrant Burmese include; bamboo shoots, bamboo, rattan, mushrooms, wild vegetables including 'buk' (in Thai) but known as Konjak³ in Japanese. These are all harvested illegally beyond sustainable levels in Khao Laem. We can only begin to imagine the level of ecological disturbance during harvesting times. Local businesses buy the illegally collected items and market them, with the high value Konjak being exported to Japan. More work is required to examine this trade and consider ways to reduce or eliminate it from the park.

SMART patrolling - focal metrics

For the last three years we monitored defined patrolling metrics as a method to evaluate the level of effort comparing results, such as interdicted crimes. This year there a new patrol team joined the previous eight as a temporary checkpoint was upgraded to be a substation with its own patrol team, namely from Bo Ong substation Team 9. There are two further temporary check points on rafts in the reservoir that monitor for illegal activities at night. Ong Phra (Bikee) which is near Sangkhlaburi at the north end of the reservoir at mouth of a river which penetrates deep into the western sector of the park. The other raft is at Dan Put Tor, in a remote area on the northeast of the reservoir.

No.	Forest Protection Unit (7-man teams)	Patrol (# times)			Patrol (# Days)			Distance # (kms.)		
		2018	2019	2020	2018	2019	2020	2018	2019	2020
1	HQ Team 1	24	105	55	72	336	169	1,273.92	2,872	1,198
2	Potana Team 2	21	99	56	57	294	160	578.74	1,843	1,545
3	Kroeng Kraweir Team 3	18	86	47	58	317	163	694.14	2,043	1,527
4	Huai Kaying Team 4	19	105	50	66	326	170	1,365.90	4,196	3,903
5	Phapung Team 5	16	72	42	60	298	162	952.38	3,606	2,693
6	Ong Phra Team 6	18	95	42	62	300	171	828.67	3,225	1,774
7	Nong Kum Team 7	14	87	51	60	322	162	808.21	4,011	1,527
8	Likea Team 8	24	105	60	68	328	168	876.35	3,182	2,335
9	Bo Ong Team 9 (New)	n/a	n/a	52	n/a	n/a	169	n/a	n/a	1,545
	Total	154	754	455	503	2,521	1,494	7,378.32	24,978	18,047.00

Khao Laem patrol teams level of effort comparison, 2018-2020

This year's accumulated patrol figures appear a little lower than last year. However, this is not the full story as each team has now started separating types of patrols, so foot, boat, vehicle and air are now defined separately. Previously, all types of patrol were grouped into one cumulative figure. This year's data patrol represents just foot patrols. We will evaluate the comparative information to decide if it should be left in this format or adapted over consecutive years to allow for this amalgamation (or separation) of data.

The previously mentioned concern about SMART use in Khao Laem (and other parks) is the current emphasis on distance covered. The pressure on the rangers to maintain a relatively high distance for each patrol means quality and safety are being compromised. For example in the rush to ensure the prescribed distance is achieved patrols are stopping less to gather information and less likely to sit and listen for unusual sounds, such as chainsaws. Also, by encouraging rangers to achieve a high coverage they are entering areas which may be dangerous due to flash floods, or forest fires. This problem of lowering standards to increase productivity is something we will be monitoring and discussing with park management. A new Thai Ranger Association (TRA) recently registered with the goal of improving ranger efficiency and safety, concerns such as the one above concerning SMART and distance patrolled will be brought to their attention at the right time for in-depth consideration. As interdictions are the main factor to reduce poaching we will attempt to revive an approach that is evaluated by number of arrests made, rather than distance covered.

³ <https://www.nupasta.com/us/what-is-konjac/>

Wildlife Monitoring

Tiger and prey surveys

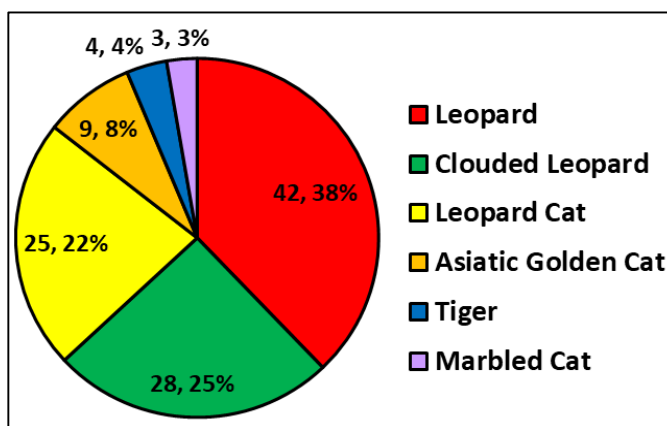
During this year four opportunistic surveys were conducted; Trips KL22, KL23, KL24 & KL25 and one Spatially Explicit Capture Recapture (SECR) grid survey between October 2020 and January 2021. In the four regular ecological surveys we used 102 cameras operational over 7,083 days and for the SECR survey we used 74 cameras (in paired sites) for a total of 3,292 days. The make of cameras involved Bushnell, Browning and Covert Scout brands, a mix of white xenon flash and infrared. For the SECR survey we utilised Panthera V7 white flash cameras in paired stations.

Species	Records	#photo
Tiger	6	35
Leopard	96	223
Clouded Leopard	20	30
Golden Cat	1	1
Marbled Cat	1	1
Leopard Cat	11	11

From the ecological surveys we obtained 6 distinct tiger records across five survey grids and during the SECR survey there were 4 distinct tiger records. Identified tigers included a previously recorded male cub seen during Trip 21 (now known as KL.M3) and one female tiger (KL.F2). We spent more time examining the tiger photos from Trip KL21 during which 3 tigers were recorded together (0.1.1.1). The male cub was identified as KL.03 and appears independent from its mother by Trip KL22. Although, it may be just the mother and other

cub were out of frame. On-going surveys will monitoring and confirm this. Tigers recorded in the grid survey were identified as M2 and M3 and a previously unrecorded female tiger which is now known as F5. There are now 8 positively identified tigers in a sector of Khao Laem with at least three more presently unidentified tiger residing there too.

