



WWF

INTERNATIONAL



SILENCE OF THE SNARES

Southeast Asia's snaring crisis



WWF is one of the world's largest and most experienced independent conservation organisations, with over 5 million supporters and a global network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by: conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

A WWF Tigers Alive Initiative, WWF Singapore, and WWF Greater Mekong production

The designation of geographical entities in this report, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of WWF concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Citation:

Belecky, M., Gray, T.N.E. (2020). Silence of the Snares: Southeast Asia's Snaring Crisis, WWF International

Authors: Mike Belecky, Gray T.N.E. WWF Tigers Alive Initiative

Design: Devina Siswanto, Visual Producer at WWF Singapore

Published in 2020 by WWF – World Wide Fund For Nature (Formerly World Wildlife Fund), Gland, Switzerland. Any reproduction in full or in part must mention the title and credit the above-mentioned publisher as the copyright owner.

© Text 2020 WWF

All rights reserved

Acknowledgements

WWF Greater Mekong provided the impetus to spotlight the snaring crisis in the GM in 2018, initiated an early version of the report, facilitated access to data from the Mekong countries and is a key collaborating office for this report.

We would like to thank all the tiger-range governments, partners and WWF Network offices for their support in the production of this report, particularly WWF Greater Mekong as well as the following people in particular:

Abdul Halik, WWF-Singapore; Andy Roberts, Wildlife Alliance; Arnaud Lyet, WWF Tigers Alive Initiative; Arnold Sitompul, WWF-Thailand; Ashley Brooks, WWF Tigers Alive Initiative; Ben Rawson, WWF-Viet Nam; Camile Coudrat, Anoulak; Carol Debra, WWF-Malaysia; Colman O Criodain, WWF International; Crispian Barlow, WWF International; Fanie Bekker, WWF-Viet Nam; Francois Guegan WWF-Laos; Hannah O'Kelly, Asian Arks; Heather Sohl, WWF Tigers Alive Initiative; Henry Chan, WWF-Malaysia; James Peter Lourens, WWF-Cambodia; Jenny Roberts, WWF Tigers Alive Initiative; Katrina de Rozario, WWF-Malaysia; Khalid Pasha, WWF Tigers Alive Initiative; Kim Stengert, WWF-Singapore; Le Quoc Thien, WWF-Vietnam; Leng Lida, Wildlife Alliance; Lorraine Scotson, IUCN Species Survival Commission; Lotika Mehta, WWF International; Madhu Rao, WCS-Global; Margaret Kinnaird, WWF International; Mark Darmaraj, WWF-Malaysia; Mark Drew, WWF Cambodia; Michelle Gan, WWF-Singapore; Nicholas Wilkinson; Nick Cox, WWF-Myanmar; Nick Marx, Wildlife Alliance; Ollie Roberts, Wildlife Alliance; Prapimpan Ngoentip, WWF-Thailand; Rachel Yan Ting Koh, WWF-Singapore; Rob Parry-Jones, WWF International; Rohit Singh, WWF International; Rucha Naware, WWF International; Rungnapa Phoonjampa, WWF-Thailand; Shariff Mohamad, WWF-Malaysia; Simon Attwood, WWF-Singapore; Simon Mahood, WCS-Cambodia; Suwanna Gauntlett, Wildlife Alliance; William du Buys; Yoganand Kandasamy, WWF Greater Mekong; Zin Mar Hein, WWF-Myanmar.

Working Team:

Michael Alexander (WWF Singapore), Michael Belecky (WWF Tigers Alive), Stuart Chapman (WWF Tigers Alive), Thomas Gray (WWF Tigers Alive), Tristan Tremschnig (WWF Tigers Alive).

Front cover photo © Ranjan Ramchandani / WWF





CONTENTS

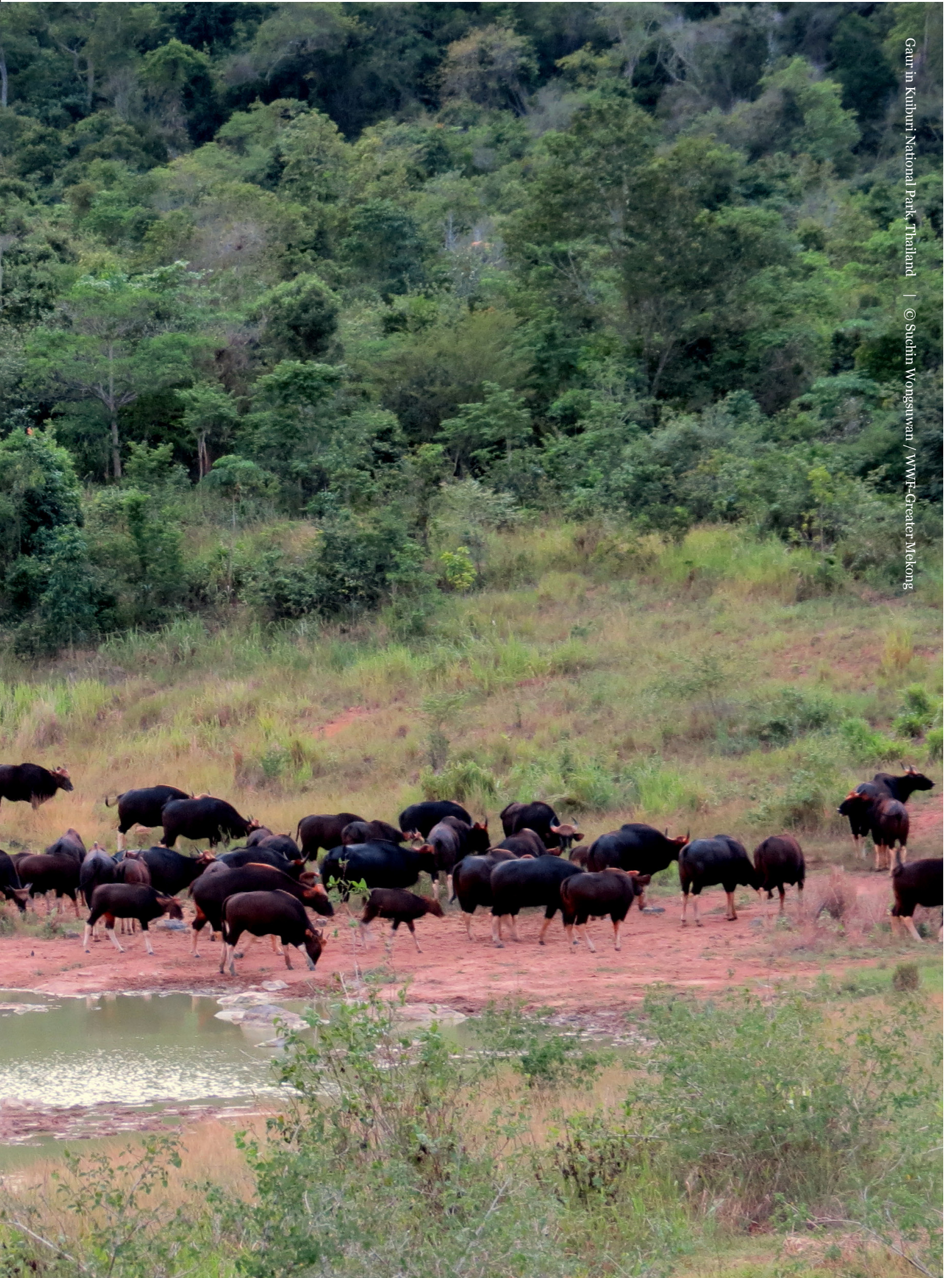
Executive Summary	04
Introduction: Southeast Asia’s wildlife under threat	08
Section 1: An overview of the snaring crisis	12
<i>Part 1: Types of snares</i>	
<i>Part 2: Animals caught in snares</i>	
<i>Part 3: How many snares are there?</i>	
Section 2: Patrolling and snare removal	30
<i>Recommendations</i>	
Section 3: Snaring, wildlife consumption, and zoonotic diseases	38
<i>Recommendations</i>	
Section 4: Empty forests and ecosystem services	46
Section 5: Indigenous peoples and local communities	56
<i>Recommendations</i>	
Section 6: Legal regulation of snaring in Southeast Asia	68
<i>Recommendations</i>	



EXECUTIVE SUMMARY

Snares are contributing to a wildlife extinction crisis, while also impacting ecosystems that support human well-being across Southeast Asia.

Usually made from wire cable, nylon, or rope, snares are rudimentary traps used to supply demand for wildlife meat and products. They also increasingly supply an urban demand for wildlife, which is often consumed as a delicacy. Overall, snares impact more than 700 mammal species in the region, including rare and charismatic animals such as the Asian elephant, Sumatran rhinoceros, saola, and banteng. They are also now the greatest threat to the long-term presence of tigers in Southeast Asia.



EXECUTIVE SUMMARY

This report details the scale of the snaring crisis, its impacts on people, nature and wildlife, and lays out a set of recommendations, which if taken holistically, could help halt and reverse this crisis.

Analyzing the largest set of data to date, WWF estimates that there are over 12 million snares present in the protected areas of Cambodia, Lao PDR and Viet Nam - a group of countries that are at the centre of the regional snaring crisis. It is these same countries where snaring has been implicated in the rapid decline and likely extinction of tigers. Evidence is provided that shows these snares to be a threat to the remaining wild tigers in other Southeast Asian countries.



Banteng | © Anton Vorauer / WWF



Asian elephant | © Julia Thiemann / WWF-Germany

The total number of snares on the ground in Southeast Asia will likely be far greater than the figures estimated in this report, which only look at a portion of the region's total protected areas. Furthermore, snares are ubiquitous outside protected areas, and often concentrated just beyond their boundaries.

In the region, commercial poachers are setting snares in large numbers to capture animals for wildlife trade - and in many cases this trade is illegal. This trade increasingly supplies meat - often as a delicacy - to urban consumers, with the flow of wildlife from remote and rural areas negatively impacting the food security for the small proportion of Southeast Asians who rely on wildlife to meet nutritional needs. This reduces the ability of indigenous peoples to obtain benefits from nature and maintain compatible cultural practices.



Saola | © David Hulse / WWF

A major additional concern is that from handling to consumption of wildlife, snare use increases human exposure to species carrying zoonotic diseases. As is discussed in this report, many of the animals targeted by snaring have been identified as among the highest risk for zoonotic disease transmission.

Urgent action is needed to address the threat snaring poses to wildlife, ecosystem services, and public health. WWF recommends that the governments of Southeast Asia strengthen legislation to act as an effective deterrent against snaring, with the approaches for doing so outlined in this report. More resources are required to support national protected areas and effective government law enforcement patrolling. Governments must take steps to limit the purchase, sale, transport and consumption of wildlife species that are of high risk for zoonotic disease transmission. This will include most of the ungulates and carnivores that are major targets for snaring. Demand reduction programmes built on solid evidence and understanding of snaring and wildlife consumption drivers are needed. Finally, but critically, governments must engage local communities as leaders and partners in the effort to end widespread snaring. These measures are necessary if we are to protect the ecosystems all Southeast Asians depend on.

“Snares impact over 700 mammal species in the region; these include rare and charismatic animals such as the Asian elephant, Sumatran rhinoceros, saola, and banteng.”





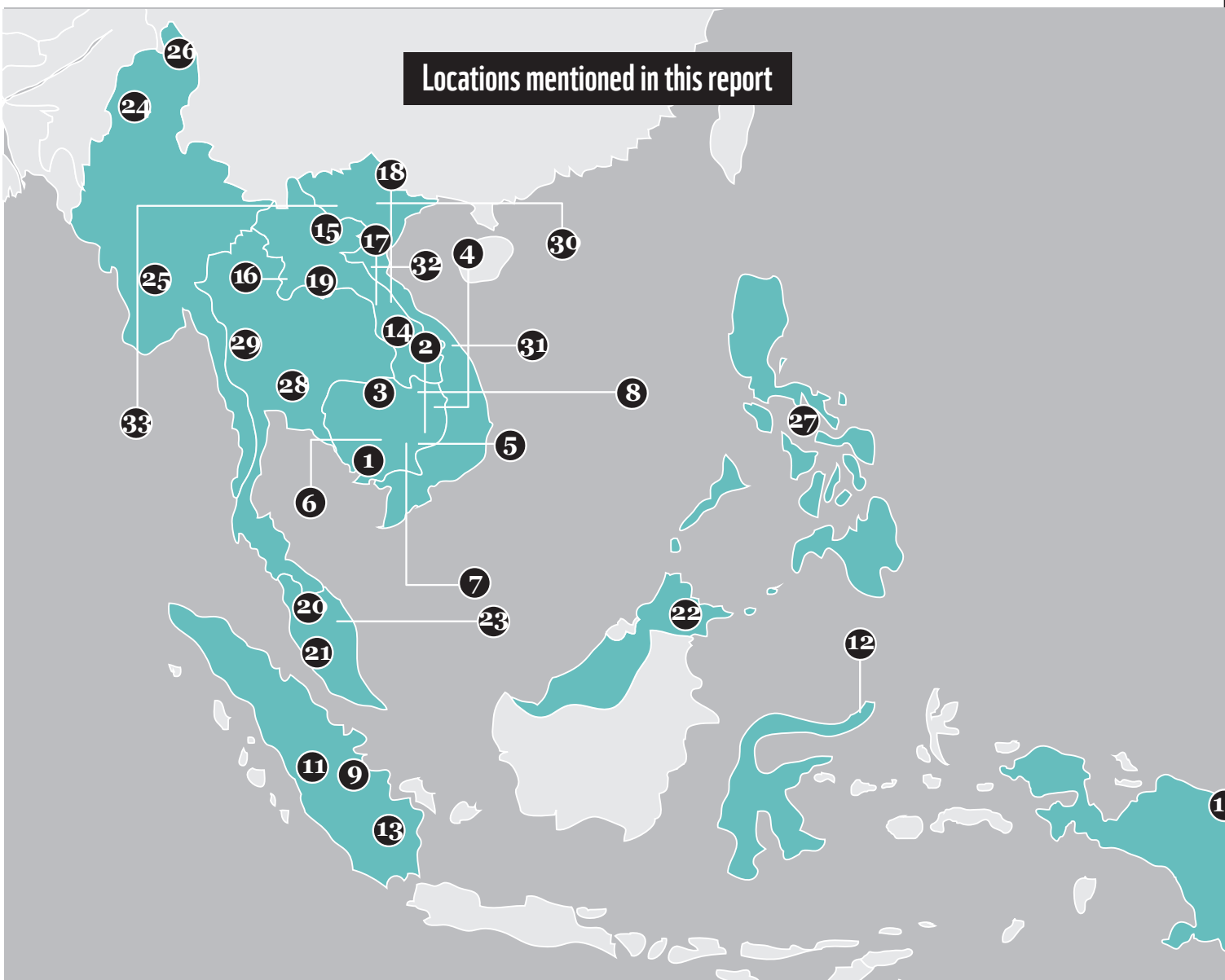
INTRODUCTION

SOUTHEAST ASIA'S
BIODIVERSITY UNDER THREAT

INTRODUCTION

Southeast Asia is one of the most biologically rich regions on Earth. From the Himalayan peaks of Myanmar to the rainforests of Borneo, millions of species call this region home.

And hundreds of new species are discovered annually including more than 2,600 new discoveries in the Greater Mekong region alone since 1997.¹ From the world's most famous and iconic predator, the tiger, to species less well known to the public such as Owston's civet, Southeast Asia is home to some remarkable species.



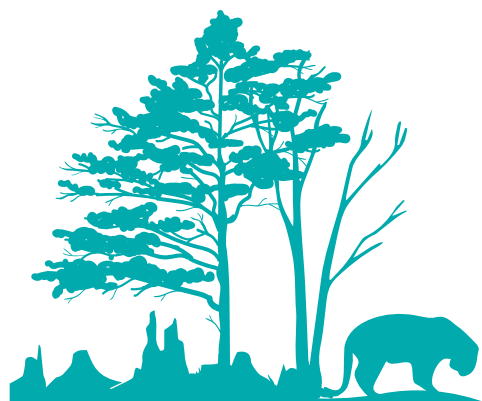
However, the region is also experiencing rapid change. For one, its human population has nearly doubled since 1980 – from 357 million then, to roughly 668 million in 2020. Economies and urban centres are also growing quickly, in many cases fuelled by rapid expansion of linear infrastructure, logging, mining, and industrial plantations. These trends have increased human access to wild places and contributed to dramatic declines in wildlife in the region. These declines have been accelerated by regional consumption of wildlife products – particularly wildlife meat, but also for use as pets, medicine or ornamentation. Today Southeast Asia has more threatened species, across almost every taxonomic group, than any other comparable region.²

As we show in this report, the increasing and widespread use of snares is, alongside habitat loss and degradation, a major reason Southeast Asia is in the midst of a major decline in wildlife.³ Many areas of the region are already experiencing a corresponding ‘snaring crisis’, where even protected areas have large quantities of these indiscriminate traps. Given that snares can capture all animals unfortunate enough to encounter them, they are a terrestrial equivalent to the drift-nets that have devastated marine and freshwater biodiversity. In this way the snaring crisis threatens not only animals, but also the ability of ecosystems to function in a manner that best supports human life and the well-being of future generations of Southeast Asians.