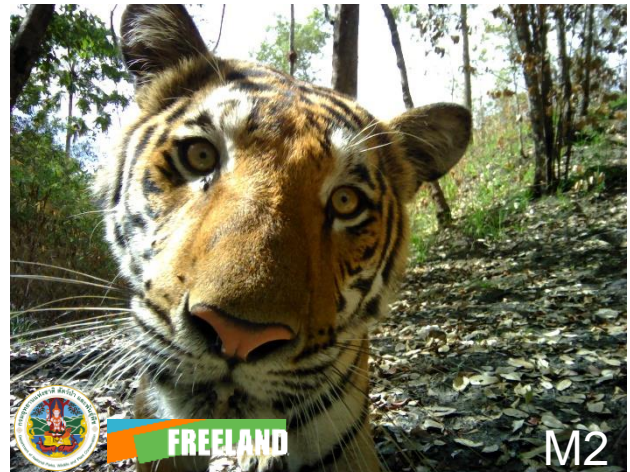
Almost one-hundred Indochinese leopard (*Panthera pardus delacouri*) records were obtained during the ecological surveys, including a female with cub. Two different black leopards were recorded (both males) and at least two further spotted males. Given the current status of this leopard sub-species as critically endangered these records are highly significant. There are further research opportunities here as three large feline species co-exist in the same area (Tiger, leopard, clouded leopard)



Comparison of feline images 2020



Tiger images from 2020



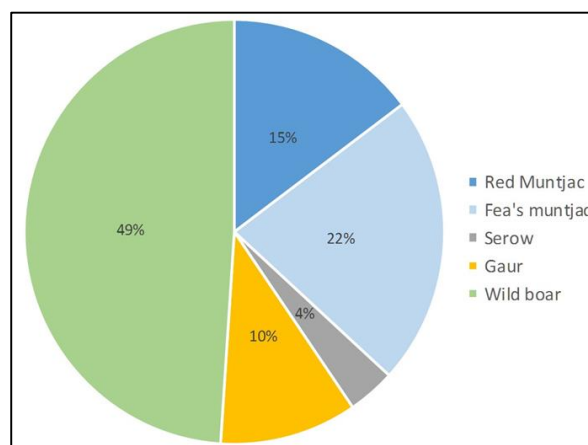
Prey species recorded this year

1. Opportunistic surveys

Species	Records	#photo
Red Muntjak	113	236
Fea's Muntjak	169	334
Serow	28	50
Gaur	81	331
Wild boar	375	1068

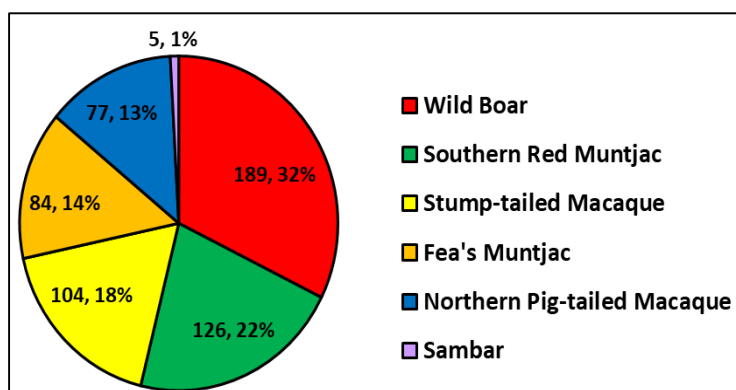
During 2019 the most common prey species photo capture was Fea's muntjak (which is IUCN data deficient) amounting to 34% of all prey captures. However, in 2020 there was been a profound increase in the number of wild boar capture images. This has continued throughout the year. Now at 49% (n=375) of total captures wild boar has become the most common tiger prey species and principal diet. This is further confirmed by field-based rapid faeces analysis, during which every sample consisted of wild boar hair.

The most noticeably absent tiger prey species in the past was the sambar deer. Over the previous five years not a single sambar record was obtained. During this year's SECR grid survey this changed and in the far east of Khao Laem adjoining Thung Yai Naresuan Wildlife Sanctuary sambar were finally recorded. We assume hunting pressure in Khao Laem led to this dearth of sambar. It is probably too early to make any assumptions about a sambar recovery, so we will continue to monitor and observe if sambar continue to be recorded. No banteng records were collected in Khao Laem, this is probably due to unsuitable habitat, as it is mountainous unlike other protected areas with flatlands (with dry or mixed deciduous forests) that have known banteng populations.



Comparison of opportunistic prey captures 2020

2. SECR Phase 1.1



Comparison of SECR prey captures 2020

Six prominent prey species were detected accounting for 47.7% (n = 585) of independent captures of which Wild Boar *Sus scrofa* was the most common 15.3% (n = 189) followed by Southern Red Muntjac *Muntiacus muntjak* 10.3% (n = 126) and Stump-tailed Macaque *Macaca arctoides* 8.5% (n = 104) (See Fig. 4). There are internal discussions occurring about macaques being prey species (or not) at this site.

This resulted in a predator/prey ratio of 4:21 or 15% (n = 111) to 84% (n = 585) independent captures, respectively.

Total independent captures during grid survey with percentage contribution per prey species.

Tiger prey species recorded 2020



Fea's Muntjak



Northern Red Muntjak



Wild Boar



Chinese (or mainland) Serow



Gaur



Sambar (SECR survey only)

Summary of SECR Phase 1.1 implementation

Introduction

Planning this first phase of the SECR survey involved overlaying 3 x 3 km grids on a Khao Laem map. The standard grid utilised extends over all of the entire Forest Complex and ensures all surveys are set over a consistent landscape plan. Grids within the Khao Laem boundary that contained denuded or converted agricultural land were discounted from the survey, as it was assumed tigers or prey would likely not be resident in such areas. We also considered the threat of survey equipment theft by villagers and so by conducting the survey away from communities and agricultural areas we anticipated this would reduce theft (this assumption proved correct and during this first phase no cameras were stolen). In some areas we spoke with community leaders to explain why the cameras were installed in the forest, in case non-timber forest product collectors saw them and were concerned they were being monitored. The project's scope and aims were further explained during Khao Laem's Protected Area Committee (PAC) meetings which involve all relevant local stakeholders.

Method

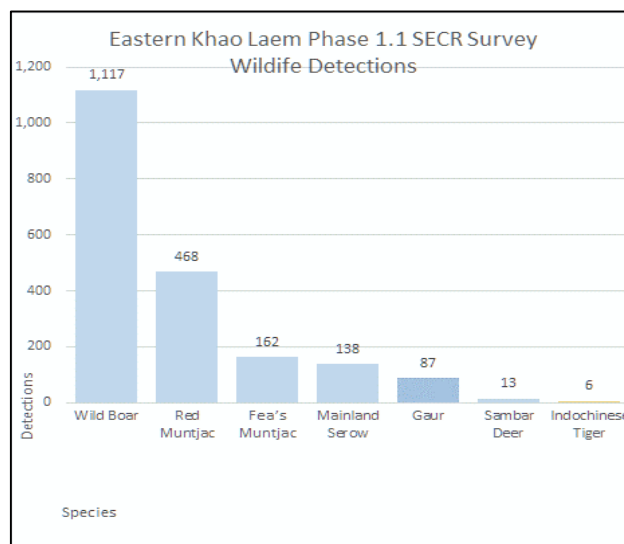
The survey was phased over two distinct parts of Khao Laem; in Phase 1.1, 37 grids of 9km² were placed and Phase 1.2, 48 grids of 9km² were utilized. This gave a total SECR survey area of 765km² to be implemented over the last quarter of 2020 and into the first quarter of 2021.

White flash cameras were installed in pairs across 37 x 9km² grids by six teams. Camera allocations to each survey team considered terrain, regular patrol routes, previous surveys, existing tiger data and the ability of each team to implement camera placement in their grids. Deployment proved a very arduous undertaking and the teams came back exhausted after 6 days. A mid-survey check was conducted during which camera batteries were changed and photographs downloaded. We were planning to operate the grids simultaneously for just 45 days, however the cameras were placed so promptly and effectively that we were able to extend the survey operational period. The final survey period averaged 88.97 days per camera, much longer than we expected.

Results

Over the SECR Phase 1.1 survey cameras operated for combined period of 3,292 days. More than 18,000 images were obtained, of which 8,633 contained wildlife. The main objective of the survey was to acquire tiger and prey data, but a broad snapshot of the parks entire wildlife diversity was obtained and after full analysis will provide more useful baseline information than the tiger and prey originally intended.

The quantity of tiger images was less than anticipated with only 6 records. With the amount of Indochinese leopard images much higher at 96 distinct records, proving the sites importance for the conservation of this critically endangered species. At the time of writing the analysis of tiger and prey data is still in process and expected to be completed by the end of March 2021. At that time we will have occupancy figures for tigers per 100km² and prey.



During 2020 combined opportunistic and SECR grid surveys tigers were detected at 11 locations throughout Khao Laem's SECR grid, four independent detections from the recently deployed SECR grid (of which three were different individuals and seven from the opportunistically placed cameras. Yielding three males and five females all detected within a minimum convex hull of 62km² (see Fig. 1 and 2 - removed). Tiger densities were estimated at 2 per 100km², estimated using the program PRESENCE using the repeated count Royle model for abundance (See table 1 for other carnivore species and prey).

Wild cats accounted for 9% of independent photos ($n = 111$) of which Leopard *Panthera pardus* was the most commonly captured ($n = 42$) followed by Clouded Leopard *Neofelis nebulosa* ($n = 28$) and Leopard Cat *Prionailurus bengalensis* ($n = 25$). Four independent photos of Tigers *Panthera tigris* were obtained (See Fig 3).

Occupancy

A maxent occupancy map was generated using the maxent program providing an output detailing habitat suitability for Tigers with a scale ranging from 0 poor habitat suitability to 1 high habitat suitability (See Figure 5 and 6 removed) For a list of landscape covariates used to generate maxent occupancy maps see Table S1 removed.

Abundance and density

Abundance estimates for predator and prey species were estimated using the program PRESENCE, running the Royle N-Mixture model (Royle, 2004) which estimates population size from temporally replicated point-count data at a number of sample sites. The variation in these point-counts provides information about the distribution of site-specific population size (N). Input data for this model are the counts of the number of individuals observed at each survey (instead of the usual '1' or '0') at each sample site.

Parameters estimated under the assumption of a Poisson distribution:

λ - population density (per site),

p - probability of detection (per individual of the species) per survey

Abundance estimates are the total abundance estimated for all camera locations (37 locations). In order to estimate density, we generated a minimum convex hull around camera locations resulting in 232km². We then divided the estimated abundance by the total area x 100 to get density per 100km².

Limitations of Abundance Estimates and Future Improvements

Future estimates will utilize more sophisticated models such as the Royle Nichols N-mixture model to generate density estimates based on environmental factors such as those used in the maxent maps. Also, during the first phase of trapping only four independent captures of tigers were obtained limiting statistical analysis from programs such as SPACECAP requiring multiple detections and individual ID of Tigers. Following the second phase deployment we should be able to gather additional tiger detections and generate more accurate densities.

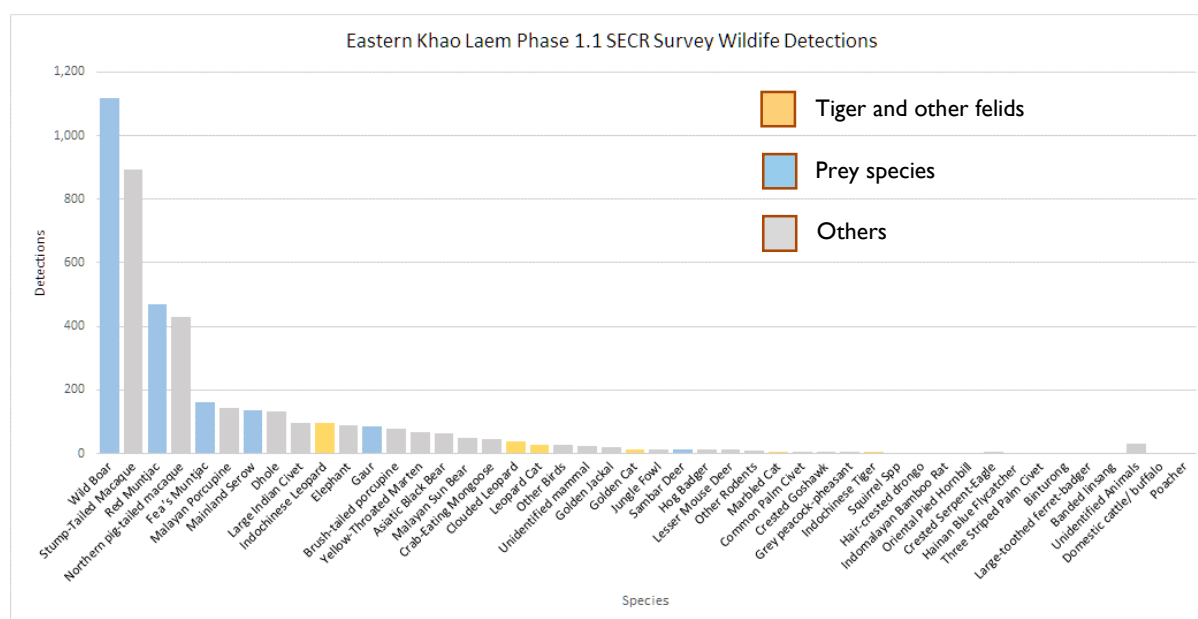
Table 1. A table contain predator and prey species abundance estimates (Royle-occupancy.