This report highlights what we currently know about the snaring crisis in Southeast Asia. It also provides a number of specific and realistic solutions that can be adopted by the governments of the region to contain and reverse it. If such measures are not urgently taken, many more species and ecosystems will be irreparably harmed, also impacting the many people who depend on them.

Note: this report contains numerous images of animals caught in snares. This may be disturbing to some readers, so we advise caution before proceeding.

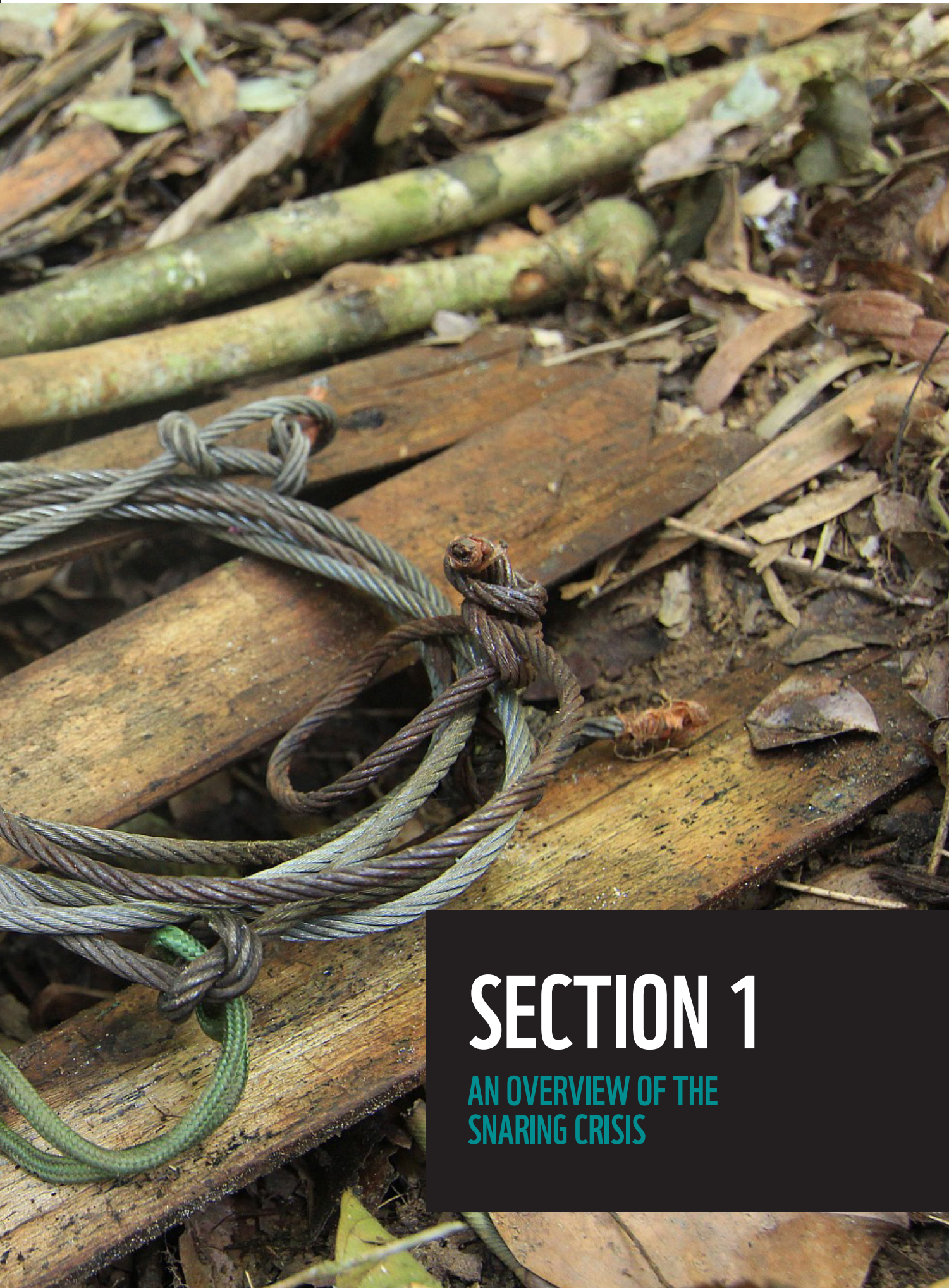
1. Cardamom National Park, Cambodia
2. Keo Seima Wildlife Sanctuary, Cambodia
3. Kulen Promtep, Cambodia
4. Srepok Wildlife Sanctuary, Cambodia
5. Phnom Prich Wildlife Sanctuary, Cambodia
6. Phnom Penh, Cambodia
7. Mondulkiri Province, Cambodia
8. Western Siem Pang Forest, Cambodia
9. Jambi Province, Indonesia
10. Jayapura, Papua, Indonesia
11. Kerinci Seblat National Park, Indonesia
12. Manado, North Sulawesi, Indonesia
13. Sungai Menang District, South Sumatra, Indonesia
14. Khammouane Province, Lao PDR
15. Nam Et-Phou Loey National Protected Area, Lao PDR
16. Nam Pouy National Protected Area, Lao PDR
17. Nakai-Nam Theun National Protected Areas, Lao PDR
18. Phou Chom Voy Provincial Protected Area, Lao PDR
19. Vientiane, Lao PDR
20. Belum Temengor Forest Complex, Malaysia
21. Kuala Lumpur, Malaysia
22. Sabah, Malaysia
23. Taman Negara National Park, Malaysia
24. Hponkanrazi Wildlife Sanctuary, Myanmar
25. Myanmar (multiple site study)
26. Yenwe Forest Reserve of Kyauktaga township, Myanmar
27. Philippines (multiple site study)
28. Khao Yai National Park, Thailand
29. Thung Yai Naresuan Wildlife Sanctuary, Thailand
30. Hanoi, Viet Nam
31. Hue-Quang Nam Saola Reserves, Viet Nam
32. Pu Mat National Park, Viet Nam
33. Son La Province, Viet Nam





A cable snare used to poach a tiger in Belum-Temengor Forest Complex, Malaysia.

© WWF-Malaysia/Lau Ching Fong



SECTION 1

AN OVERVIEW OF THE
SNARING CRISIS

SECTION 1: An overview of the snaring crisis

PART 1: Types of snares

Snaring is one of the simplest but most effective hunting techniques practiced in Asia.

Snares are cheap to produce and easy to set in large numbers; with home-made wire, nylon or cable snares the predominant form of hunting across large areas of Southeast Asia.⁴ These differ from ‘traditional’ snares, which are made from liana, rattan, and other natural fibres. These materials serve to limit both the total number of snares that can be set at one time, and on their ‘lifespan’ after they are placed. Cable or wire snares, in contrast, can be produced quickly and cheaply, have inexhaustible supply, and can remain active in the forest for long periods of time.

What is a snare?

Snares are animal traps in which anchored flexible nooses (often made from cable, wire nylon, or rope) are set to trap animals around the neck, torso, or leg.

Drivers of the snaring crisis:

- Increased demand for wildlife meat from growing urban middle class consumers in East and Southeast Asia
- Increased accessibility into previously remote protected areas due to infrastructure developments (e.g. roads, hydropower) – this enables hunters to access such areas more easily, and allows for the rapid transport of wildlife back to urban areas.
- Increased access to and use of wire cable and rope snares by poachers, as opposed to the more traditional liana and rattan.
- Gaps in wildlife protection legislation in relation to snaring, as well as inconsistent enforcement of existing wildlife protections and protected areas laws.

Snares do not pick and choose the species they trap, making them an indiscriminate method of hunting. Anything and everything on the forest floor, from tortoises to elephants, are vulnerable. Because snares are used to catch a wide variety of species (see pages 20-23) they continue to be placed even after the most commercially valuable species become rare in a given area. This differs from many other hunting methods, which often allow a species to recover (or at least stabilize at low levels) as it becomes more rare and less likely to be encountered by hunters. Snares however, continue to remove individuals from the population, therefore preventing the natural recovery of overexploited species.

Given that both the effort and costs of setting snares is so low (particularly for nylon or rope snares), there is little disincentive that might stop hunters or poachers from placing them. Indeed, many snares are set and never checked, with a significant proportion of the animals caught in them left to rot. Snares have often been singled out as one of the cruelest means of hunting, given that animals can sometimes languish for days or weeks in a snare before dying from their injuries, dehydration or from starvation. Even when an animal does escape a snare, it will often perish later from infection caused by the injury, or starve due to the fact that the injury has limited its ability to walk, forage or hunt.



Confiscated wire snares from eastern Cambodia.

© WWF Cambodia



Large cable snares set for ungulates, Lao PDR.

© Saola Working Group



Single species target - type-specific impact

These snares are set for single species based on its body-size and shape, and are unlikely to trap or kill species with a different body type. They are frequently set in order to capture live animals for use in wildlife farms, although many die before traps are checked.

Snares of this type are relatively rare, and their use influenced by market pressures. For example, snares which target civets are set to capture these animals for civet coffee farms in Viet Nam, Indonesia, and the Philippines. It is estimate that thousands of wild civets are captured every year to maintain these farms.⁶ Additional examples of body size limited snaring include snares targeting porcupine and pangolin.



Single species target - indiscriminate impact

In many cases, snares are set with a specific target species in mind. Often, but not exclusively, these are high value species such as tiger or bear, which are illegally traded for perceived medicinal or status value. These snares are not as specialized in design as the body-type specific snares and as such catch a wide variety of species. These are usually set in lower numbers and with greater thought and effort than for multi-species targeting snares. Examples include:

- Thick wire cable snares for tigers
- Large drift fences with big cable snares for bears



Multi-species target - indiscriminate impact

This is by far the most common type of snare in Southeast Asia, and particularly prevalent in Cambodia, Lao PDR, and Viet Nam. These are often constructed with cheap and locally available materials such as rope, nylon or thin wire cables (often bike brake cables), and can be placed in high numbers with little investment, effort, or planning. The motivation for their placement can be the capture of ungulates to sell into the wildlife meat trade (larger snares) or to capture small carnivores or birds (smaller snares). However, as an indiscriminate snare, they catch many other animals.

These snares have a wide variety of types, and differ in position, anchor type, material and presence or absence of a drift fence. A drift fence is a small barrier constructed with sticks that corrals all animals moving along a path towards snares which are set in regularly spaced gaps along the fence.



Electric Snares

There is recent evidence of the use of electric snares to hunt ungulates. These lethal home-made contraptions can be constructed by connecting wire cables to freestanding batteries, via an inverter, or by attaching wire cables directly to electric power lines. These wire cables can then be laid across the ground for hundreds of metres, and have even been used to electrify waterholes and saltlicks. Although often made from similar materials as the ‘trapping’ snares that are the focus of this report, these electric snares differ in the way that animals are killed.

In 2019 across two protected areas in eastern Cambodia a total of 1.3 kilometres of electric snares were removed and deactivated by rangers.



At least four human deaths due to electric snaring have occurred in Cambodia and Indonesia in recent years:

- In November 2016 Sorn Phoeaurn, a deputy police chief, was killed in Mondulkiri Province after stepping on shock snare cables with an attached battery.⁷
- In November 2019, Yem Sokhim, a farmer in Mondulkiri Province, was killed instantly by an electric snare as he went to collect water near a rice field.⁸
- In December 2019, an electrified wire cable set to kill deer and pigs, caused the deaths of two individuals, Supardi and Ripul Amsa, in the Sungai Menang District of South Sumatra, Indonesia.⁹



Snares for crop-guarding

Throughout Southeast Asia snares are used by local farmers in the vicinity of their villages as a crop guarding mechanism (i.e. to prevent wild animals eating cultivated plants). These snares are still indiscriminate, and can kill many non-target (including endangered) species and deplete wildlife populations. Other means of preventing or compensating for crop damage by wildlife should be actively promoted. Preventative means can include fencing, light or noise deterrents, or the hiring of guards to watch crops at night.

Snared banteng and red muntjac trophies.




























© Lor Sokhoeurn / WWF-Cambodia

SECTION 1: An overview of the snaring crisis

PART 2: Animals caught in snares

Snares are known to capture mammals, birds, and reptiles, with more than 700 Southeast Asian mammal species directly exposed to and negatively impacted by snaring.





































These include some of the region's most iconic and well known species like tiger, elephant, rhinoceros, orangutan, and bears. Overall, snaring impacts 80% of Southeast Asian families of land mammals.

		<i>Family</i>	<i>English Name</i>	<i>Species in SEA</i>
	 	Muridae	Mice, rats, gerbils	300
	 	Cricetidae	Hamsters, voles, lemmings	4
	 	Sciuridae	Squirrels	94
	 	Spalacidae	Bamboo rats	4
	 	Hystricidae	Porcupines	7
		Diatomyidae	Laotian rockrat	1
	 	Soricidae	Shrews	67
	 	Erinaceidae	Hedgehogs	7
		Cercopithecidae	Monkeys	45
		Hylobatidae	Gibbons	17

 *Target for snaring*

 *Possibly targeted for snaring*

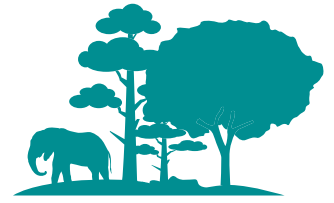
 *By-catch from snaring*

		<i>Family</i>	<i>English Name</i>	<i>Species in SEA</i>
		Hominidae	Great Apes	3
	 	Bovidae	Cattle	17
	 	Cervidae	Deer	23
	 	Suidae	Pigs	12
	 	Tragulidae	Chevrotain	6
	 	Moschidae	Musk Deer	2
	 	Mustelidae	Weasels-Martens	18
	 	Felidae	Cats	11
		Canidae	Dogs	5
	 	Herpestidae	Mongoose	6
	 	Viverridae	Civets	13
	 	Mephitidae	Stink Badgers	2
	 	Ursidae	Bears	2
		Prionodontidae	Linsang	2
		Ailuridae	Red Panda	1
	 	Leporidae	Rabbits	6
	 	Ochotonidae	Pikas	2
		Tupaiaidae	Tree Shrews	20
	 	Rhinocerotidae	Rhinoceros	2
	 	Tapiridae	Tapirs	1
	 	Manidae	Pangolins	3
		Elephantidae	Elephants	1

Cambodia, Lao PDR, and Viet Nam are at the centre of the Southeast Asian snaring crisis with higher number of snares than elsewhere in the region (see page 26). There are twelve terrestrial mammal species (i.e. excluding bats, primates, cetaceans) classified by the IUCN as Endangered or Critically Endangered within these three countries, all of which are strongly impacted by snaring. Unless snaring is drastically reduced it is likely that these species will disappear from the region. An additional seven Endangered or Critically Endangered semi-terrestrial primates, including grey and red-shanked douc, also occur in these three countries – they too are imperilled by the regional snaring crisis.

The 12 terrestrial mammal species in Cambodia, Viet Nam and Lao PDR that are classified by the IUCN as Endangered or Critically Endangered are all strongly impacted by snaring.





"There are twelve Endangered or Critically Endangered terrestrial mammal species in Cambodia, Lao PDR and Viet Nam which are strongly impacted by snaring."



Large-antlered muntjac



Saola



Hairy-nosed otter



Annamite striped rabbit



Banteng



Dhole





SECTION 1: An Overview of the Snaring Crisis

PART 3: How many snares are there?

Data were collected on the number of snares removed by rangers from 11 protected areas in five Southeast Asian countries (Cambodia, Indonesia, Lao PDR, Malaysia, Viet Nam) between 2005 and 2019 (Table 1). There were between three and 10 years of data collected per site. Across all patrolled sites a total of 371,856 snares were removed (approximately 53,000 per year) (Table 1).

<i>Site</i>	<i>Size</i> (km ²) ¹⁰	<i>Snares</i> (total removed)	<i>Snares removed</i> <i>/year</i> average)	<i>Data years</i>
Srepok Wildlife Sanctuary, Cambodia ¹	3,730	12,600	1,260	2010-2019
Phnom Prich Wildlife Sanctuary, Cambodia ¹	2,700	7,219	1,444	2015-2019
Keo Seima Wildlife Sanctuary, Cambodia ³	2,990	8,477	942	2010-2018
Kulen Promtep, Cambodia ³	5,500	10,789	2,158	2014-2018
Southern Cardamom National Park, Cambodia ²	5,546	195,206	19,521	2010-2019
Nam Et-Phou Loey National Protected Area, Lao PDR ⁶	3,000	1,144	191	2010-2015
Nam Pouy National Protected Area, Lao PDR ¹	2,500	240	80	2016-2018
Nakai Nam Theun National Protected Area, Lao PDR ⁴	3,445	3,400	850	2016-2019
Hue-Quang Nam Saola Reserves, Viet Nam ¹	320	127,857	14,206	2011-2019
Royal Belum State Park, Malaysia ¹	1,175	1,272	212	2014-2019
Kerinci Seblat National Park, Indonesia ⁵	6,500	3,652	365	2005-2014

Table 1: Snare removal data from 11 sites in Southeast Asia.

Data Sources

¹ WWF / Government Partner SMART Patrol Reports

² Gray et al., 2018 / Wildlife Alliance Annual Reports [https://www.wildlifealliance.org/financial-reports/]

³ WCS / Government Partner SMART Patrol Reports

⁴ Anoulak Annual Reports [https://www.conservationlaos.com/resources/our-annual-reports/]

⁵ Risdianto, D., Martyr, D.J., Nugraha, R.T., Harihar, A., Wibisono, H.T., Haidir, I.A., Macdonald, D.W., D'Cruze, N. and Linkie, M., 2016. Examining the shifting patterns of poaching from a long-term law enforcement intervention in Sumatra. *Biological Conservation*, 204, pp.306-312.