Nichols), density per 100km² estimates and

Species	Abundance Estimate (RN)	SD (95%)	Min	Max	Density 100km2	Independent Captures	RAI (100-TN)	Naïve Occupancy	Estimated Occupancy	MCP	Notes
Wildcat											
<i>Panthera tigris</i>	4.77	2.52	1.69	13.44	2.05	4	0.12	0.0556	0.118		3 Individuals*
<i>Panthera pardus</i>	15.98	6.83	6.91	36.91	6.88	42	1.26	0.2083	0.3506		
<i>Neofelis nebulosa</i>	15.64	5.8	7.56	32.35	6.74	28	0.84	0.1806	0.3447		
<i>Prionailurus bengalensis</i>	NA	NA	NA	NA		25	0.75		NA		
<i>Canis aureus</i>	NA	NA	NA	NA	NA	9	0.27	0.1081	NA		
<i>Cuon alpinus</i>	NA	NA	NA	NA	NA	23	0.69	0.2703	NA		
<i>Martes flavigula</i>	NA	NA	NA	NA	NA	32	0.96	0.3243	NA		
Prey											
<i>Sus scrofa</i>	798.94	192.18	498.61	1280	344.37	189	5.67	0.7297	1		
<i>Muntjac spp</i>	119	25.49	78.21	181.07	51.29	204	6.12	0.6757	0.9599		
<i>Bos gaurus</i>	17.41	6.23	8.63	35.12	7.50	23	0.69		0.3754		
<i>Capricornis milneedwardsii</i>	NA	NA	NA	NA	NA	48	1.44		NA		
<i>Rusa unicolor</i>	NA	NA	NA	NA	NA	5	0.15		NA		

Table S1. A table with details of landscape covariates included within the maxent occupancy mapping.

Covariate Type	Covariate Description	Year	Resolution	Source
Edge	Distance to forest edge	2015	1m	(CRISP), National University of Singapore
Forest Integrity	Forest Integrity Index	2020	300m	https://www.forestlandscapeintegrity.com/
Elevation	SRTM Digital Elevation	2020	30m	https://dwtkns.com/srtm30m/
Habitat	MODIS Classification	2015	250m	(CRISP), National University of Singapore
Population Density	Global Human Settlements	2015	250m	https://ghsl.jrc.ec.europa.eu/
Night Lights	DMSP-OLS Night-time Lights	2013	1km	https://eogdata.mines.edu/dmsp/



Obstacles to success that the project has encountered over the last year

Over the last year there have been numerous challenges which have influenced the project. Starting in the dry season of 2020 (Jan-April) Khao Laem was subject to many frequent forest fires. We have no information about how this impacted wildlife within the park, but fire suppression took a considerable amount of the ranger's time. Mostly these fires were deliberately set by villagers hoping to stimulate the growth of mushrooms for the successive rainy season, but also fires were started by poachers to draw wildlife into areas where they could be shot easily. Fire promotes the growth of new grass and the ungulates (tiger prey) move to this to graze.

As 2020 dry season was extremely hot and dry vast sections of Khao Laem were without fresh water. This made already arduous patrolling even more difficult and as previously reported, the lack of fresh water led to some rangers contracting leptospirosis. Fires also posed a danger to the safety of rangers, as it is possible to become surrounded by the fire with no safe exit. The rangers were conscious of this and consequently took care not to put themselves in such a situation.

The covid-19 pandemic initially posed a problem, as the Thai government requested the population self-isolate and banned inter-provincial travel. This however this travel ban was short-lived and we were able to continue ecological surveys in the park without a break. Due to restrictions and careful management of the covid situation by the Thai government the impact of a new covid spike in November 2020 was minimised and by the end of January 2021 there were less than 80 new cases recorded per day. For some conservation organisations their international staff cannot enter Thailand without participating in a 14 day quarantine. This is cost prohibitive for anyone less than permanent staff and so many organisations simply have not been sending western consultants to Thailand. We were not affected by this being based in Thailand, with some staff even living in Kanchanaburi the same province as Khao Laem, meaning inter-provincial travel bans did not apply to them.

We had a slight delay while initiating the SECR grid survey, but this was deliberate and not a problem. Consequently we have been able to substantially increase the size of the survey and make it more comprehensive in nature.

None of the above challenges made a negative impact on the project budget. The modifications to the SECR survey plan did delay the conclusion of the grid survey. But only by a short time and we still hope to have an initial analysis from the eastern survey by the end of March 2021.

Project phasing (6 month revisions as described in the interim report in blue)

Objective	Activities	Team members	Month 2020-21											
			Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
1	Planning project with park/DNP officials by integrating SMART tiger data and 2018-19 tiger survey locations into SECR grid survey plan <i>Revised SECR planning to be late Sept, early October</i>	TR/WI/SS									✓			
	Preparation of survey equipment (e.g. camera-traps, ordering batteries, silica and field equipment) <i>Further equipment for expansion of SECR ordered in September</i>	TR/WI								✓				
	Coordination for large SECR grid survey with rangers - including planning routes to remote locations <i>Revised. To be conducted late September</i>	TR/AS/WI/SS								✓				
	SECR grid camera deployment/on-job-training <i>Revised. May to Aug postponed to Oct-January</i>	WI/SR/SS									✓	✓	✓	✓
	Check (ecological survey) camera-traps and download data. SECR grid first check November	WI/SR	✓		✓		✓			✓		✓		
	Collate/catalogue camera-trap data – on-going	WI & AS										✓	✓	✓
2	SECR Survey Analysis Workshop <i>Revised – date TBD in 2021</i>	FF/DNP/EA/SS												
	Prepare analysis report. <i>Revised full report due August 2021, but interim analysis report may be prepared in early 2021</i>	TR/WI/EA												
M & E	End-of-project debrief with DNP officials <i>Revised. As the full SECR survey will not be concluded until the end of 2021 the terminating debrief will be delayed. However quarterly meetings with the wildlife conservation are now proposed.</i>	WI/TR/EA												
Reporting	Report to WildCats Conservation Alliance	TR								✓				Mar

In objective 1 all proposed activities were implemented successfully. Over the year the two described surveys were conducted including the Phase 1.1 eastern SECR survey and in February 2021 Phases 1.2 was successfully started. The first camera checks in western Khao Laem will be in April 2021, with the SECR survey being concluded in May 2021. The plan is to revisit eastern Khao Laem starting October 2021, to re-run the SECR survey to enable a short term comparison survey to be conducted.

Activities in Objective 2 involves a data analysis workshop, in-depth data analysis and the SECR survey debrief are all delayed due to two reasons, firstly the huge amount of data returned from the surveys is taking longer than anticipated to catalogue and analyse and secondly, all project are busy implementing parallel surveys in adjoining protected areas, and no one is free to join a workshop. With due permission from WildCats we would like to adjust this workshop activity to be a courtesy trip to Huai Kha Kheng WS tiger centre, where we will brief our partners in the DNP and prepare plans for an analysis survey in late 2021 or early 2022. By that time we hope that the covid situation will have improved and the international experts we were hoping would also join the workshop will be able to enter Thailand.

Budget:

The project budget expenditures were on track and there were no over-runs. See attached excel file containing the ledgers of expenses and a financial report allocating the expenses into the budget format.

From the granted £18,779.00 (746,465THB) we carried over 42,762.44THB from 2019 for a total 2020 budget of 789,227.69THB. We utilised 756,047.59THB leaving a balance of 33,180.00THB in hand. This was originally allocated for the data analysis workshop, but we would like a modification to utilise these funds for another complementary activity to be described in a request letter.

Media: Please provide a list of recent publications and media both local and national which mentions the work funded by this project and/or mentions WildCats Conservation Alliance

Tiger/Project related media

Mongabay Feb. 2021: For border-crossing Thai tigers, the forest on the other side isn't as green
<https://news.mongabay.com/2021/02/for-border-crossing-thai-tigers-the-forest-on-the-other-side-isnt-as-green/>

IUCN Web news July 2020: IUCN joins #RoarforThaiTigers - Global Tiger Day 2020, underscores need for transboundary tiger conservation
<https://www.iucn.org/news/thailand/202008/iucn-joins-roarforthaitigers-global-tiger-day-2020-underscores-need-transboundary-tiger-conservation>

Towards the end of this project a team of reporters from UK's Ch4 TV news joined to film the work. This news story was not aired due to the US elections. However, the story has now been adapted into a 30 minute documentary which looks at the success of in-situ tiger conservation in Thailand in contrast to the severe problems of domestic tiger farming.

During 2020 a group of poachers from Vietnam were arrested in Thailand with tiger remains from Thung Yai WS, the adjoining park north of Khao Laem. These traffickers travelled by bus from Vietnam, across Lao PDR to Thailand specifically to poach and traffic tiger parts back to Vietnam. This was well covered in the Thai media, although it did not make the international press. We investigated the story, met with police and witnesses and even gave a small reward to witnesses who informed the police about the traffickers.

Two Khao Laem related news stories made the local media over the last few months. Both involve large scale encroachment cases.

October 2021. B15m resort owned by retired major general being demolished
<https://www.bangkokpost.com/thailand/general/1998863/b15m-resort-owned-by-retired-major-general-being-demolished>

March 2021 Thai language encroachment case concerning a coffee shop and fruit farm highlighted in DNP social media <https://www.facebook.com/1608062546175314/posts/2798702957111261/>

Donations and park support

Over the last six months from a complementary donation we have been able to support patrolling provision supplements for Khao Laem, which helped sustain and foster increased effort in SMART patrol data collection. To assist the park further we also supported printers (utilising the 2019 WildCats carry over) so copies of reports can be shared with relevant supporting offices such as the Protected Area Regional Office in Ban Pong, Kanchanaburi. We also supported the preparation and printing on vinyl of large Khao Laem 1/50,000 UTM maps, so each substation could clearly see the terrain within their area of responsibility. We expect these hard wearing maps to last many years. We also supplied long sleeved shirts to all the rangers to wear under their uniforms.



Items donated to support Khao Laem



30 sets of field equipment donated in October 2020



January 2021. Compass donation for patrols



January 2021. Donated water filters

Appendix

Opportunistic/ecological survey results

Locations of cameras during ecological surveys during 2020
(102 cameras operational over 7,083 days)

Tiger images 2020 (February 2020 - January 2021 KL22-25)

Indochinese Tigers (*Panthera tigris corbetti*)



Tiger (*Panthera tigris*)
6 encounters with 35 images
Identified 6 individuals

Other carnivores encountered during this year.

Indochinese Leopards (*Panthera pardus delacourii*)

Leopard images (February 2020 - January 2021 KL22-25)



25 Indochinese leopard records



Clouded Leopards (*Neofelis nebulosa nebulosa*)

(February 2020 - January 2021 KL22-25)



8 clouded leopard records



Appendix.

Logframe - Khao Laem: Tiger Conservation Project with September 2020 revisions and comments in brown and 2021 final output in right column

Impact; This project will help secure the future for tigers in one of the remaining two known breeding populations of Indochinese Tigers.			
Project Summary	Measurable Indicators	Means of Verification	Final output
<p>Outcome:</p> <p>Improved management and evidence-led protection strategies facilitating safer tiger dispersal within WEFCOM help maintain the site as one of mainland Southeast Asia's last tiger strongholds</p>	<p>1. Rigorous scientific methods are utilised to survey tigers at Khao Laem, indicators will include:</p> <p><i>A Tiger density (tigers per 100km²) is obtained during a post SECR survey data analysis workshop</i></p> <p><i>The first ever formal tiger population size established for KLN</i></p> <p><i>Number of individual tigers identified during surveys that have been documented in other parts of WEFCOM obtained via sharing photographs with the Khao Nam Ram research station in Huai Kha Kheng WS</i></p> <p><i>Update: This collaboration and data sharing occurred every two months</i></p> <p><i>Number and density of likely prey species to support the local tiger population</i></p> <p><i>Interim update: As SECR grid survey delayed until October - prey data analysis similarly delayed.</i></p> <p>2. Comprehensive post SECR survey data analysis and associated workshop delivers an accurate understanding of tiger density and</p>	<p>1.1 Camera-trap survey results demonstration capture rate improvement compared with previous year</p> <p>1.2 Analysis of SECR data using R suite Spacecap package during data analysis workshop, leading to the first ever tiger abundance estimate for Khao Laem NP</p> <p>1.3 Comparing tiger photos' recorded during SECR survey with National DNP tiger database will identify resident individuals and differentiate from dispersing individuals from the Thung Yai-Huai Kha Kheng source site</p> <p><i>Update: Confirmed 3 tigers not in the national database</i></p> <p>1.4 Park SMART database will be utilised to compare 2018, 2019 and 2020 patrol coverage, violations and wildlife sign. As patrols become more efficient we <i>expect</i> to see a decline in violations and an increase in wildlife sign recorded. However, there are many factors that may influence such change either way.</p>	<p>1.1 During 2019 we recorded 6 individual tigers from 103 images and during 2020 we recorded 6 individuals over 35 images. Comparison of two years level of effort; 2019 = 8,302 Camera trap days 2020 = 10,373 Camera trap days.</p> <p>This year represents a 25% increase in effort and we expected to see a corresponding increase in tiger image captures. This was not the case. However, as the number of identified individual tigers stayed constant this is not concerning.</p> <p>1.2 Tiger data analysis is on-going with using R suite package Spacecap use explanation above in report narrative</p> <p>1.3 Comparing individual tigers through images. Only one of the KLN tigers was ever recorded previously and is in the national database. We are planning a trip to the tiger centre in Huai Kha Kheng to sit in person with their team to run through the Khao Laem images.</p> <p>1.4 SMART annual comparison. This was conducted and a brief overview of some figures are here in this report. As expected there were various external factors that influenced this year's figures. These have been discussed in the narrative of this report.</p>