⁶ Gray, T.N., Hughes, A.C., Laurance, W.F., Long, B., Lynam, A.J., O'Kelly, H., Ripple, W.J., Seng, T., Scotson, L. and Wilkinson, N.M., 2018. The wildlife snaring crisis: an insidious and pervasive threat to biodiversity in Southeast Asia. *Biodiversity and conservation*, 27(4), pp.1031-1037.



Detecting snares in Southeast Asia

Although ubiquitous across Southeast Asia's forests, snares are not easy to find. They are usually small, concealed and spread across vast, remote areas. As such, even well-trained and motivated ranger patrol teams have difficulties finding and removing snares. One experimental study that attempted to quantify frequency of snare detection involved a group of Cambodian rangers who were instructed to search prescribed 1x1-km grid cells for 'dummy' snares which had been set by the researcher in collaboration with local hunters. Slightly fewer than 40% of available snares were detected in evergreen forest sites, while just over 20% of snares were detected in mixed forest sites.¹¹ In the same landscape a modelling exercise using snare survey data (collected by law enforcement rangers but not during routine patrol activities) estimated snare detection probability at ~33%.¹² A similar study suggested snare detection probability was ~25% within a 0.25-km² area during a 60-minute search by trained rangers.¹³

However, the 'average' detectability of snares by rangers in Southeast Asian protected areas may be significantly lower, for two reasons: i) the above rates were estimated in controlled conditions, where rangers were preoccupied with identifying the dummy snares (normal patrol conditions would differ), and; ii) the rangers used in this study were highly trained and supported by high levels of conservation investment in capacity building and management.

It should be recognized that the entirety of any given protected area is not patrolled every year, and that even in those areas patrolled not all snares would be detected by law enforcement teams. Therefore, to derive an estimation of the total number of snares in each protected area the following three assumptions were made:

- Snares could only be detected during foot patrols.
- Rangers patrolled on foot 25% of the protected area annually.
- In areas covered by patrols, between 10% (low detection rate) and 30% (high detection rate) of total snares present were detected (see text box above). Figures reported below are from a medium detection rate (20%) with low and high rates provided in parenthesis.

Within each protected area the total number of snares estimated, using the above assumptions, was divided by the area covered by snare removal patrols in order to estimate site-specific snare densities. Site-specific snare densities were then averaged to produce a regional snare density estimates. This was then applied across all protected areas in the sub-region for which enough data was available to reasonably make such an estimate (eastern continental Southeast Asia – see Table 2).

Important note: the estimation of the number of snares present in Southeast Asia is a best estimate based on limited data, and as such lacks high levels of statistical certainty. The numbers are provided to demonstrate the severity of the snaring crisis in Southeast Asia.

The estimated snare density across the 11 protected areas varied dramatically, from 880/km² (590-1,775) in the Hue-Quang Nam Saola Reserves in Viet Nam to 1.1/km² (0.7-2.2) in Kerinci Seblat,¹⁴ Indonesia. Based on protected area specific snare densities the total number of snares present across the 11 protected areas was estimated at **824,580** (549,170-1,649,160). Between them, these 11 protected areas cover almost 40,000 km² and support critical populations of some of Asia's rarest and most charismatic mammals including tiger, Asian elephant, saola, and banteng. All of these species are directly threatened by the Southeast Asian snaring crisis, with this huge number serving to highlighting the extent of that threat.

Regional differences pertaining to snaring:

In eastern continental Southeast Asia (Cambodia, Lao PDR, Viet Nam) smaller snares were set in large numbers, mainly to capture ungulates and small mammals for commercial wildlife meat trade. Across the nine sites in these countries the mean density of snares was estimated to be 110.7/km² (73.8-222.5).

Although snares of this type are also found in the Sundaic study sites (Peninsular Malaysia and Sumatra), many snares in those countries are of the thicker cable variety (5-10mm thick). This indicates that the poachers who set them were likely aiming to capture larger animals such as tiger, leopard or bear that would be able to chew through or break smaller snares.

These differences between regions also speaks to the fact that intensive snaring causes animal extirpations in a stepwise fashion, eventually culminating in an 'empty forest' (see page 48). First, larger species disappear from the snared landscape, and then progressively smaller animals become locally extinct. This progression has been observed in Cambodia, Lao PDR and Viet Nam with few large animals remaining in many of these countries' protected areas.¹ Without strong action this same scenario could soon play itself out across the rest of Southeast Asia.

Estimates for total snares in the protected areas of Cambodia, Lao PDR and Viet Nam are provided in Table 2. No such estimate is produced for the Sundaic study sites owing to insufficient sample size (n = 2). As such, the production of more snare encounter rate studies in these countries (and others such as Thailand, Myanmar, and the Philippines) should be recognized as a priority activity.

To estimate the number of snares across the region from which the majority of available studies were sourced (eastern continental Southeast Asia, which includes Cambodia, Lao PDR and Viet Nam) the regional snare density average from existing snare detection data (Table 1) was extrapolated to the remainder of protected areas across those countries (Table 2).

The calculations indicate that there are an estimated **12.3 million snares** (8.2 – 24.8 million) present in the protected areas of Cambodia, Lao PDR, and Viet Nam.



A sun bear found caught in a snare in the Belum Temengor Forest Complex, Malaysia.

© WWF-Malaysia/
Lau Ching Fong

The total number of snares laid across Southeast Asia will be considerably higher than this number. Although the available evidence from the two study sites in the Sundaic region suggests that snare numbers may be far lower in other Southeast Asian countries, it is still important to recognize that the estimate above (12.3 million snares) accounts for only a fraction of the ASEAN region’s total protected areas (roughly 11%).² Furthermore, snares are frequently set outside protected areas (often just outside their boundaries) with similarly destructive consequences for wildlife.

Country	Protected Area Coverage (km²)³	Geographical sub-region	Estimated snare density (km²)	Estimated number of snares present
Cambodia	47,503	Eastern continental Southeast Asia	110.7	12,296,445
Lao PDR	38,582		(73.8-222.5)*	(8,197,630-24,715,078)*
Viet Nam	24,994			

**minimum and maximum range of estimated snare numbers in parenthesis.*

Table 2: Estimated snares present in the protected areas of Cambodia, Lao PDR and Viet Nam.

Data Sources

¹ Gray, T.N., Billingsley, A., Crudge, B., Frechette, J.L., Grosu, R., Herranz-Muñoz, V., Holden, J., Keo, O., Kong, K., Macdonald, D. and Neang, T., 2017. Status and conservation significance of ground-dwelling mammals in the Cardamom Rainforest Landscape, southwestern Cambodia. *Cambodian Journal of Natural History*, 2017, pp.38-48. See also; Hoffmann, M., Abramov, A., Duc, H.M., Long, B., Nguyen, A., Son, N.T., Rawson, B., Timmins, R., Van Bang, T. and Willcox, D., 2019. The status of wild canids (Canidae, Carnivora) in Vietnam. *Journal of Threatened Taxa*, 11(8), pp.13951-13959. See also; Rasphone, A., Kéry, M., Kamler, J.F. and Macdonald, D.W., 2019. Documenting the demise of tiger and leopard, and the status of other carnivores and prey, in Lao PDR's most prized protected area: Nam Et-Phou Louey. *Global Ecology and Conservation*, 20, p.e00766.

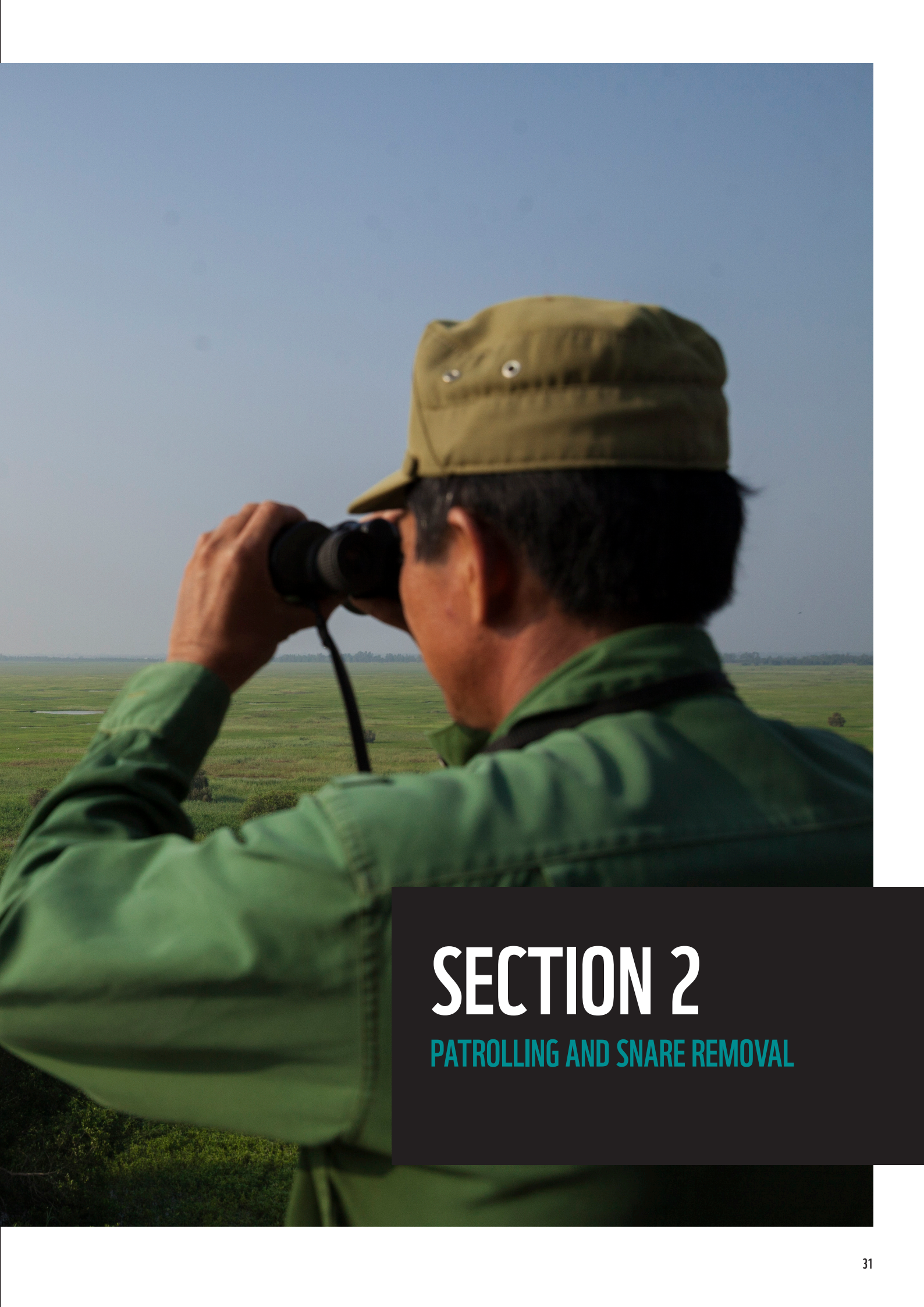
² The landscape for which the 12.3 million snare estimate is made accounts for 64,539 km², which is only 10.8% of the 595,339 sq.km. of terrestrial PA coverage across all 10 ASEAN countries.

³ Sources for total protected area coverage calculations were obtained from: IUCN/UNEP at <https://www.protectedplanet.net/>



*Government park guard,
Chanh Minh Do, looks
through binoculars over
Tram Chim National
Park, Viet Nam.*

© Thomas Cristofolletti / WWF-US



SECTION 2

PATROLLING AND SNARE REMOVAL

SECTION 2: Patrolling and snare removal

Government and community rangers undertake a wide variety of roles to ensure that protected areas maintain their biodiversity and ecosystem services function for the benefit of current and future generations.

Effective law enforcement patrolling reduces threats to wildlife in protected areas¹⁵ and is a critical component of comprehensive anti-poaching strategies, such as the Zero Poaching Framework.¹⁶



National forest guard with wire snare in Central Annamites, Viet Nam.

© Denise Stilley/
WWF-Viet Nam

In Southeast Asia a widely employed strategy is the use of ranger patrols, both as a means of enforcing anti-snaring laws, and also to directly remove snares. This is one of the most straightforward approaches to combatting the snaring crisis, although it comes with some limitations, given that it generally does not address the root causes of poaching. The potential of ranger impact in anti-snaring work is often further limited by a low probability of serious legal consequences for apprehended offenders, resulting in little disincentive for those involved in snaring to stop placing new snares (see page 72).

As noted in the previous section, between 2005 and 2019 more than 370,000 snares were removed by patrol rangers from just 11 protected areas in five countries. As to the task of snare removal alone (i.e. ignoring any deterrent effects) there are three main constraints that currently limit the overall impact of using rangers for this task. These are; i) insufficient numbers of rangers in many parts of Southeast Asia; ii) the low detectability of snares; and iii) the low cost of snare replacement. As such, in the majority of high snare density landscapes ranger patrols alone will fall well short of removing the majority of snares.¹⁷

Insufficient number of rangers and poor work conditions

- Recent assessments have revealed that government rangers in Southeast Asia are dealing with multiple issues that might limit their overall effectiveness. A survey conducted at the work sites of more than 2,000 rangers in this region showed that 30% did not believe their original training was sufficient to prepare them for the job, and roughly half thought that their basic equipment and communications devices were inadequate. More than half also believed that the poachers they apprehend were treated too lightly by judges and prosecutors, which may negatively influence motivation.¹⁸
- Best international practice recommends that governments ensure 2-10 rangers per 100km² of protected area. ¹⁹The density within this broad range that will be appropriate is dependent on the scale of the poaching threat. Given the acute threats of widespread snaring and other wildlife crime in Southeast Asia, countries in this region would be advised to attain ranger densities of between 5-10 rangers/100 km², a threshold that the majority of Southeast Asian countries likely fall below at this time.

Low detectability of snares

- Even when rangers are well equipped, trained, and motivated, the probability of rangers detecting snares in a patrolled area is low.²⁰
- When snare detectability by rangers increases, poachers have been observed to change their behaviour in response – for example, by hiding and disguising snares, or placing them off trails or in less clustered patterns.²¹
- Intelligence-led patrolling significantly increases snare detectability. In Sumatra, Indonesia, it was found that patrols conducted on the basis of local information sharing were significantly more likely to detect snares than routine patrols, with tip offs increasing detections by over 40%.²²
- Foot patrols are the only effective mean for detecting snares. However, foot patrol coverage is often low in Southeast Asian protected areas²³, where the use of vehicles or boats is commonplace.





How effective are snare removal strategies?

Where highly valuable and rare species (e.g. tiger or rhinoceros) are hunted by organized poaching gangs using snares, the high opportunity costs of this type of snaring often means that intensive snare removal efforts may be an effective deterrent. Such snaring requires significant time and effort by hunters, who often travel across international borders and then walk days through difficult terrain to reach remote sites, survey for animal signs, and set large and heavy cable snares. Such large snares, particularly those which have been set for tigers, a species which generally moves predictably along paths and animal tracks, are also much easier to find than smaller ungulate snares. As such the destruction of a high proportion of snares is possible and may be viewed as a significant setback by the poachers that placed them.

It should be noted however that this snaring scenario is not the regional norm, and that numerous studies have concluded that snare removal alone is insufficient to prevent the negative impacts of snares on wildlife.

For instance, under most modelled scenarios, snare removal by ranger patrolling is unlikely on its own to be the difference between extinction and survival for most species. Abundant and quickly reproducing species often survive even with no snare removals while rare and slower breeding species are still likely to be extirpated according to this modelling.²⁴

Evidence shows that snare removal patrols can reduce snare abundance by up to one-third, especially where initiated in areas with no previous patrolling. This has been demonstrated in Viet Nam and Malaysia following the creation of community led patrolling, anti-poaching, and snare removal teams (see page 66).²⁵ However, it has also been observed that the introduction of snare removal patrols in a landscape for the first time will be likely deter a certain subset of poachers only. This means that subsequent reductions in snare placement intensities are far more difficult to attain, as this requires changing the actions of a subset of poachers who are harder to deter.²⁶ For example, a study in Viet Nam showed an initial reduction of 25-40% in snare containing areas in the first year of patrols, but no subsequent reductions thereafter.²⁷

Government patrol removes a snare in Viet Nam.



RECOMMENDATIONS:

Given the severity of the snaring crisis in Southeast Asia – even within protected areas – governments of the region should:

- Increase the number of protected area rangers, and ensure that, at a minimum, patrol ranger densities reach 5 rangers per 100km² in protected areas.
- Increase ranger patrol coverage and frequency, including foot patrol coverage and frequency, in protected areas. The first priority for such increases should be areas where large snares targeting commercially valuable species (e.g. bear, tiger, leopard, etc.) are being detected.
- Ensure rangers are adequately equipped and trained to safely identify snares and prevent poacher incursions into protected areas.
- Increase the proportion of ranger patrols that are intelligence-led (i.e. those that use informants and patrol optimization software such as SMART).
- Recognize that ranger patrols alone cannot reduce snaring adequately, and that these approaches need to be combined with strong laws, working with local communities, and a high likelihood of those apprehended receiving the penalty proscribed by law.

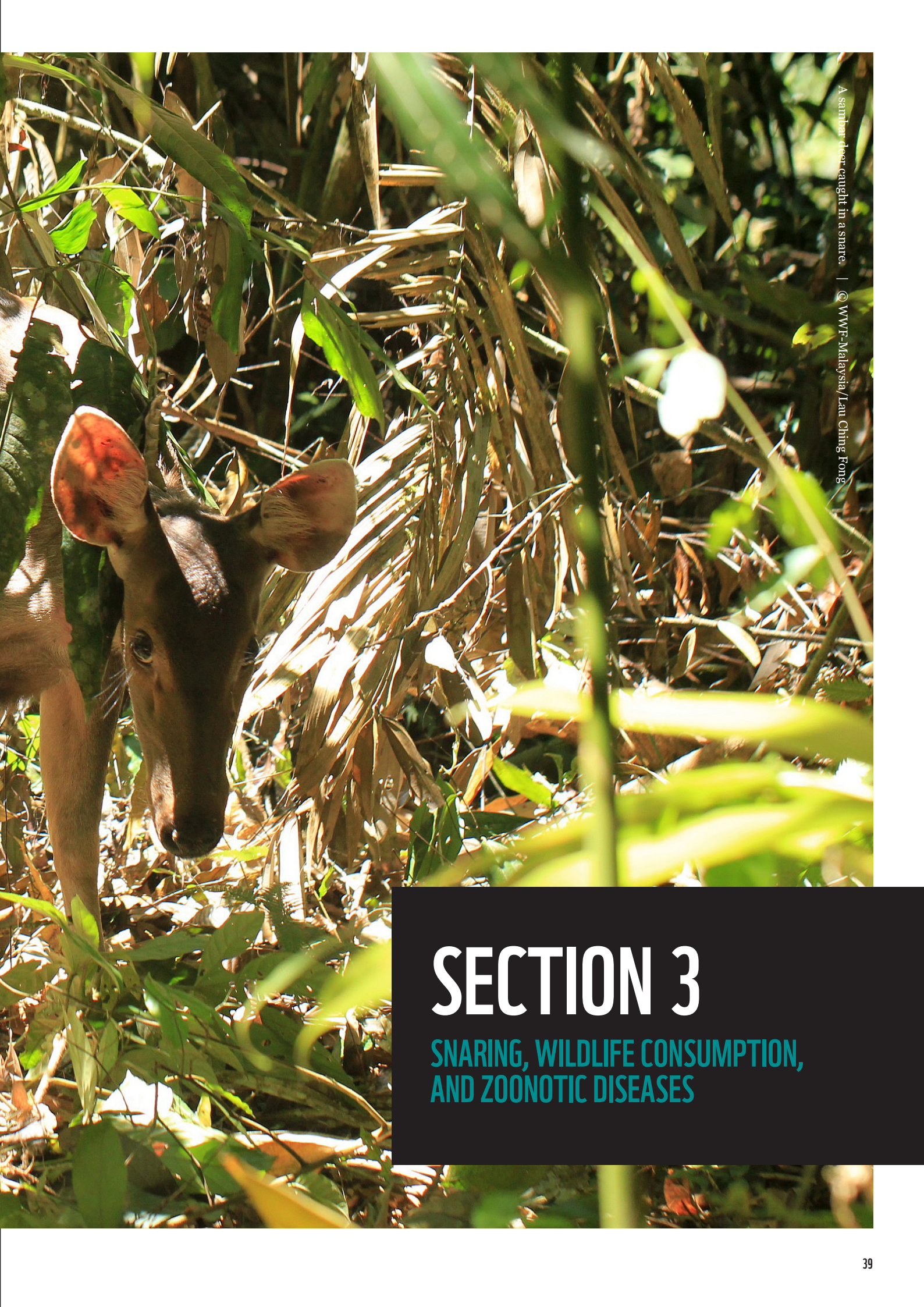
*Removing a wire snare in
Belum Temengor Forest
Complex, Malaysia.*

© Lau Ching Fong









A sambar deer caught in a snare. | © WWF-Malaysia/Lau Ching Fong

SECTION 3

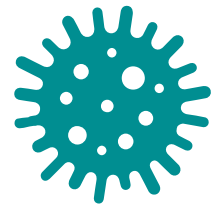
SNARING, WILDLIFE CONSUMPTION,
AND ZOOONOTIC DISEASES

SECTION 3: Snaring, wildlife consumption, and zoonotic diseases

Demand for high-risk wildlife meat is driving the vast majority of snaring activity:

Although not historically true, today across large areas of Southeast Asia it is the urban middle and upper classes which consume a large proportion of wildlife - with wildlife meat increasingly regarded as a delicacy or means of demonstrating status and influence.²⁸ In high density urban areas in the region, even where the average consumer only eats small amounts of wildlife annually, the large number of total consumers means that demand will have a significant impact on wildlife populations. This shift in urban consumption is enabled by increasing access to biodiverse areas which had previously been hard to reach.

Currently, much of what we know about wildlife meat consumption in Southeast Asia comes from studies conducted in Viet Nam. These have shown that while meat of pangolin or tiger might be reserved for the very wealthy, most small carnivores and ungulates are frequently eaten as luxury foods by people with more limited incomes (e.g. middle class). Surveys have suggested that between 20% and 80% (depending on the city and the survey) of urban Vietnamese eat wildlife meat products at least once per year.²⁹ Given that the urban population of Viet Nam is approximately 35 million, and growing, the potential numbers of consumers is already exerting significant and likely unsustainable pressure on regional wildlife.



Zoonotic diseases

A zoonosis is an infectious disease caused by a pathogen – such as a virus or bacteria – that has jumped from an animal host to a human. These account for a large proportion of overall diseases experienced by humans:

- 58% of all identified human pathogen species are known to be of zoonotic (animal) origin.³⁰
- Between 60% and 73% of emerging or re-emerging infectious diseases – those that are either new, or rapidly increasing – are known to be of zoonotic origin.³¹
- 71% of zoonotic diseases known to have emerged between 1940-2004, involved a pathogen with a wildlife host, as opposed to other animal hosts (e.g. domesticated animals).³²
- Wild-caught animals are likely to pose a higher risk of future zoonotic disease emergence than farmed animals, including farmed wildlife.³³

Zoonotic diseases – which include rabies, Ebola, tuberculosis, HIV, and emerging coronaviruses such as SARS, MERS, and COVID-19 – have had a significant impact on human health and wellbeing. The most recent and high-profile example is COVID-19, which has been the cause of hundreds of thousands of deaths, and millions of infections worldwide at the time of writing. In April 2020, it was projected by the Asian Development Bank that COVID-19 will cause between USD2.0 and 4.1 trillion losses from the global economy, with losses of 1.0% to 2.2% of total GDP in developing Asia; a category that includes the vast majority of Southeast Asian countries.³⁴

Snaring and handling wildlife increases the likelihood of zoonotic disease spillover:

zoonotic diseases become more probable in situations where close contact between humans and wildlife increases.³⁵ The quickening pace of habitat destruction and fragmentation in recent years is one way in which this proximity has been increased. Considerable increases in global trade and urban consumption of wildlife is another. Models created to predict areas at elevated risk for zoonotic disease emergence have identified high risk in South and Southeast Asia, where all the above drivers are prevalent.³⁶

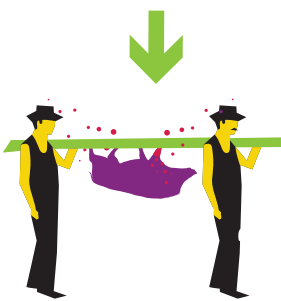


Hunter handles snared animal (blood can transmit disease, especially if hunter has open wounds)

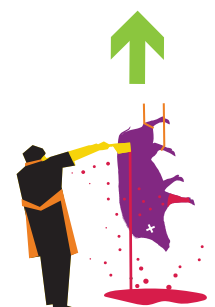


Consumption of animal purchased in market or restaurant

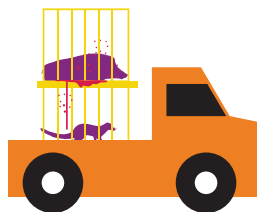
HOW SNARING INCREASES EXPOSURE TO ZOOONOTIC DISEASES



Animal usually handed to intermediary for transport to market (or through multiple intermediaries)



Butchering of animal (high-risk point for disease transmission)



Animal or carcass transported and stored with other animals (risk magnifier)



Handled by multiple workers when brought to market/restaurant



Like other forms of hunting, the practice of snaring often sets off a chain of human-wildlife contacts, each of which poses risks for zoonotic disease incidents. Given the scale at which animal snaring occurs, the cumulative risk of snare use is greater than that for less common forms of hunting.



© Keo Sopheak / PDoE / WWF-Cambodia

In Southeast Asia, snaring is among the most prevalent forms of hunting to capture animals for human consumption³⁷ and the stocking of wildlife farms.³⁸ The volume and efficiency of animal capture made possible by widespread snare use means more contact between humans and wild animals (i.e. more incidents of contact with the hunter, a wider variety of species captured, and more animals feeding markets) than is the case with more targeted hunting methods.

Snaring also allows the possibility of animals being captured alive. Although not the norm, it does occur in some cases, particularly when capturing animals for wildlife farms. Live or recently butchered animals are generally a greater risk for zoonotic disease spread than those which have been dead for some time, although the amount of time different pathogens can survive in dead animals is variable, and impacted by other factors such as storage temperature.

Importantly, species targeted for snaring, most notably ungulates and carnivores, have been identified as amongst the highest risk mammal groups for zoonotic disease transmission.³⁹ Wild pigs – a very commonly snared species in Cambodia, Lao PDR, and Viet Nam – have been found to host the greatest numbers of zoonotic pathogens of any species traded in Asian markets.⁴⁰ Two Southeast Asian species – masked palm civet and Sunda pangolin, both of which are often snared – have been identified as possible intermediary hosts for zoonotic disease transfers. Masked palm civets were identified as intermediary for SARS cases in humans⁴¹, while the Sunda pangolin is known to harbour a number of coronaviruses, as well as the deadly Sendai virus. These pangolins may also be capable of transmitting SARS to humans.⁴²

Where are snared species purchased and consumed?

Consumers in Southeast Asia purchase snared wildlife meat from a variety of sources, often as a delicacy, including at markets, restaurants, traders, friends, associates, or even the hunters themselves.⁴³ Studies provide insight on the diversity of locations where wildlife species are sold in the region – in each of those below, many of the species identified were those commonly captured by snares:

- In Viet Nam between 60% and 80% of wildlife meat consumption in urban centres occurs in restaurants.⁴⁴ The most regularly consumed species, representing almost 75% of all consumption, is wild pig – a species heavily hunted by snaring in mainland Southeast Asia.⁴⁵
- Wildlife seizure data collected from 2005 to 2017 in Cambodia showed that 46% of wildlife meat seizures (representing 61% of seized biomass) that was likely to have come from snared animals (defined as ungulates, carnivores, lagomorphs) occurred in markets, while 48% of such seizures (32% of biomass) occurred at restaurants and resorts.⁴⁶
- In North Sulawesi, Indonesia, recent surveys show that wildlife meat, including ungulate species likely to have been snared, is routinely available for sale, and was found in 73% of markets and supermarkets.⁴⁷
- Nationwide surveys across Lao PDR have shown that species likely to be caught in snares (e.g. ungulates, carnivores, galliformes) comprise approximately a third of wildlife biomass for sale.⁴⁸

Demand reduction efforts to reduce consumption of wildlife meat are key

Conservationists and policymakers are increasingly recognizing that Social and Behaviour Change Communications (SBCC) techniques, widely used in the health and development sectors, are critical in the fight against the illegal trade in wildlife⁴⁹ – a trade that is both fed by snaring and driving the increased use of snares. Despite its likely utility, to date more than 80% of SBCC campaigns have focused solely on reducing consumption of wildlife products from the most iconic species (e.g. rhinoceros, elephant, tigers, pangolins, etc.), with little focus on wildlife meat consumption.⁵⁰

To tackle the Southeast Asian snaring crisis, there is a critical need for well-designed SBCC campaigns to influence and alter consumer choice and to reduce demand for wildlife meat. Such efforts would likely go hand in hand with approaches aimed at reducing the potential of a new zoonotic disease outbreak, and as such could be delivered in coordination with health officials.



© Keo Sopheak / PDoE / WWF-Cambodia



RECOMMENDATIONS:

WWF and partners are leading a global call to action on COVID-19 and wildlife trade (preventpandemics.org). Under this campaign the coalition is calling on policymakers to:

1. Shut down high-risk wildlife markets, with a priority focus on those in high-density urban areas.
2. Urgently scale up efforts to combat wildlife trafficking and halt trade of high-risk taxa.
3. Strengthen efforts to reduce consumer demand for high-risk wildlife products.

Implementation of these recommendations, along with measures to curb habitat loss and fragmentation, will dramatically reduce the probability of future zoonotic disease outbreaks, and also significantly reduce snaring levels. It should be emphasized that any costs associated with implementing the recommendations would be minimal in comparison to the human and financial toll associated with any future zoonotic disease outbreaks.

To effectively implement these recommendations within a Southeast Asian context, we call on the governments of the region to:

- Prevent the purchase, sale, transport and consumption of all high-risk taxa⁵¹ (alive or dead) in markets or restaurants, with the earliest such efforts directed at high-density urban areas.
- Ensure that fines, criminal penalties and licence revocation measures are strict enough to be effective.
- Introduce robust market and restaurant monitoring mechanisms to ensure high-risk wildlife products⁵² are not being sold.
- Ensure involvement of ministries responsible for environment, health and public security in the development and implementation of regulations.
- Strengthen efforts to reduce consumer demand for high-risk wildlife products, and incorporate Social and Behaviour Change Communications (SBCC) approaches.



Wild Pig and Red Muntjac | © WWF - Cambodia



SECTION 4

EMPTY FORESTS AND DAMAGED ECOSYSTEM SERVICES

SECTION 4: Empty forests and damaged ecosystem services

Defaunation – or the emptying of animal species from ecosystems – is being greatly accelerated by snaring in Southeast Asia.

Today a mere 1% of land in tropical Asia – which largely overlaps with Southeast Asia – supports a full set of large mammals (i.e. those weighing more than 20kg).⁵³ Another review of the evidence from tropical Southeast Asia concludes that animal populations in the region began a steep decline in the 1980s, and that hunting is by far the single greatest threat to endangered vertebrates in that region. It also pointed out that improvements in hunting technology (e.g. snaring) were one of the main drivers of this decline.⁵⁴ As a result of these trends, 113 mammal species are threatened by extinction due to hunting in Southeast Asia, compared to 91 in Africa, 61 in the rest of Asia, 38 in Latin America, and 32 in Oceania.⁵⁵



The term ***Empty Forests*** was coined in 1992 by Kent Redford, in reference to areas of South America which lacked large mammals as a result of human impact, despite otherwise excellent habitat. In his work Redford remarked:

"The presence of soaring, buttressed tropical trees does not guarantee the presence of resident fauna. Often trees remain in a forest that human activities have emptied of many of its large animals. The absence of these animals has profound implications, one of which is that a forest can be destroyed by humans from within as well as from without"
- Redford K.H. ⁵⁶

The negative impacts of species decline extend far beyond dead animals alone. Many of the animals commonly snared play key ecological roles that are linked to human wellbeing - providing valuable benefits that are often referred to as ecosystem services. A number of these are listed in the table below.

<i>Function disrupted by snaring-induced defaunation</i>	<i>Overview</i>	<i>Example of Southeast Asian species impacted by snaring</i>	<i>Impact of defaunation</i>
Seed dispersal ⁵⁷	Between 50% and 80% of all tropical plants rely exclusively on animals for seed dispersal.	Asian elephant, Malayan tapir, bears, chevrotain, wild pig, macaques, civets, Sumatran rhinoceros	<ul style="list-style-type: none"> - Increased extinction risk for plant species; particularly fruit-bearing plants that can provide food for local peoples. The loss of seed dispersing species can also reduce the ability of certain plants to respond to climate change. - Reduced forest carbon storage, due to shift in tree species composition.
Predation ⁵⁸	Top predators play an important role in top-down control of prey species, smaller carnivores, herbivores and pest species.	Tiger, leopard, dhole, clouded leopard	<ul style="list-style-type: none"> - When large predators are lacking in a landscape, populations of small and medium sized omnivores and carnivores may be up to ten times more abundant than normal. This may give rise to new 'problem wildlife'. - The removal of top predators often leads to increases in crop damages, caused by population growth in certain species that feed on crops. - Increased populations of prey species (herbivores, smaller carnivores, etc.) can also cause increased extinction risk in certain plant species, as well as changes in forest structure and regeneration due to over-grazing.
Nutrient transport ⁵⁹	Grazing and dung from mammals is critical for nutrient cycling and transport.	Sambar, banteng, gaur, Asian elephant, Eld's deer, rhinoceroses	<ul style="list-style-type: none"> - Reduced plant productivity and diversity. - Changes in habitat structure.
Engineering ecosystems ⁶⁰	Burrowing, wallowing, and grazing (particularly by ungulates, rodents, and lagomorphs) is critical for maintaining ecosystem structure in grasslands, savannah, and dry forests.	Siamese hare, bamboo rat, Asian elephant, wild water buffalo, porcupines	<ul style="list-style-type: none"> - Reduced habitat diversity. - Increased risk of soil erosion. - Increased frequency and intensities of fires - Loss of niches for amphibians, reptiles, birds.