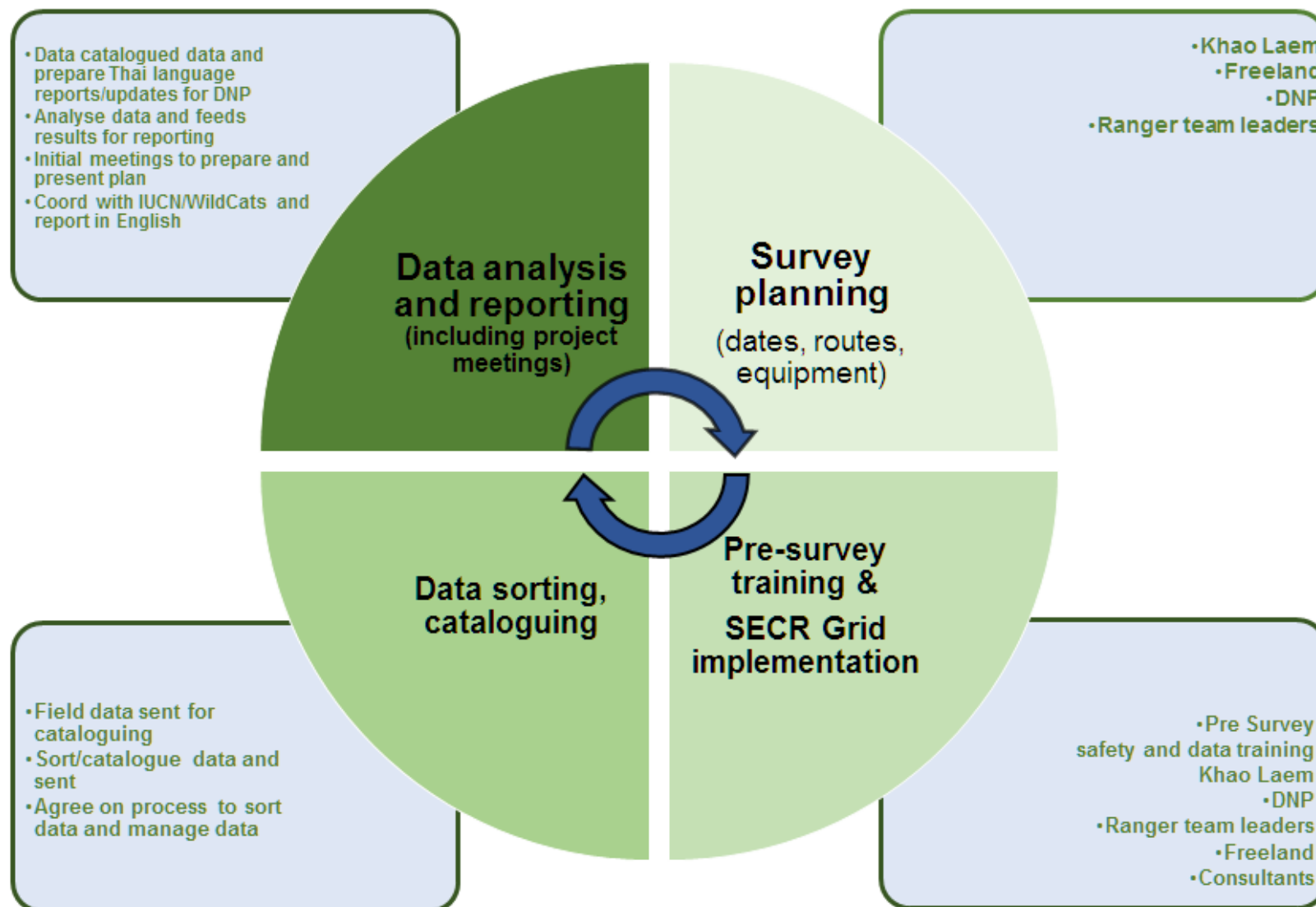
	<p>produces standardised comparative baseline figure for tigers at the site <i>Interim update: Delayed as SECR survey delayed</i></p> <p>3. Cost share: KLNP demonstrates dedication to continuing park-based wildlife and violation monitoring, metrics recorded in SMART will include:</p> <p><i>Number of potential sources of threat, or disturbance, documented and compared for changes</i></p> <p><i>(2019-1/2 baseline figures include 8 encroachment cases, 9 logging cases, 4 poaching offences).</i></p> <p><i>Number of patrol reports (SMART) generated independently by the park (Baseline 12 – remains at 12)</i></p> <p><i>Overall improvement in patrol effectiveness over the 2020 project period. Utilising SMART we will compare 2019 baseline coverage (185 Patrols over the course of 663 days covering distance of 6,841.14 km²)</i></p>	<p>1.5 Post-project debrief questionnaire with DNP officials with key focal indicators discussed, including ranger efficiency, interdicted crimes, and news from confidential informants</p>	<p>1.5 As the project is on-going we have not discussed matters formally with senior officials and so assumptions about park protection effectiveness are anecdotal at this point.</p> <p><i>Additional comment. As this project and others in Thailand are generating positive results about tigers this will be amalgamated into the Thailand report for the 2022 International tiger summit in Russia, demonstrating a tiger population increase and constructive cooperation between stakeholders.</i></p> <p>2. The SECR survey has been postponed for now until the phase 1.2 SECR survey is completed and data been catalogued in the first quarter of 2022</p> <p>3. SMART. The figures for this are in the report. All identified indicators were met. See the table 'Khao Laem patrol teams level of effort comparison, 2018-2020'</p>
Objective 1. Improving knowledge of tigers, prey and threats in KLNP			