Pigtail macaque

© Edward Parker / WWF



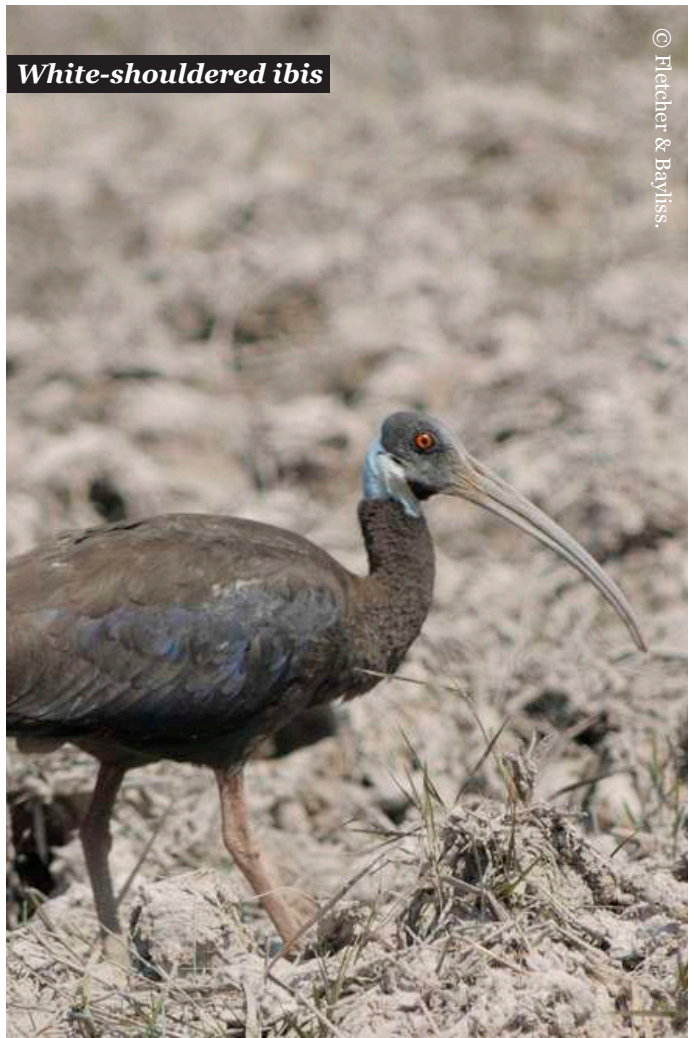
Seed dispersing animals:

Perhaps the most important seed dispersers in Southeast Asian forests impacted by snaring activities are ground-dwelling primates, such as pig-tailed and stump-tailed macaques. Between 60% and 85% of macaque faeces has been shown to contain seeds, and studies have suggested that the seed dispersal of small to medium sized fruited trees can be reduced 20-fold following extirpation of macaques.⁶¹

In a study that compared the prevalence of certain tree species in two Thai protected areas which were characterized by very different levels of hunting, the researchers came to the conclusion that that local removal of seed dispersing animals by hunters was likely creating an 'extinction debt' for certain trees, one that would only become apparent in the coming decades.⁶²



Forest canopy, Jambi, Sumatra, Indonesia | © Fletcher & Bayliss / WWF



White-shouldered ibis

© Fletcher & Bayliss

Ecosystem engineers:

One of the critical roles animals play in ecosystems is their physical ‘engineering’ value through the acts of grazing, trampling, and wallowing. Larger animals, such as ungulates, generally have greater impacts of this type, and as such are important *ecosystem engineers*. Unfortunately, these are also the species which have been most directly impacted by snaring in Southeast Asia. As an example, the grazing and wallowing of four species of wild cattle (banteng, gaur, wild water buffalo, and the now extinct kouprey) in the dry savannah forests of Cambodia is believed to have been critical in maintaining habitat diversity, including freshwater pools, in the forest. These pools provide essential foraging habitat for two of the world’s rarest bird species; the Critically Endangered white-shouldered ibis and the giant ibis. In the absence of these large herbivores, sedimentation and increases in vegetation height at waterholes reduces their suitability for these threatened ibis species.⁶³



A snared tiger being rescued in Belum-Temengor Forest Complex, Malaysia.

© WWF-Malaysia/Lau Ching Fong



Snaring is costing Southeast Asia its tigers

As perhaps the world's most iconic species, tigers have a huge grip on the public imagination. Within the last 10-15 years, three of only 13 remaining 'tiger range countries' have lost their tigers. All of these (Cambodia, Lao PDR, and Viet Nam)⁶⁴ are in Southeast Asia, with additional evidence of overall tiger decline in the remainder of the region.

Widespread snaring of both tigers and tiger prey has frequently been identified as the culprit behind tiger declines in Southeast Asia. A clear example of this comes from Nam Et-Phou Louey National Protected Area in Lao PDR, where an analysis of camera trap data and other evidence led researchers to conclude that it was a spike in snaring that brought about a rapid and steep decline for tigers there. From one of the most promising tiger protected areas in the region only 10 years prior, to extinct from that protected area (and thus the country), this study does much to show how widespread snaring can quickly wipe out large cats (leopards were also killed off during this period), even in relatively well-funded parks.⁶⁵

An illustration of how the snaring threat to tigers is growing across the breadth of the region, comes from an analysis of law enforcement data from Kerinci Seblat National Park in Sumatra, Indonesia. Here, 3,882 snare traps were found and destroyed over the course of a decade. The trends were also discouraging; with twice the number of snares found in 2013 and 2014 than the average over the preceding eight years. Techniques for snaring tigers were also seen to be changing, with the setting of tiger 'snare clusters' of six or more snares in a single location. These were recorded only from 2011 onward.⁶⁶



© Adam Oswell / WWF



The loss of tigers in Southeast Asia to snares has major consequences

- **Loss of economic potential:** tiger tourism creates jobs and enhances local economies within countries. For instance, in India, a single tiger was estimated to have generated roughly USD 10 million in revenue per year during her lifetime. The park she lived in (*Ranthambore Tiger Reserve*) contributing USD 33.4 million per year to the local economy alone.⁶⁷ Although ‘tiger tourism’ revenue in Southeast Asia would never match that generated in India and Nepal (given that it is harder to spot tigers in denser rainforest surroundings), tigers still bring in considerable tourist interest, even in areas where sightings would be unlikely.
- **Loss of other investments:** when flagship species such as tigers are lost from a landscape, that area will often see a precipitous drop in conservation funding from donors, financing institutions and non-governmental organizations. Often a portion of this investment flows to local communities and development objectives – much needed funds that are lost when conservation donor funding shifts to other regions.
- **Loss of ecosystem services:** the loss of a species like tigers can lead to a wide number of negative impacts on the ecosystem services that support people. These are outlined in further detail in a separate WWF report titled *Beyond the Stripes: Save Tigers Save So Much More*.
- **Cultural impacts:** The loss of any major species to snaring is also often the loss of an animal that has significant cultural or religious meaning in many Southeast Asian societies. In this way snaring extinctions can also lead to reduced local ecological knowledge, and the inability to maintain that knowledge across generations. Such ‘cultural benefits’ are one of the four major categories of ecosystem services recognized.



*Orang asli man crafting
a blowpipe for hunting
in Kuala Betis, Peninsula
Malaysia.*

© Gerald S. Cubitt / WWF



SECTION 5

INDIGENOUS PEOPLES AND LOCAL COMMUNITIES

SECTION 5: Indigenous peoples and local communities

Indigenous peoples and local communities depend closely on Southeast Asia's ecosystems, natural resources and wildlife for their health, livelihoods and well-being.

They are therefore deeply impacted by the region's snaring crisis. This section will look at this impact and a number of related issues.



Hunter motivation in Southeast Asia:

Few studies have detailed the motivations, methods, and harvest rates of hunters in Southeast Asia, partly due to sensitivities around asking questions about activities that may be illegal. In this way, any understanding of the dynamics of hunting, and the decisions and behaviour of those involved in it, lags well behind the understanding of the ecological consequences of hunting. Those limitations notwithstanding, it is still relatively clear, based on findings described in this section, that hunting is undertaken primarily for one of four reasons in Southeast Asia:

- Commercial trade (generally the primary motivation for snaring inside protected areas)
- Crop guarding
- Supplementation of existing food sources
- Recreation

The following pages summarize existing evidence around the topic, and lay out the case that modern snares are not essential for subsistence hunting purposes. Many of the studies look at hunting in general, which may include both legal or illegal hunting depending on the context. Their discussion is not meant to imply in any ways that legal hunting conducted by sustainable methods, and particularly for subsistence, should be banned.

The largest global survey to date addressing the importance of wildlife to households in tropical and sub-tropical countries provides useful context on the issue of hunter motivation. This looked at nearly 8,000 responses from households in villages across 24 countries, and found that:

- 26.5% of Asian households surveyed were involved in the hunting of wildlife, which was significantly less than African (44.2%) or Latin American households (52.6%). In Southeast Asia, 83% of surveyed Cambodian households engaged in hunting, compared to 21% in Indonesia and 10% in Vietnam.
- Hunting accounted for only 1.7% of total annual household income in the Asia region, compared to 1.9% in Africa and 4.6% in Latin America. As such, the authors concluded that reliance on wildlife was lower than expected.
- Of 24 countries surveyed, Vietnam had the highest proportion of cash income derived from hunting, which was roughly 60% of total income. Here, total wildlife income was defined as cash income plus subsistence income.
- Such wildlife resources are most important to those living in smaller and more remote communities.⁶⁸

This final point is of considerable importance, and highlights the threat that increased urban consumption of wildlife – much of which is supplied by snares – poses to remote communities.

Although the results of this study are useful, it is important to note its limitations when it comes to the matter of snaring in Southeast Asia. These include the fact that, i) it did not distinguish hunting methods; ii) it included birds, reptiles and amphibians alongside mammals in its definition of wildlife; and iii) the sampling strategy for surveys did not prioritize sites of high conservation value, with many survey sites found in agricultural landscapes. As such, the majority of the hunting activity considered in this global review was unlikely to be done by snaring.

The following section takes a closer look at Southeast Asian evidence for motivation behind the hunting of mammals. These studies from forest frontier communities in Cambodia⁶⁹, Viet Nam⁷⁰, Indonesia⁷¹ and Myanmar⁷² suggest that sustenance value ascribed to hunting is often lower than the other motivators previously mentioned particularly when hunting is done using snares.

Where hunting is undertaken for subsistence or home consumption, available studies also suggest that other methods (e.g. dogs and sling shots in Cambodia; blow pipes and spears in Malaysia; dogs, bows or guns in Myanmar) are often preferred over snares.⁷³ In some forest edge communities, a significant proportion of people engage in some hunting activities involving snare use, but most people do so opportunistically and as a supplemental economic activity rather than for sustenance reasons.⁷⁴ They often do this in seasons when their primary livelihood activity such as agriculture, non-timber forest product collection, or urban jobs do not occupy them.⁷⁵ As such it is often the case that a majority of snares are found close to villages.⁷⁶

Many communities near forests also have a small number of professional hunters, who have links with middlemen and traders, and for whom hunting is usually their main source of income. These hunters often spend considerable time in the forest and regularly use snares.⁷⁷ This commercial hunting, conducted deep in the forest or protected area and away from villages, means there is often a secondary peak in snare intensity – in Eastern Cambodia this was roughly 10 to 15km away from the edge of villages.⁷⁸

In many cases, the middlemen and traders from urban centres lend money to remote villagers, in exchange for a proportion of the profit made on the sale of any wildlife hunted by those individuals.⁷⁹ In some cases vulnerable villagers will find themselves trapped in a debt-cycle which obliges them to continue hunting in order to pay back these lenders.







Katu Chief in Quang Nam Province, Viet Nam. | © Elizabeth Kemp / WWF

How common is subsistence hunting?

A number of studies have examined the proportion of hunting done for sustenance and family consumption rather than trade:

- In interviews with hunters of the Katu ethnic group in Viet Nam, only one out of 16 hunters who went into the forest interior to set snares said that food was their primary motivation for doing so, while nine cited cash income as the reason they hunted.⁸⁰
- In communities surrounding three protected areas in the Central Annamites of Viet Nam socio-economic surveys found that between 25% and 30% of villages hunted, primarily using snares. Whilst hunting was not a primary source of food or subsistence, it was the main income source for approximately 40% of individuals who hunted. For most interviewees hunting with snares was largely opportunistic and regarded as a habit or recreation rather than a cultural tradition.⁸¹
- Surveys in three villages surrounding Samkos Wildlife Sanctuary in the Cardamom rainforest of Cambodia found that snaring was widespread but was of only marginal livelihood and food security importance. The majority of snaring was very localized and primarily motivated by the desire to guard crops. However, in each village a small number of commercial hunters (who used hunting as a primary livelihood activity and source of income) were identified. Focus groups reported that these commercial hunters would set 50–90 snares in the forest at one time and check these snares every three days.⁸²
- Through a series of workshops and meetings with indigenous peoples living within Thung Yai Naresuan Wildlife Sanctuary in Thailand, it was revealed that for all species, and in every village zone, commercial hunting contributed more heavily than subsistence hunting to animal population declines. Furthermore, this gap between commercial and subsistence hunting was largest for larger mammals, such as tigers and bears. It was also determined that networks of urban Thai traders were largely behind this commercial poaching. The collaborative approach that this article describes shows the benefits of open dialogue between local communities, protected area managers and NGOs, which resulted in increased communication, conservation understanding, as well as the introduction of joint monitoring and patrolling activities.⁸³

How common is subsistence hunting?

Snaring induced defaunation may impact the nutritional security of Southeast Asia's poorest people:

as discussed previously, the depletion of forest animals by commercial hunters poses a huge risk to the well-being of the poorest and most vulnerable peoples in Southeast Asia, who often reside in remote areas and have limited access to livestock. This assertion is supported by data recently compiled from a global survey of rural poor households, collected by the Poverty Environment Network.⁸⁴ To this small percentage of Southeast Asians wildlife may be the only readily attainable or affordable source of protein, fats, and critical nutrients. When forests are emptied by high intensity and indiscriminate snaring, the consequences for these 'sustenance' users of wildlife may be severe. For instance, it can lead to protein or micronutrient (e.g. iron) deficiencies that can present serious health threats, including growth stunting, anaemia, and problems in brain development.⁸⁵

The issue of 'food security' also extends beyond the current situation individuals are facing. As has been noted by a number of commentators, households cannot be seen as food secure if current access to sufficient food is also accompanied by the destruction of the natural capital that will be necessary to provide future nutrition.⁸⁶ This noted, measures should be taken to ensure hunting is conducted using sustainable and discriminate means (i.e. not using modern snares) that target species with high reproduction (or 'replacement') rates.

Snaring is associated with other

economic activities: major projects or commercial activities undertaken in or near biodiverse areas represents another driver of increased snare placement. For example, in areas of the interior of East Malaysia, bushmeat was present in only 29% of meals – but found in 49% of meals served in logging camps, whose workers are often economic migrants non-local to the area.⁸⁷ It has been further observed that many logging companies view wildlife as a free subsidy towards feeding their workers.⁸⁸ Snaring has also been associated with rubber plantation workers in Indonesia⁸⁹, and also East Malaysia⁹⁰ where numerous elephant have been killed by snares set in plantations bordering Forest Reserves.

Indigenous peoples are a necessary partner if snaring is to be reduced in

Southeast Asia: Given the significant stake indigenous peoples and local communities (IPLCs) have in the long term maintenance of ecosystem functions, food security and cultural traditions, they are important partners in any effective strategy to reduce snaring. These groups also have considerable influence over the landscapes they inhabit, which are more likely to overlap with the biodiverse areas which are most threatened by snare use (see Table 3). In general, conservation and anti-snaring strategies will be likely to fail without the informed consent and support of such groups. Even in those cases where all forms of hunting by all persons is illegal within protected area, snaring and other hunting is often concentrated around the edges of such areas.⁹¹ Working with local groups can help limit the placement of snares in these landscapes, while also reducing the number of outsiders snaring in such areas.

	<i>Cambodia</i>	<i>Indonesia</i>	<i>Lao DPR</i>	<i>Malaysia</i>	<i>Myanmar</i>	<i>Philippines</i>	<i>Thailand</i>	<i>Vietnam</i>
Indigenous % overlap with protected landscapes	44.3%	69.1%	87.4%	70.9%	72.5%	17.2%	64.3%	63.6%
Indigenous % overlap with non-protected landscapes	33.0%	43.1%	77.5%	61.7%	57.5%	10.2%	52.5%	49.1%

Table 3: Estimated percentage overlap of indigenous peoples’ lands with both protected and non-protected landscapes in eight Southeast Asian countries⁹² Note that this table should not be used for comparative purposes (i.e. comparison between countries) given that data are derived from multiple sources employing different definitions and criteria. This table is only used to illustrate the fact that within each of these countries indigenous peoples overlap with protected landscapes (i.e. more biodiverse landscapes) at higher rates than in non-protected landscapes.