<p>Output 1.</p> <p>Freeland in conjunction with KLNP officials deploy 40 camera-traps in a SECR survey consisting of at least twenty 3km x 3km grids (>180km²). This will be designed to correspond to an existing standard landscape grid design that encompasses the whole WEFCOM landscape and following analysis help understand abundance, distribution and dispersal of tigers at the site.</p>	<p>At least 180km² of now identified proven tiger habitat surveyed utilising 3 x 3 km SECR grid. Baseline 144km² (informally surveyed) Target: 180km² formally surveyed Revision. This has now been increased with additional support from IUCN to be 765km²</p> <p># tigers initially identified during survey Baseline 5 Target: >10</p> <p># of potential prey species identified during surveys. Baseline 4 Target: >5</p> <p>Namely, gaur, serow, wild boar, barking deer + 1 more</p> <p># of key sites or corridors important for tiger dispersal identified Baseline 0 Target: >2</p> <p>Update. An important (unprotected) wildlife corridor northwest of Khao Laem has been identified. Measures will be introduced to assess this site in 2021</p>	<ol style="list-style-type: none"> 1. Camera-trap survey results will lead to an immediate identification of individual tigers and prey species and a basic understanding of abundance 2. Following discussions and analysis during joint post activity Data Management and analysis workshop key dispersal sites for increased protection will be identified 3. Feedback from external advisors/partners (e.g. DNP, Panthera, WildCRU wildlife researchers) will help understand the situation and guide next steps 	<ol style="list-style-type: none"> 1. Output 1 was surpassed with 765km² formally surveyed during the SECR survey. With 96 cameras 2. Tigers to be identified. The prediction was 10, this was not achieved as only 6 were positively identified. However, a further 3 were recorded, but images were not good enough for a positive identification. One new tiger was recorded. 3. Potential prey species identified during surveys. This increased from 4 (if the two muntjak species are lumped together) or 6 if they are not and with the addition of sambar. Therefore this target was met, 4. Through the grid survey we have been able to identify sites with high species richness and one area north of Khao Laem (Khao Chang Phuek) which forms a corridor between Thung Yai West WS and Thung Pha Phum NP. This mountainous area remains un-surveyed at the time of writing. We hope to conduct some low intensity surveys around mid-2021 5. We have been working with biologists from Nottingham university as Eric Ash from WildCRU is concluding his PhD and extremely busy. As surveys are still on-going we have not made any progress on next steps.
<p>Objective 2. Building capacity in DNP staff to manage, interpret and analyse camera trap and SMART data</p>			
<p>Output 2a.</p> <p>Freeland will work with park staff to collate camera-trap information. We will mentor staff on standard practices of camera-trap database</p>	<p>KLNP Officials mentored on standard practices of camera-trap database management and types of information required for summarizing results. Baseline 0 Target: 2</p> <p>Update. One official has already been identified and received some training</p>	<ol style="list-style-type: none"> 1. Camera trap data analysed during joint post activity data management and SECR data analysis workshop. Officials ability will be verified during this activity through review of each by supervising biologists from project partners (FF, Panthera, DNP) 	<ol style="list-style-type: none"> 1. SECR survey is still on-going and tiger and prey data is still being collated for analysis 2. The SECR surveys were implemented as planned, albeit a little later than anticipated. 3. Workshop is delayed 4. We are still awaiting initial data analysis to deliver figures useful for comparative analysis

<p>management and types of information required for summarizing results. A data analysis training workshop will be implemented at KLNP. Information will be concluded into a summary report on the tiger situation at the park. Results will be incorporated into the WEFCOM tiger survey database and provide guidance for discussion and included in the next Thailand Tiger Action Plan (due in 2022).</p> <p>Update. We are in dialogue with Panthera/ZSL about pooling resources to conduct a larger data analysis training workshop in 2021</p>	<p>A data analysis workshop held with KLNP and other DNP staff participating. Partner NGOs working in this landscape and scientific institutions will be invited as instructors and trainers.</p> <p style="text-align: right;"><i>Baseline 0</i> Target: 1</p> <p>Revision. This will now occur in late 2021 or 2022</p>	<ol style="list-style-type: none"> 2. Figures verified during same post activity data management and SECR analysis workshop 3. Finally figures are discussed and agreed with DNP at a national level 	
<p>Cost share activity: Supporting independent wildlife surveys, SMART patrolling and gauging effectiveness of results (note as KLNP officials are already trained in use of SMART this last component is aimed more at supporting field based data collection and mentoring enhanced data entry and interpretation)</p>			
<p>Output 2b.</p> <p>Number of DNP officials with increased capacity in survey, monitoring and patrolling</p>	<p>Capacity development during this project will be informal on-job-training and mentoring in decision making processes mostly involving best practices in tiger surveys.</p> <p style="text-align: right;">Current Baseline 0 Target 8 team leaders trained #rangers able to use trail cameras, know where to place them for best results Current baseline 30</p>	<ol style="list-style-type: none"> 1. Assessment of officials' skill retention will be gauged during on-job-training and more formal evaluation activities, with results concluded in a validation report. 2. Feedback from park superintendent about staff performance will be 	<ol style="list-style-type: none"> 1. Through mentoring during surveys we have been able to train 6 officials in survey and monitoring. 2. The number of rangers joining each survey varied, from 27 to 47. Their attention varied and not all showed an interest in learning how to use the survey equipment. 3. Officials using SMART has stayed constant. Unfortunately the level of competence is

skills trained during the project life	<p>Target 40</p> <p>Update. 14 rangers has received on-job-training and a further 20-25 will receive more formal training in early October before initiating the SECR survey</p> <p>#SMART Data entry officials mentored in higher level SMART software use (such as plug-ins including SMART profiles and possibly SMART field sensors to catalogue camera data).</p> <p>Current baseline 2</p> <p>Target 4</p> <p>#rangers receiving on-job-training in contemporary patrol procedures (dependent on further resources)</p> <p>Current baseline 0</p> <p>Target 8</p>	<p>canvassed during training validation and also included in this report</p> <p>3. Freeland Law enforcement advisor will implement and report on validation exercise identifying individual officials trained and their increased ability</p> <p>4. Park SMART database outputs demonstrate an increase in data entered</p> <p>5. Post-project debrief with DNP officials</p>	<p>quite low and reporting remains basic. More input is required to improve capacity.</p> <p>4. We were able to conduct survey training for 44 rangers. This did not involve patrol tactics or other aspects of law enforcement though. We supported the new Thai Ranger Association to submit a proposal to IUCN which will fund a SMART patrol training course. At the time of writing we learnt they were successful and that IUCN will support their proposal. This will also lead to more patrol equipment being donated to rangers.</p>
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Khao Laem SECR Tiger and prey survey 2020-2022 Implementation flowchart