Previous research delivered in Southeast Asia also indicates that local communities would be receptive to overtures from officials to work together to combat the snaring threat. For example, the survey of 1,167 individuals living in 77 villages proximate to protected areas in Myanmar revealed that 93.1% would be likely to attend a meeting by park authorities to learn more about conservation, and 84.5% thought community members should work alongside park rangers to reduce poaching. In the Philippines, 98.3% of 2,099 surveyed community members in and around protected areas believed that locals should work alongside rangers to reduce poaching.⁹³



Tram Chim, Viet Nam | © Thomas Cristofolletti / WWF-US



Case studies:

Communities take an active role in efforts to stop snaring.

As noted previously (see page 32), more rangers are one of many elements needed if the snaring crisis is to be successfully stopped in coming years. In some Southeast Asian countries, local peoples have been instrumental in such patrolling efforts:

- **Orang asli patrols, Malaysia:** Belum-Temengor is one of Southeast Asia's most important tiger landscapes. With evidence of a 50% decline in tiger numbers from 2009-2018⁹⁴, urgent action was needed. In mid-2018, WWF-Malaysia initiated an ambitious initiative coined as Project Stampede, where local indigenous (Orang asli) rangers formed 10 five-man teams to patrol local forest on foot and remove snares. Although lacking enforcement powers, they act as eyes and ears for the authorities, reporting poaching or snaring incidents. In the three years prior to initiating Project Stampede, WWF-Malaysia's three patrol teams had removed 200 active snares across 8,000 kilometres of foot patrols in Belum-Temengor. In the year after Project Stampede was launched, only 30 active snares were recorded over 10,000 kilometres of foot patrols. In just one year, the number of snares detected per unit of effort of patrols had declined by 89%. More recent data is even more encouraging, with only two active snares detected during 2019 across 11,000 kilometres of foot patrols. Unfortunately, the COVID-19 outbreak had put a temporary halt to such patrols. This is yet another example of the far-reaching impacts of zoonotic diseases discussed earlier (see page 40).
- WWF-Greater Mekong and its partners' **Carbon and Biodiversity (CarBi)** Programme has been supporting ranger patrolling, including village patrol regimes, in protected areas in the Central Annamites of Viet Nam. This work, which also includes many other elements of community engagement, has demonstrated a reduction in snare numbers in at least two protected areas.

Traditional indigenous hunting method protections should not include the use of modern snares: The recognized rights of indigenous peoples often include the right to hunt on their lands using traditional and culturally preferred means. Such rights should be encouraged and protected. However, use of cable and wire snares should be clearly distinguished from traditional snaring materials when defining the scope of these unique rights, in order to protect the forests and ecosystems that people depend on.

It should also not be assumed that snare use is commonplace in indigenous communities in the region. In many cases snares will not be among the most culturally preferred means of hunting. For example, in the Jahai indigenous community in northern Peninsular Malaysia – who are one of the very few remaining nomadic hunter gatherer communities in Southeast Asia – hunting was widely practiced (94%), but almost exclusively for subsistence and personal consumption. Five hunting methods were reported (blowpipes, spears, snares, shotguns, and fire traps) with blowpipes preferred for almost all species including most ungulates. Traditional snares (made of bamboo and tree branches) were mainly used to capture muntjac and wild pig.⁹⁵ In Myanmar, of 34 species hunted by local communities in the Bago Yoma forests, only four were hunted with any type of trap.⁹⁶

The adoption of modern snaring practices can happen quickly: Rapid declines in wildlife can occur when non-local hunters introduce snaring methods that did not previously exist in a given area. This can be particularly damaging when it is the use of wire and cable snares being introduced, as has happened in numerous instances across the breadth of Southeast Asia. Even in relatively remote regions such as Papua, Indonesia, evidence shows that the use of cable snares may be growing due to recent introduction of the practice from migrants passing through areas where such methods were not common traditionally.⁹⁷

Traditional hunting rights should be for community use, not commercial trade: Like the use of modern cable or wire snares, there should also be limits on the use of traditional hunting rights (i.e. rights not granted to the general public) in relation to commercial trade. Malaysian law provides a good example of how this matter might be regulated:

Notwithstanding anything in this Act, an aborigine may hunt any protected wildlife as specified in the Sixth Schedule⁹⁸ for his sustenance or the sustenance of his family members. (2) Any protected wildlife hunted under subsection (1) shall not be sold or exchanged for food, monetary gains or any other thing.

Guidance from the CBD Liaison Group on Bushmeat: A number of the priorities and recommendations flagged in this report, reiterate points made in the expert recommendations released by the Convention on Biological Diversity (CBD) Liaison Group on Bushmeat. They write:

*'Access, rights and associated accountability, as well as the responsibility to sustainably manage wildlife resources, should be transferred whenever possible to indigenous and local communities and other local stakeholders who have a vested interest in maintaining these resources and who can deliver sustainable, desirable solutions. The capacities of these empowered indigenous and local communities should be built and strengthened to ensure that they have the capacity to exercise these rights. Conservation and sustainable use of wildlife resources would be enhanced through the incorporation of traditional knowledge and customary sustainable use into management and monitoring systems, as well as by favouring the use of the most ecologically friendly (e.g. species-specific), cost-efficient and humane hunting methods.'*⁹⁹

This emphasis on humane or ecologically friendly hunting technique is important, as snaring is neither of those things. As such solutions for local management should only incorporate less harmful, discriminate forms of hunting.



RECOMMENDATIONS:

Given the important ecosystem services lost when snaring empties forests in the region, and also recognizing the importance of sustainable use of wildlife to local and indigenous communities, governments of the region should:

- Recognize the diverse and significant negative impacts of widespread snaring on the ecosystem services provision, future economic potential, and food security of their citizens, and work towards implementing strong legal prohibitions on snaring.
- Introduce strong penalties for companies whose employees or temporary hires are caught using snares in biodiverse areas during the course of their employment. An incomplete list of sectors that should be subject to such penalties include road construction, forestry, mining, rubber and palm oil.
- Protect sustainable traditional indigenous means of hunting, while taking efforts to reduce the spread of modern snaring approaches (such as use of cable and wire snares) to new regions.
- While protecting traditional indigenous means of hunting, ensure that animals otherwise banned for hunting or sale do not enter commercial trade. This is necessary to avoid possible legal loopholes in laws established to protect biodiversity and public health.
- Organize formal meetings and dialogues with indigenous peoples and local communities, with the goal of creating mutual agreements and strategies to combat snaring and other wildlife or environmental crimes.
- Expand to the extent possible, indigenous and local community member employment in projects and careers that aim to reduce snaring as one of their elements. These groups should also be employed in ranger and snare removal work, both as stop-gaps and long-term solutions to combat snaring.
- Provide hunters with viable opportunities for career change (snare removal related employment, vocational training, support for small business start-up, etc.) in order to reduce overall pressures on local biodiversity.









SECTION 6

LEGAL REGULATION OF SNARING IN SOUTHEAST ASIA

SECTION 6: Legal regulation of snaring in Southeast Asia

<i>Country</i>	<i>Cambodia</i>	<i>Indonesia</i>	<i>Lao DPR</i>
Main controlling legislation	Law on Forestry, 2002 Law on Natural Protected Areas, 2008	Act of Republic of Indonesia No.5/1990 on Conservation of Living Resources and Their Ecosystems	Wildlife and Aquatic Law, No. 07
Most recent update of main controlling legislation	2008	1990	2007
Does law mention snares by name?	NO	NO	NO
Does law mention traps by name?	YES	NO	YES
Are either 'snare' or 'trap' defined in the law?	NO	NO	NO
Is the use of snares in protected areas prohibited under law?	YES Snaring falls under 'hunting'	YES Snaring falls under 'catch, injure, kill'	YES Snaring falls under 'hunting'
Are there minimum penalties for trapping or snaring inside a protected area? [minimums provided only - both for imprisonment and fines]	SPECIES DEPENDENT 1 year <i>and/or</i> 10 million Riels [~\$2,400] for hunting rare species (Law on Forestry); 100,000 Riels [\$24] (Law on Natural Protected Areas); 1 year <i>and/or</i> 15 million Riels [\$3,600] for vulnerable, rare, for critically endangered wildlife species. (Law on Natural Protected Areas).	NO ⁵	SPECIES DEPENDENT 3 months. for prohibited category species only
Snare use prohibited outside protected areas?	PARTIAL for rare and endangered species only	PARTIAL for protected animals only	PARTIAL for prohibition category species only
Possession of snares prohibited in protected areas?	NO	NO	NO
Possession of materials that can be used to make snares prohibited in protected areas?	NO	NO	NO

Disclaimer: the analysis above was limited to laws released at the national level only. Furthermore, there is a possibility that additional laws, regulations or guidelines that were not identified here have some role in the control of snaring activities.

¹ Different wildlife protection statutes are in force in Sabah (*Wildlife Conservation Enactment 1997*) and Sarawak (*Wildlife Protection Ordinance 1998*). These laws are generally viewed as weaker than the Wildlife Conservation Act, 2010. See: Krishnasamy, K. and Zavagli, M., 2020. Southeast Asia: At the heart of wildlife trade. *TRAFFIC, Southeast Asia Regional Office*, Petaling Jaya, Selangor, Malaysia.

² Although not in the law itself, Resolution 05/2018/NQ-HDTP which guides the interpretation of the relevant criminal code provision (234) clarifies that: *Using prohibited hunting tools or equipment means use of weapons, poisonous arrows, explosives, toxins, tunnels, pits, plugs, big traps, trapping plugs, snare traps, electric traps, anchor traps, large iron teeth, or other dangerous tools and equipment prohibited from use for hunting by the competent authorities.* Note however, that the term 'prohibited hunting tools' used here, does not match the term 'banned hunting equipment' used in the criminal code.

<i>Peninsular Malaysia¹</i>	<i>Myanmar</i>	<i>Philippines</i>	<i>Thailand</i>	<i>Vietnam</i>
Wildlife Conservation Act, 2010	The Conservation of Biodiversity and Protected Areas Law (The Pyidaungsu Hluttaw Law No 12/2018)	Wildlife Resources Conservation and Protection Act National Integrated Protected Areas System (NIPAS) Act of 1992 (Republic. Act No. 7586)	Wildlife Preservation and Protection Act B.E. 2562 (2019) National Park Act B.E. 2562 (2019)	Criminal code No100/2015/QH13 Decree No. 06/2019/ND-CP on Management of Endangered, Precious and Rare Forest Plants and Animals and Implementation of CITES Decree 157/2013/ND-CP
2010	2018	2001	2019	2015
YES	NO	NO	NO	YES²
YES	NO	NO	YES	YES
YES	NO	NO	NO	NO
YES	YES Snaring falls under 'hunting' ³	YES Snaring falls under 'hunting' and 'collecting' ⁴	YES Snaring falls under 'hunting'	YES
YES⁶ 50,000 ringgit [~\$11,500] 100,000 ringgit [~\$23,000] for the hunting of nine species afforded the highest protection	YES 300,000 kyats [~\$200] and/or jail time upon conviction 3 years for hunting a 'completely protected animals'	YES <i>hunting</i> unprotected species: 10 days and 5,000 peso [~ \$100] <i>hunting</i> critical species: 2 years and 30,000 pesos [~\$600] <i>killing</i> unprotected species: 6 months and 10,000 pesos [~\$200] <i>killing</i> critical species 6 years and 100,000 pesos [~\$2,000]	SPECIES DEPENDENT 3 years and/or 300,000 bhat [~\$9,500] for preserved (rare) wild animals	YES 3 years or 300,000,000 dong [~\$12,800]
YES	PARTIAL for all classes of protected wild animals and for any animal without license	PARTIAL without permit or for protected classes of species	PARTIAL for all preserved or protected wild animals	PARTIAL Some prohibition on snare use in other forest types (e.g. production forests) ⁷
YES	NO	NO	YES⁸	NO
NO	NO	NO	NO⁹	NO

³ Hunting means 'any method used to harm, catch or kill wildlife. This definition includes transporting wildlife without permission'

⁴ Snaring falls under 'hunting' in section 20(a) of the *National Integrated Protected Areas System (NIPAS) Act* and 'collecting' in the *Wildlife Resources Conservation and Protection Act*.

⁵ Under Indonesian law only maximum sentences are defined; for snaring offences involving the capture or killing of a protected animal these would be 'imprisonment up to a maximum of 5 years and a fine up to a maximum Rp. 100 million'.

⁶ Note that imprisonment is also stated as mandatory for these offences but no minimum timeframe is stated.

⁷ As specified through Decree no No.156/2018/ND-CP on enforcement of a number of articles of the law on forestry.

⁸ 'National Park Act B.E. 2562 (2019) Section 19 (7): within the national park, no person shall take in any gear for hunting or catching animal or any weapon. Whoever acts in contravention of the provisions of Section 19 (7) shall be punished with a fine not exceeding 10,000 Baht.'

⁹ This may depend on the interpretation of the term 'gear' in National Park Act B.E. 2562 (2019) Section 19 (7). No direct evidence of charges being brought against those possessing materials that could later be converted into snares was uncovered during this review.

Legal prohibitions on snaring across Southeast Asia:

The table above provides a comparison of the key features of anti-snaring laws in each of the eight large biodiverse countries in the ASEAN region. It highlights a number of significant shortcomings, including the fact that:

- Only one country (Malaysia) legally defines what constitutes a snare.
- Only two countries (Malaysia and Viet Nam) guarantee a serious minimum penalty for *any* type of hunting by snares within a protected area (with minimum fines between USD 11,000 and 13,000).
- Only two countries (Malaysia and Thailand) explicitly prohibit the *possession* of snares in protected areas under their laws.
 - This is a major oversight by other countries, particularly given the improbability of catching a poacher in the act of setting a snare or retrieving an animal from a previously set snare. Even if in some jurisdictions snare possession might be captured under a broad interpretation of other ‘hunting’ prohibitions, a matter of this importance should not be ambiguous within the law. This general lack of consideration of the possession of snares in Southeast Asia is also greatly out of step with other regions – for instance, possession bans are far more frequently present in laws implemented by countries in Africa.¹⁰⁰
- None of the laws in the region include provisions that clearly prohibit the possession (in protected areas) of materials that can be quickly fashioned into snares.
 - This is a shortcoming that should be rectified when laws are updated. There would however, likely need to be an exception made that allows authorized park staff and researchers to carry such materials.
- The majority of countries prescribe significantly higher penalties in cases where the poacher is apprehended possessing an animal or carcass that belongs to a highly protected species class.
 - Given that snares are indiscriminate, and thus have a significant potential to capture protected class species, it is a major oversight that those using snares must be caught red-handed with such species to face the most serious charges. It is suggested that countries should find ways to legally define the use of snares as an attempt to hunt the most protected species that might be caught by that snare within the protected area in which it was placed.





© Le Cong Anh Tuan / WWF-Viet Nam

Characteristics of effective anti-snaring laws:

An ideal anti-snaring law would see each of the elements specified in the table addressed. Of current laws in Southeast Asia, Malaysia's is the most appropriate for addressing the challenge posed by snaring. Its key provision reads as follows:

Prohibition of possessing, etc., snares,

29.(1) *No person shall—*

(a) possess or keep any snare; or

(b) set, place or use any snare for the purpose of hunting any wildlife.

(2) Any person who contravenes subsection (1) commits an offence and shall, on conviction:

(a) in relation to an offence under paragraph (a), be liable to a fine not exceeding one hundred thousand ringgit or to imprisonment for a term not exceeding three years or to both; and

(b) in relation to an offence under paragraph (b), be liable to a fine of not less than fifty thousand ringgit and not more than one hundred thousand ringgit and to imprisonment for a term not exceeding two years.

Presumption of using a snare

57. *Where a person is found in possession of a snare, it shall be presumed that the snare is being used by the person for the purpose of hunting any wildlife.*

Definition of snare¹⁰¹

any type of trap that is made of light wire cable looped through a locking device or of small nylon cord tied so that it will tighten as the animal pulls against it

Another well-drafted snaring provision is seen in a recently proposed revision to India's *Wildlife Protection Act, 1972*. Although it has been withdrawn, it still provides another template for effective anti-snaring legislation. Its key provision reads as such:

'no person shall manufacture, sell, purchase, keep, transport or use any animal trap except with prior permission in writing of the Chief Wild Life Warden given for educational and scientific purposes'¹⁰²

In this case, 'trap' as defined would include all types of snares.¹⁰³ Importantly, the text would also shift the burden of proof on to those who have snares in their possession:

'In the prosecution for any offence under this section, it shall be presumed that a person in possession of animal trap is in unlawful possession of such trap, unless the contrary is proved by the accused'

Both the Malaysian and draft Indian provisions provide useful starting points for Southeast Asian countries looking to modernize their snaring provisions to combat the snaring crisis. That said, both also lack a clear prohibition on the possession of materials (in protected areas) that might be easily converted into snares,¹⁰⁴ with the inclusion of such provisions key in any future laws.

Increasing penalties for snare use and possession:

When wildlife laws with snare related amendments are being revised in most Southeast Asian countries, it will also be essential to increase snaring penalties so that they are commensurate with the level of ecological damage they cause. With half of the countries included in the previous analysis having wildlife laws that are more than a decade old, it should be understood that the threat posed by snares is more clear and pressing than it would have been when those laws were originally drafted.

Given that a high proportion of snaring is conducted for commercial purposes, those hunting with snares will often have significant financial backing. As such, it will be necessary that newly agreed fines and imprisonment periods are adequate to deter such individuals. What that exact level is will be dependent on the country; but understanding this point is of critical importance for those charged with drafting new legislation.

Communicating increased legal penalty for snaring:

Any deterrent effect from new laws will also be of little value if the contents of those laws are not widely communicated to those whom they would most affect. For example, in interview with 26 Viet-Nameese hunters living near a protected area in the Central Annamite Landscape nearly all were aware that they could not hunt in the reserve or hunt certain threatened species. However, none of those individuals knew what the penalties were for doing so. In addition, many also felt that the borders of the protected area had not been communicated to them clearly.¹⁰⁵ Beyond the deterrent effect, it is also an issue of fundamental fairness. It would be highly unjust for a person to face drastically increased consequences if there was little attempt to communicate changes in snaring laws. This can be done through a combination of posters, newspaper and social media ads, community meetings, and television and radio messaging.

Classifying snares among other prohibited forms of hunting:

Another approach that may be feasible in several Southeast Asian countries – and one that could possibly be implemented prior to more comprehensive legislation overhauls – would involve adding snares to existing lists of prohibited hunting methods, such as use of explosives, electricity, poisons or fire. This would also be logical given that snares are indiscriminate similar to other prohibited hunting means that are commonly banned. Although they frequently go unenforced,¹⁰⁶ many African countries have taken this approach and directly list metallic snares and other traps alongside other banned indiscriminate methods of hunting.¹⁰⁷



Adequate prosecution and conviction rates for snaring crimes are also essential:

This element speaks to the deterrent effect, for even strong laws will do little to prevent poaching if the poacher is aware that those laws are rarely enforced by certain links in the enforcement chain (this includes at the very least, enforcement officers, prosecutors, and judges). Indeed, problems in appropriately applying and consistently realizing penalties called for in wildlife protection laws often outweigh shortcomings in the content of laws themselves. In a recent survey of a group of subject matter experts – the majority of which were from Asia – more than three-quarters of respondents indicated they believed this to be the case.¹⁰⁸ There are also some examples from Southeast Asia that support this:



- Despite being one of the only countries in the region with strong minimum penalties for all types of snaring, the prospects of being charged for snaring crimes remain low in Viet Nam. As a result, snare placement is amongst the highest – if not the highest – in Southeast Asia (see page 26).
- In 18 wildlife crime cases investigated by the Department of Forestry Inspection in Lao PDR between 2011-2014, none were referred to a public prosecutor. Also, only 1.4% of 1,072 timber related offenses were referred to a prosecutor.¹⁰⁹
- During a similar period in Malaysia, prosecutors filed charges in a very limited number of the total environmental cases reported; roughly 1% in 2009; 2% in 2010; 12% in 2011; and 10% in 2012.¹¹⁰

To understand the degree to which this is a currently problem – and to set out the strategy needed for improvements – all Southeast Asian countries should track prosecution and conviction rates for wildlife crimes, including snaring crimes specifically.



Wire snare | © Denise Stillely / WWF-Viet Nam

Foreign groups are using snares to remove the natural resources of Southeast Asian countries:

Groups illegally undertaking snaring activities outside of their country of citizenship has become an increasingly problematic trend, particularly during the last five to ten years. The example of just one country – Malaysia – is provided here, in order to illustrate this point.

According to previous statements from the Director General of Peninsular Malaysia's Department of Wildlife and National Parks (PERHILITAN), the first apprehension of foreign nationals involved in wildlife criminal activity within Peninsular Malaysia came as recently as 2002 when four Thai nationals were apprehended in Taman Negara National Park. Three years then passed before the next such arrest in 2005.¹¹¹ Officials in Malaysia also noted that during the early years of such incidents (2002-2016) snaring involving foreigners in Malaysia's protected areas were usually undertaken as a secondary activity by poachers who were looking to extract valuable agarwood. However, since that time it has been observed that the hunting of animals has become the *primary* aim of such incursions, in large part due to snaring induced declines of animals in other parts of Southeast Asia.

“A decade ago this was almost unheard of but we are now picking up an increasing number of offenders from Indo-China in our jungles and state parks, especially in Taman Negara...we believe this is partially due to the shortage of game in their countries and they have turned to coming here to hunt.”¹¹²

- Salman Saaban,
Director of PERHILITAN's Enforcement
Division (September, 2017)

Statistics from Malaysia – which are likely indicative of the trends seen in many other Southeast Asian countries – also provide further evidence that this situation is quickly worsening. In operations during the 2013-2018 period, Malaysian officials destroyed 3,500 snares and arrested 162 individuals, of whom

64 (40%) were foreign.¹¹³ This proportion of non-nationals apprehended for such activities was up to 60% during the first four months of Operasi Bersepadu Khazana (OBK), a special operation spearheaded by the police and PERHILITAN which was launched in September 2019 to curb poaching. The results of OBK during this time included 460 snares destroyed, and the arrest of 82 individuals; 49 of whom were foreign nationals (14 from China, 12 from Cambodia, six each from Myanmar and Bangladesh, four each from Indonesia and Viet Nam, and three from Thailand).¹¹⁴

“The foreigners enter Malaysia both legally and illegally. They will stay at makeshift camps for between one and three months to hunt protected animals before a new batch of foreigners take over.”

- Datuk Mastor Mohd Ariff,
Federal police internal security and public order
deputy director DCP (October 22, 2019)¹¹⁵

Although groups of hunters seem to be the norm in these situations, even a single poacher can cause significant damage to animal populations. For example, a single foreign national arrested under the OBK effort in October 2019 was apprehended with 162 nylon snares and numerous wild pig parts.¹¹⁶

This issue should be of critical concern to governments in the region for a number of reasons. These include the fact that;

- This shifting of snaring activity from nearby countries shows that even when domestic snaring is under control there will still be a threat of snaring-precipitated wildlife decline and its associated ‘empty forest syndrome’. This means that Southeast Asia as a whole is vulnerable to a wave of biodiversity decline, spreading outwards from over-hunted areas of the region.
- Snaring by foreign individuals may give the perception that there are problems or inefficiencies regarding national security and border controls between the various countries involved.



RECOMMENDATIONS:

Given the current limitations in anti-snaring provisions in Southeast Asia, governments of the region should:

- Adjust minimum and maximum sentences and fines for snaring-related activities. These should be set at a level that will provide a significant deterrent effect, even to well-financed commercial wildlife traders.
- Add provisions that would define snare possession or use as an attempt to hunt the most protected class of species that could be caught inside the protected area where the snare use was intended.
- Introduce clear legal prohibition on possession of snares in protected areas. This prohibition should also extend to non-authorized personnel in possession of materials that can be quickly converted into snares within the boundaries of protected areas. This should include bans on the possession of wire and metal cables of all types, and in the absence of a clear legitimate use, bans on the possession of rope and nylon in quantities that could be converted into snares.
- Introduce laws that include strict liability provisions that place the burden of proof on the possessor of snares or materials that can be used to make snares.
- Ensure adequate search and seizure powers for officials working within protected areas.
- Where possible, extend prohibitions on snare use and possession to landscapes that border protected areas. Country-wide bans on snare use or possession should also be considered.
- Clearly define 'snaring' and 'snares' in law, and add snares to lists of indiscriminate banned hunting methods such as use of poisons, fire, or electricity.
- Use a wide variety of means to communicate clearly to those who may be impacted by new snaring laws the content of those laws, and the possible consequences of snaring.
- Track enforcement, prosecution, and conviction statistics for all snaring and wildlife crime related cases in the country, and take all necessary steps to ensure that low rates of prosecution and conviction are not limiting the impact of anti-snaring provisions.
- Study the effectiveness of anti-snaring measures introduced in other countries during the process of updating domestic snaring policies, strategies and laws.
- Undertake ASEAN-level coordination to limit the ability of wildlife criminals to operate across multiple countries in the region. These countries should also ensure that effective mutual legal assistance agreements are in place for wildlife crimes, so that those who participate in snaring-related activities cannot make use of international borders to shield themselves from effective prosecution. Penalties for the import, export or transit of illegally traded wildlife products should also be increased and harmonized across Southeast Asian countries.



Wild pig caught in a snare | © Pham Viet Nuooc / WWF

- ¹ WWF Greater Mekong, 2017. Stranger Species: New Species Discoveries in the Greater Mekong 2016. Viewed 27 May 2020, <http://greatermekong.panda.org/discovering_the_greater_mekong/species/new_species/stranger_species/>
- ² Benítez-López, A., Alkemade, R., Schipper, A.M., Ingram, D.J., Verweij, P.A., Eikelboom, J.A.J. and Huijbregts, M.A.J., 2017. The impact of hunting on tropical mammal and bird populations. *Science*, 356(6334), pp.180-183. *See also*; Harrison, R.D., Sreekar, R., Brodie, J.F., Brook, S., Luskin, M., O'Kelly, H., Rao, M., Scheffers, B. and Velho, N., 2016. Impacts of hunting on tropical forests in Southeast Asia. *Conservation Biology*, 30(5), pp.972-981. *See also*; Hughes, A.C., 2017. Understanding the drivers of Southeast Asian biodiversity loss. *Ecosphere*, 8(1), p.e01624.
- ³ Tilker, A., Abrams, J.F., Mohamed, A., Nguyen, A., Wong, S.T., Sollmann, R., Niedballa, J., Bhagwat, T., Gray, T.N., Rawson, B.M. and Guegan, F., 2019. Habitat degradation and indiscriminate hunting differentially impact faunal communities in the Southeast Asian tropical biodiversity hotspot. *Communications Biology*, 2(1), pp.1-11.
- ⁴ Gray, T.N., Hughes, A.C., Laurance, W.F., Long, B., Lynam, A.J., O'Kelly, H., Ripple, W.J., Seng, T., Scotson, L. and Wilkinson, N.M., 2018. The wildlife snaring crisis: an insidious and pervasive threat to biodiversity in Southeast Asia. *Biodiversity and Conservation*, 27(4), pp.1031-1037. *See also*; Harrison, R.D., Sreekar, R., Brodie, J.F., Brook, S., Luskin, M., O'Kelly, H., Rao, M., Scheffers, B. and Velho, N., 2016. Impacts of hunting on tropical forests in Southeast Asia. *Conservation Biology*, 30(5), pp.972-981.
- ⁵ Gray, T.N., Hughes, A.C., Laurance, W.F., Long, B., Lynam, A.J., O'Kelly, H., Ripple, W.J., Seng, T., Scotson, L. and Wilkinson, N.M., 2018. The wildlife snaring crisis: an insidious and pervasive threat to biodiversity in Southeast Asia. *Biodiversity and Conservation*, 27(4), pp.1031-1037. *See also*; Lindsey, P.A., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R.W., Eves, H., Henschel, P. and Lewis, D., 2013. The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. *Biological conservation*, 160, pp.80-96.
- ⁶ D'Cruze, N., Toole, J., Mansell, K. and Schmidt-Burbach, J., 2014. What is the true cost of the world's most expensive coffee?. *Oryx*, 48(2), pp.170-171.
- ⁷ 2016. A police officer is killed by a wildlife trap. Panha Vorn Khmer News. Viewed 29 May, 2020 <<http://pvknweb.com/?p=2127>> WWF-Cambodia, 2019. First Case: Electric Wire Snare Kill Local People at Memom Village in PPWS and Lumphat Wildlife Sanctuary. Internal brief, WWF.
- ⁸ 2019. Niat Menyetrum Hewan Buruannya, Justru 2 Warga Ini yang Tewas Kena Setrum. *BERITAANDA.net*. Viewed 29 May, 2020 <<https://beritaanda.net/niat-menyetrum-hewanburuannya-justru-2-warga-ini-yang-tewas-kena-setrum/>>
- ⁹ 2019. Niat Menyetrum Hewan Buruannya, Justru 2 Warga Ini yang Tewas Kena Setrum. *BERITAANDA.net*. Viewed 29 May, 2020 <<https://beritaanda.net/niat-menyetrum-hewanburuannya-justru-2-warga-ini-yang-tewas-kena-setrum/>>
- ¹⁰ Size refers to the area over which patrols were conducted rather than, necessarily, to the gazetted size of the protected area.
- ¹¹ O'Kelly, H.J., Rowcliffe, J.M., Durant, S. and Milner-Gulland, E.J., 2018. Experimental estimation of snare detectability for robust threat monitoring. *Ecology and Evolution*, 8(3), pp.1778-1785.
- ¹² O'Kelly, H.J., Rowcliffe, J.M., Durant, S.M. and Milner-Gulland, E.J., 2018. Robust estimation of snare prevalence within a tropical forest context using N-mixture models. *Biological Conservation*, 217, pp.75-82.
- ¹³ Ibbett, H., Milner-Gulland, E.J., Beale, C.M., Dobson, A., Griffin, O., O'Kelly, H.J. and Keane, A., 2020. Experimentally assessing the effect of search effort on snare detectability. *Biological Conservation*, 247, p.108581.
- ¹⁴ Risdianto, D., Martyr, D.J., Nugraha, R.T., Harihar, A., Wibisono, H.T., Haidir, I.A., Macdonald, D.W., D'Cruze, N. and Linkie, M., 2016. Examining the shifting patterns of poaching from a long-term law enforcement intervention in Sumatra. *Biological Conservation*, 204, pp.306-312.

SECTION 2

- ¹⁵ Moore, J.F., Mulindahabi, F., Masozera, M.K., Nichols, J.D., Hines, J.E., Turikunkiko, E. and Oli, M.K., 2018. Are ranger patrols effective in reducing poaching-related threats within protected areas?. *Journal of Applied Ecology*, 55(1), pp.99-107. *See also;*
- Oberosler, V., Tenan, S., Zipkin, E.F. and Rovero, F., 2020. Poor management in protected areas is associated with lowered tropical mammal diversity. *Animal Conservation*, 23(2), pp.171-181. *See also;*
- RMNP, 2020. Assessment on the effectiveness of conservation law-enforcement using Spatial Monitoring & Reporting Tool (SMART): A case study from the Royal Manas National Park. Department of Forests and Park Services, Ministry of Agriculture and Forests, Royal Government of Bhutan.
- ¹⁶ Singh, R., Biggs, D., Moreto, W., Lyet, A., Mevey, D., Ononino, A., Khadka, M., Chapagain, D., Parry-Jones, R., Huijbregt, B., Barlow, A. and Creasey, M., 2019. Zero Poaching Guidelines: A best practice approach to help conservation partners in achieving zero poaching. WWF Wildlife Crime Initiative.
- ¹⁷ Ibbett, H., Milner-Gulland, E.J., Beale, C.M., Dobson, A., Griffin, O., O'Kelly, H.J. and Keane, A., 2020. Experimentally assessing the effect of search effort on snare detectability. *Biological Conservation*, 247, p.108581. *See also;*
- Risdianto, D., Martyr, D.J., Nugraha, R.T., Harihar, A., Wibisono, H.T., Haidir, I.A., Macdonald, D.W., D'Cruze, N. and Linkie, M., 2016. Examining the shifting patterns of poaching from a long-term law enforcement intervention in Sumatra. *Biological Conservation*, 204, pp.306-312. *See also;* Gray, T.N., Hughes, A.C., Laurance, W.F., Long, B., Lynam, A.J., O'Kelly, H., Ripple, W.J., Seng, T., Scotson, L. and Wilkinson, N.M., 2018. The wildlife snaring crisis: an insidious and pervasive threat to biodiversity in Southeast Asia. *Biodiversity and conservation*, 27(4), pp.1031-1037.
- ¹⁸ Belecky, M., Singh, R., Moreto, W.D., 2019. Life on the Frontline 2019: A Global Survey of the Working Conditions of Rangers 2018. *WWF*.
- ¹⁹ Bruner, A.G., Gullison, R.E., Rice, R.E. and Da Fonseca, G.A., 2001. Effectiveness of parks in protecting tropical biodiversity. *Science*, 291(5501), pp.125-128.
- ²⁰ Ibbett, H., Milner-Gulland, E.J., Beale, C.M., Dobson, A., Griffin, O., O'Kelly, H.J. and Keane, A., 2020. Experimentally assessing the effect of search effort on snare detectability. *Biological Conservation*, 247, p.108581. *See also;*
- Linkie, M., Martyr, D.J., Harihar, A., Risdianto, D., Nugraha, R.T., Leader-Williams, N. and Wong, W.M., 2015. EDITOR'S CHOICE: Safeguarding Sumatran tigers: evaluating effectiveness of law enforcement patrols and local informant networks. *Journal of Applied Ecology*, 52(4), pp.851-860. *See also;*
- Moore, J.F., Mulindahabi, F., Masozera, M.K., Nichols, J.D., Hines, J.E., Turikunkiko, E. and Oli, M.K., 2018. Are ranger patrols effective in reducing poaching-related threats within protected areas? *Journal of Applied Ecology*, 55(1), pp.99-107. *See also;*
- O'Kelly, H.J., Rowcliffe, J.M., Durant, S. and Milner-Gulland, E.J., 2018. Experimental estimation of snare detectability for robust threat monitoring. *Ecology and Evolution*, 8(3), pp.1778-1785.
- ²¹ Wilkinson, N., 2016. Report on effects of five years of snare removal patrols on snaring in the Thua Thien Hue-Quang Nam Saola Landscape: an analysis of data collected by Forest Guard patrols. *WWF CarBi project, Hanoi, Vietnam*.
- ²² Linkie, M., Martyr, D.J., Harihar, A., Risdianto, D., Nugraha, R.T., Leader-Williams, N. and Wong, W.M., 2015. EDITOR'S CHOICE: Safeguarding Sumatran tigers: evaluating effectiveness of law enforcement patrols and local informant networks. *Journal of Applied Ecology*, 52(4), pp.851-860.
- ²³ O'Kelly, H.J., Rowcliffe, J.M., Durant, S.M. and Milner-Gulland, E.J., 2018. Robust estimation of snare prevalence within a tropical forest context using N-mixture models. *Biological Conservation*, 217, pp.75-82.
- ²⁴ Kragt, M.E., Hay, E., Scheufele, G., Bennett, J. and Renton, M., 2020. Predicting the effectiveness of community antipoaching patrols for conserving threatened wildlife in the Lao PDR. *Journal of Applied Ecology*, 57(2), pp.320-330.
- ²⁵ Kragt, M.E., Hay, E., Scheufele, G., Bennett, J. and Renton, M., 2020. Predicting the effectiveness of community antipoaching patrols for conserving threatened wildlife in the Lao PDR. *Journal of Applied Ecology*, 57(2), pp.320-330. *See also;*
- Linkie, M., Martyr, D.J., Harihar, A., Risdianto, D., Nugraha, R.T., Leader-Williams, N. and Wong, W.M., 2015. EDITOR'S CHOICE: Safeguarding Sumatran tigers: evaluating effectiveness of law enforcement patrols and local informant networks. *Journal of Applied Ecology*, 52(4), pp.851-860. *See also;*
- Wilkinson, N., 2016. Report on effects of five years of snare removal patrols on snaring in the Thua Thien Hue-Quang Nam Saola Landscape: an analysis of data collected by Forest Guard patrols. *WWF CarBi project, Hanoi, Vietnam*.
- ²⁶ Risdianto, D., Martyr, D.J., Nugraha, R.T., Harihar, A., Wibisono, H.T., Haidir, I.A., Macdonald, D.W., D'Cruze, N. and Linkie, M., 2016. Examining the shifting patterns of poaching from a long-term law enforcement intervention in Sumatra. *Biological Conservation*, 204, pp.306-312. *See also;*
- Wilkinson, N., 2016. Report on effects of five years of snare removal patrols on snaring in the Thua Thien Hue-Quang Nam Saola Landscape: an analysis of data collected by Forest Guard patrols. *WWF CarBi project, Hanoi, Vietnam*.
- ²⁷ Wilkinson, N., 2016. Report on effects of five years of snare removal patrols on snaring in the Thua Thien Hue-Quang Nam Saola Landscape: an analysis of data collected by Forest Guard patrols. *WWF CarBi project, Hanoi, Vietnam*.