Appendix – Species recorded during SECR Phase 1.1

Common Name	Scientific Name	Thai Name	Status (2020)	First 45 days	Second 45 days	Total 90 days
Indochinese Tiger	<i>Panthera tigris</i>	เสือโคร่ง	Endangered	5	1	6
Indochinese Leopard	<i>Panthera pardus</i>	เสือดำ เสือดาว	Critically Endangered	32	64	96
Clouded Leopard	<i>Neofelis nebulosa</i>	เสี้อยายเมฆ	Vulnerable	20	19	39
Golden Cat	<i>Pardofelis temminckii</i>	เสือไฟ	Near Threatened	4	11	15
Leopard Cat	<i>Prionailurus bengalensis</i>	แมวคาว	Least Concern	17	10	27
Marbled Cat	<i>Pardofelis marmorata</i>	แมวลายหินอ่อน	Near Threatened	7	0	7
Dhole	<i>Cuon alpinus</i>	หมาใน	Endangered	58	76	134
Golden Jackal	<i>Canis aureus</i>	หมาจิ้งจอก	Least Concern	5	17	22
Large Indian Civet	<i>Viverra zibetha</i>	ชะมดแคงหางปล้อง	Least Concern	55	42	97
Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	อีเห็นข้างลาย, อีเห็นธรรมดา	Least Concern	3	4	7
Three Striped Palm Civet	<i>Arctogalidia trivirgata</i>	อีเห็นหน้าขาว	Least Concern	1	0	1
Binturong	<i>Arctictis binturong</i>	หมีขอ หรือ บินตุรง	Vulnerable	1	0	1
Yellow-Throated Marten	<i>Martes flavigula</i>	หมาไน	Least Concern	55	14	69
Crab-Eating Mongoose	<i>Herpestes urva</i>	พังพอนกินปู	Least Concern	22	24	46
Large-toothed ferret-badger	<i>Melogale personata</i>	หมาหริ่ง	Least Concern	0	1	1
Banded linsang	<i>Prionodon linsang</i>	ชะมดแปดลายแถบ	Least Concern	1	0	1
Hog Badger	<i>Arctonyx collaris</i>	หมูหริ่ง	Vulnerable	12	0	12
Asiatic Black Bear	<i>Ursus thibetanus</i>	หมีควาย	Vulnerable	3	62	65
Malayan Sun Bear	<i>Helarctos malayanus</i>	หมีหมา	Vulnerable	14	37	51
Wild Boar	<i>Sus scrofa</i>	หมูป่า	Least Concern	607	510	1,117
Mainland Serow	<i>Capricornis milneedwardsii</i>	เลียงผา	Near Threatened	41	97	138
Fea's Muntjac	<i>Muntiacus feae</i>	เก้งหม้อ	Data Deficient	88	74	162
Red Muntjac	<i>Muntiacus muntjak</i>	เก้ง	Least Concern	106	362	468
Brush-tailed porcupine	<i>Atherurus macrourus</i>	เม่นหางพวง	Least Concern	35	43	78
Gaur	<i>Bos gaurus</i>	กระทิง	Vulnerable	68	19	87
Sambar Deer	<i>Rusa unicolor</i>	กวางป่า	Vulnerable	1	12	13
Lesser Mouse Deer	<i>Tragulus kanchil</i>	กระซอกหนู	Least Concern	6	6	12
Elephant	<i>Elephas maximus</i>	ช้างเอเชีย	Endangered	52	38	90
Stump-Tailed Macaque	<i>Macaca arctoides</i>	ลิงเสน	Vulnerable	402	491	893
Northern pig-tailed macaque	<i>Macaca leonina</i>	ลิงกังเหนือ	Vulnerable	174	256	430
Malayan Porcupine	<i>Hystrix brachyura</i>	เม่นใหญ่แดงคอดยาว	Least Concern	77	66	143
Indomalayan Bamboo Rat	<i>Rhizomys sumatrensis</i>	อีหนูใหญ่	Least Concern	2	1	3
Squirrel Spp				3	1	4
Other Rodents				3	5	8
Unidentified mammal				0	24	24
Jungle Fowl	<i>Gallus gallus</i>	ไก่ป่า	Least Concern	3	11	14
Hair-crested drongo	<i>Dicurus hottentottus</i>	นกแซงแซวหางค้อน	Least Concern	4	0	4
Crested Goshawk	<i>Accipiter trivirgatus</i>	เหยี่ยวนกเขาหางขอ	Least Concern	7	0	7
Grey peacock-pheasant	<i>Polyplectron bicalcaratum</i>	นกแว่นสีเทา	Least Concern	4	3	7
Oriental Pied Hornbill	<i>Anthraceros albirostris</i>	นกแก้ว	Least Concern	1	2	3
Crested Serpent-Eagle	<i>Spilornis cheela</i>	เหยี่ยวรุ้ง	Least Concern	3	0	3
Hainan Blue Flycatcher	<i>Cyornis hainanus</i>	นกจับแมลงอกสีฟ้า	Least Concern	2	0	2
Crested Serpent-Eagle	<i>Spilornis cheela</i>	เหยี่ยวรุ้ง	Least Concern	0	3	3
Raptor Spp				0	0	0
Other Birds				8	19	27
Unidentified Animals				33	0	33
Poacher				1	2	3
Protected Area Staff				123	0	123
Team Setup Staff				1,923	2,121	4,044
Domestic dog				0	20	20

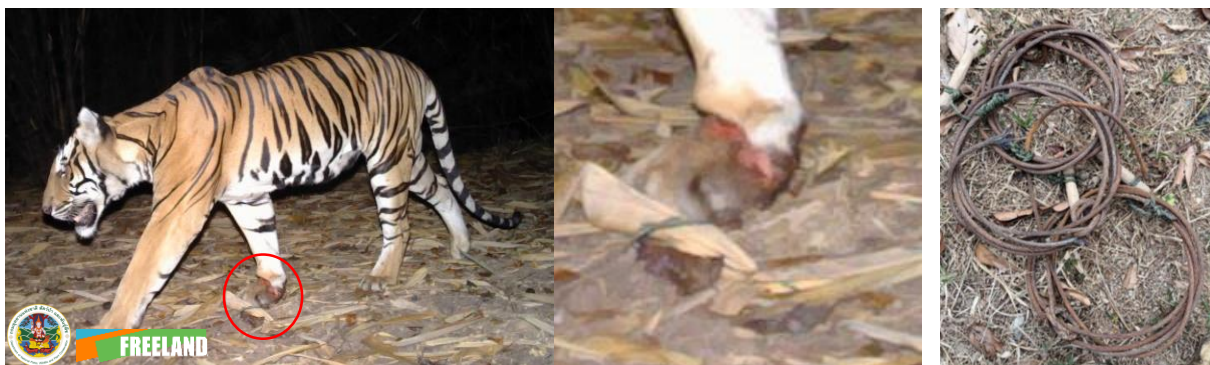
Poachers and other threats recorded during the grid survey



During the grid survey relatively few poachers were recorded. However, as the survey was conducted during the dry season the NTFP collectors were not working and so this considerably reduced the amount of people in the forest. There were 20 domestic dog records. This is concerning as any of these may be a vector carrying viral diseases that could jump to wild carnivores, especially canine distemper virus (CDV) which has been recorded infecting tigers in many range states. None of the feral dogs or those belonging to poachers have ever been vaccinated against such viruses.

Snares

As with the rest of Southeast Asia snaring is a problem at Khao Laem. The most heavily impacted area is in the north of the park on the river that divides Khao Laem from Thung Yai. Here a community comprised of Karen and migrant workers regularly poach in the park using snares. The following image of a tiger from that area clearly demonstrates snares remain a serious issue.



Next steps (CYQ2_2021 TO Q4_2021)

March 2021

By the end of March initial population figures will be produced for tigers and prey. Ecological cameras checked

April 2021

Following 45 days deployment SECR cameras will be checked for the first time (batteries changed and data downloaded). Review and start cataloguing images

May 2021

End of SECR Phase 1.2. Cameras collected back from field. Data cataloguing starts. Ecological cameras checked

June 2021

Data cataloguing completed and data analysis starts

July 2021

Ecological cameras checked

August 2021

Ranger training

September 2021

Ecological cameras checked

October 2021

Phase 2.1 SECR survey starts in East Khao Laem

November 2021

SECR survey cameras checked. Ecological cameras checked

December 2021

SECR survey running

January 2022

End of SECR Phase 2.1 Cameras collected back from field. Data cataloguing starts. Ecological cameras checked