- 28 Drury, R., 2011. Hungry for success: urban consumer demand for wild animal products in Vietnam. *Conservation and Society*, 9(3), 247-257. *See also*;
- Pruvot, M., Khammvong, K., Milavong, P., Philavong, C., Reinharz, D., Mayxay, M., Rattavong, S., Horwood, P., Dussart, P., Douangneun, B. and Theppangna, W., 2019. Toward a quantification of risks at the nexus of conservation and health: The case of bushmeat markets in Lao PDR. *Science of the total environment*, 676, pp.732-745. *See also*;
- Sandalj, M., Treydte, A.C. and Ziegler, S., 2016. Is wild meat luxury? Quantifying wild meat demand and availability in Hue, Vietnam. *Biological Conservation*, 194, pp.105-112.
- 29 Drury, R., 2011. Hungry for success: urban consumer demand for wild animal products in Vietnam. *Conservation and Society*, 9(3), 247-257. *See also*;
- Sandalj, M., Treydte, A.C. and Ziegler, S., 2016. Is wild meat luxury? Quantifying wild meat demand and availability in Hue, Vietnam. *Biological Conservation*, 194, pp.105-112. *See also*;
- WWF Vietnam, 2017. Consumption of wild meat and other Wildlife Products in Hue City. Internal Report.
- 30 Woolhouse, M.E. and Gowtage-Sequeria, S., 2005. Host range and emerging and reemerging pathogens. *Emerging Infectious Diseases*, 11(12), p.1842.
- 31 Woolhouse, M.E. and Gowtage-Sequeria, S., 2005. Host range and emerging and reemerging pathogens. *Emerging Infectious Diseases*, 11(12), p.1842
- 32 Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L. and Daszak, P., 2008. Global trends in emerging infectious diseases. *Nature*, 451(7181), pp.990-993.
- 33 Daszak, P., Olival, K.J. and Li, H., 2020. A strategy to prevent future pandemics similar to the 2019-nCoV outbreak. *Biosafety and Health* 2(1), pp.6-8.
- 34 Asian Development Bank, 2020. Asian Development Outlook 2020: what drives innovation in Asia? Asian Development Bank, Manila.
- 35 Bonilla-Aldana, D.K., Dhama, K. and Rodriguez-Morales, A.J., 2020. Revisiting the one health approach in the context of COVID-19: a look into the ecology of this emerging disease. *Adv Anim Vet Sci*, 8(3), pp.234-237.
- 36 Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L. and Daszak, P., 2008. Global trends in emerging infectious diseases. *Nature*, 451(7181), pp.990-993.
- 37 Gray, T.N., Hughes, A.C., Laurance, W.F., Long, B., Lynam, A.J., O'Kelly, H., Ripple, W.J., Seng, T., Scotson, L. and Wilkinson, N.M., 2018. The wildlife snaring crisis: an insidious and pervasive threat to biodiversity in Southeast Asia. *Biodiversity and Conservation*, 27(4), pp.1031-1037. *See also*;
- Harrison, R.D., Sreekar, R., Brodie, J.F., Brook, S., Luskin, M., O'Kelly, H., Rao, M., Scheffers, B. and Velho, N., 2016. Impacts of hunting on tropical forests in Southeast Asia. *Conservation Biology*, 30(5), pp.972-981.
- 38 Brooks, E.G., Robertson, S.I. and Bell, D.J., 2010. The conservation impact of commercial wildlife farming of porcupines in Vietnam. *Biological Conservation*, 143(11), pp.2808-2814. *See also*;
- Livingstone, E., Gomez, L. and Bouhuys, J., 2018. A review of bear farming and bear trade in Lao People's Democratic Republic. *Global Ecology and Conservation*, 13, p.e00380. *See also*;
- Livingstone, E. and Shepherd, C.R., 2016. Bear farms in Lao PDR expand illegally and fail to conserve wild bears. *Oryx*, 50(1), pp.176-184.
- 39 Han, B.A., Kramer, A.M. and Drake, J.M., 2016. Global patterns of zoonotic disease in mammals. *Trends in Parasitology*, 32(7), pp.565-577. *See also*;
- Johnson, C.K., Hitchens, P.L., Pandit, P.S., Rushmore, J., Evans, T.S., Young, C.C. and Doyle, M.M., 2020. Global shifts in mammalian population trends reveal key predictors of virus spillover risk. *Proceedings of the Royal Society B*, 287(1924), p.20192736. *See also*;
- WWF Global Science, 2020. Beyond Boundaries: Insights into emerging zoonotic diseases, nature, and human well-being. Internal science brief. Unpublished.
- 40 Cantlay, J. C., Ingram, D. J., & Meredith, A. L. (2017). A review of zoonotic infection risks associated with the wild meat trade in Malaysia. *EcoHealth*, 14(2), 361-388.
- 41 Wang, L.F. and Eaton, B.T., 2007. Bats, civets and the emergence of SARS. In *Wildlife and emerging zoonotic diseases: the biology, circumstances and consequences of cross-species transmission* (pp. 325-344). Springer, Berlin, Heidelberg.
- 42 Liu, P., Chen, W. and Chen, J.P., 2019. Viral Metagenomics Revealed Sendai Virus and Coronavirus Infection of Malayan Pangolins (*Manis javanica*). *Viruses*, 11(11), p.979.

- 43 FFI Cambodia, 2018. Exploring Bushmeat Consumption Behaviours among Phnom Penh Citizens. Internal Report. *See also*;
- Greatorex, Z.F., Olson, S.H., Singhalath, S., Silithammavong, S., Khammavong, K., Fine, A.E., Weisman, W., Douangngeun, B., Theppangna, W., Keatts, L. and Gilbert, M., 2016. Wildlife trade and human health in Lao PDR: an assessment of the zoonotic disease risk in markets. *PloS One*, 11(3). *See also*;
- Heinrich, S., Ross, J.V., Gray, T.N., Delean, S., Marx, N. and Cassey, P., 2020. Plight of the commons: 17 years of wildlife trafficking in Cambodia. *Biological Conservation*, 241, p.108379. *See also*;
- Latinne, A., Saputro, S., Kalengkongan, J., Kowel, C.L., Gaghiwu, L., Ransaleleh, T.A., Nangoy, M.J., Wahyuni, I., Kusumaningrum, T., Safari, D. and Feferholtz, Y., 2020. Characterizing and quantifying the wildlife trade network in Sulawesi, Indonesia. *Global Ecology and Conservation*, 21, p.e00887. *See also*;
- Sandalj, M., Treydte, A.C. and Ziegler, S., 2016. Is wild meat luxury? Quantifying wild meat demand and availability in Hue, Vietnam. *Biological Conservation*, 194, pp.105-112. *See also*;
- Schweikhard, J., Kasper, K., Ebert, C. L., Lehmann, M., Erbe, P., and Ziegler, T., 2019. Investigations into the illegal wildlife trade in central Lao PDR. *TRAFFIC Bulletin*, 31(1), 19.
- 44 Drury, R., 2011. Hungry for success: urban consumer demand for wild animal products in Vietnam. *Conservation and Society*, 9(3), 247-257. *See also*;
- Nguyen, S.V., 2003. Wildlife trading in Vietnam: Why it flourishes. EEPSEA Research Reports, Singapore. 1-75. *See also*;
- WWF Vietnam, 2017. Consumption of wild meat and other Wildlife Products in Hue City. Internal Report.
- 45 WWF Vietnam, 2017. Consumption of wild meat and other Wildlife Products in Hue City. Internal Report.
- 46 Heinrich, S., Ross, J.V., Gray, T.N., Delean, S., Marx, N. and Cassey, P., 2020. Plight of the commons: 17 years of wildlife trafficking in Cambodia. *Biological Conservation*, 241, p.108379.
- 47 Latinne, A., Saputro, S., Kalengkongan, J., Kowel, C.L., Gaghiwu, L., Ransaleleh, T.A., Nangoy, M.J., Wahyuni, I., Kusumaningrum, T., Safari, D. and Feferholtz, Y., 2020. Characterizing and quantifying the wildlife trade network in Sulawesi, Indonesia. *Global Ecology and Conservation*, 21, p.e00887.
- 48 Greatorex, Z.F., Olson, S.H., Singhalath, S., Silithammavong, S., Khammavong, K., Fine, A.E., Weisman, W., Douangngeun, B., Theppangna, W., Keatts, L. and Gilbert, M., 2016. Wildlife trade and human health in Lao PDR: an assessment of the zoonotic disease risk in markets. *PloS One*, 11(3). *See also*;
- Pruvot, M., Khammavong, K., Milavong, P., Philavong, C., Reinharz, D., Mayxay, M., Rattavong, S., Horwood, P., Dussart, P., Douangngeun, B. and Theppangna, W., 2019. Toward a quantification of risks at the nexus of conservation and health: The case of bushmeat markets in Lao PDR. *Science of the total environment*, 676, pp.732-745. *See also*;
- Schweikhard, J., Kasper, K., Ebert, C. L., Lehmann, M., Erbe, P., and Ziegler, T., 2019. Investigations into the illegal wildlife trade in central Lao PDR. *TRAFFIC Bulletin*, 31(1), 19.
- 49 Burgess, G., 2016. Powers of persuasion: Conservation communications, behavioural change and reducing demand for illegal wildlife products. *Traffic Bulletin*, 28(2): 65-73.
- 50 Veríssimo, D. and Wan, A.K., 2019. Characterizing efforts to reduce consumer demand for wildlife products. *Conservation Biology*, 33(3), pp.623-633.
- 51 Here, *high-risk taxa* are defined as 'groups of related wild species that are known to be reservoirs of pathogens that could potentially spillover and be dangerous to humans; especially those that are known to host zoonoses (e.g. bats, rodents, ungulates, carnivores, primates, pangolins, civets).'
- 52 Here, *high-risk wildlife* products are defined as 'any products from high-risk taxa intended for human consumption or medicinal use'.

- ⁵³ Corlett, R.T., 2007. The impact of hunting on the mammalia fauna of tropical Asian forests. *Biotropica*, 39(3), pp.292-303. *See also*;
- Morrison, J.C., Sechrest, W., Dinerstein, E., Wilcove, D.S. and Lamoreux, J.F., 2007. Persistence of large mammal faunas indicators of global human impacts. *Journal of Mammalogy*, 88(6), pp.1363-1380.
- ⁵⁴ Harrison, R.D., Sreekar, R., Brodie, J.F., Brook, S., Luskin, M., O'Kelly, H., Rao, M., Scheffers, B. and Velho, N., 2016. Impacts of hunting on tropical forests in Southeast Asia. *Conservation Biology*, 30(5), pp.972-981.
- ⁵⁵ Ripple, W.J., Abernethy, K., Betts, M.G., Chapron, G., Dirzo, R., Galetti, M., Levi, T., Lindsey, P.A., Macdonald, D.W., Machovina, B. and Newsome, T.M., 2016. Bushmeat hunting and extinction risk to the world's mammals. *Royal Society open science*, 3(10), p.160498.
- ⁵⁶ Redford, K.H., 1992. The empty forest. *BioScience*, 42(6), pp.412-422.
- ⁵⁷ McConkey, K.R., 2018. Seed dispersal by primates in Asian habitats: from species to communities, to conservation. *International Journal of Primatology*, 39(3), pp.466-492. *See also*;
- Corlett, R.T., 2017. Frugivory and seed dispersal by vertebrates in tropical and subtropical Asia: an update. *Global Ecology and Conservation*, 11, pp.1-22. *See also*;
- Kitamura, S., Yumoto, T., Poonswad, P. and Wohandee, P., 2007. Frugivory and seed dispersal by Asian elephants, *Elephas maximus*, in a moist evergreen forest of Thailand. *Journal of Tropical Ecology*, 23(3), pp.373-376. *See also*;
- Campos-Arceiz, A. and Blake, S., 2011. Megagardeners of the forest—the role of elephants in seed dispersal. *Acta Oecologica*, 37(6), pp.542-553; *See also*;
- Peres, C.A., Emilio, T., Schiatti, J., Desmoulière, S.J. and Levi, T., 2016. Dispersal limitation induces long-term biomass collapse in overhunted Amazonian forests. *Proceedings of the National Academy of Sciences*, 113(4), pp.892-897.
- ⁵⁸ Brodie, J.F., Redford, K.H. and Doak, D.F., 2018. Ecological function analysis: incorporating species roles into conservation. *Trends in Ecology & Evolution*, 33(11), pp.840-850. *See also*;
- Ripple, W.J., Estes, J.A., Beschta, R.L., Wilmers, C.C., Ritchie, Soulé, M.E., Bolger, D.T., Alberts, A.C., Wrights, J., Sorice, E.G., Hebblewhite, M., Berger, J., Elmhagen, B., Letnic, M., Nelson, M.P. and Schmitz, O.J., 2014. Status and ecological effects of the world's largest carnivore. *Science*, 343(6167), p.1241484. *See also*;
- M. and Hill, S., 1988. Reconstructed dynamics of rapid extinctions of chaparral-requiring birds in urban habitat islands. *Conservation Biology*, 2(1), pp.75-92. *See also*;
- Terborgh, J., 2009. The trophic cascade on islands. *The theory of island biogeography revisited*, pp.116-142.
- ⁵⁹ Schupp, E.W., Jordano, P. and Gómez, J.M., 2017. A general framework for effectiveness concepts in mutualisms. *Ecology Letters*, 20(5), pp.577-590. *See also*;
- Roman, J., Estes, J.A., Morissette, L., Smith, C., Costa, D., McCarthy, J., Nation, J.B., Nicol, S., Pershing, A. and Smetacek, V., 2014. Whales as marine ecosystem engineers. *Frontiers in Ecology and the Environment*, 12(7), pp.377-385. *See also*;
- Ripple, W.J., Newsome, T.M., Wolf, C., Dirzo, R., Everatt, K.T., Galetti, M., Hayward, M.W., Kerley, G.I., Levi, T., Lindsey, P.A. and Macdonald, D.W., 2015. Collapse of the world's largest herbivores. *Science advances*, 1(4), p.e1400103.
- ⁶⁰ Waldram, M. S., Bond, W. J., & Stock, W. D., 2008. Ecological engineering by a mega-grazer: white rhino impacts on a South African savanna. *Ecosystems*, 11(1), 101-112. *See also*;
- Davidson, A. D., Detling, J. K., & Brown, J. H., 2012. Ecological roles and conservation challenges of social, burrowing, herbivorous mammals in the world's grasslands. *Frontiers in Ecology and the Environment*, 10(9), 477-486. *See also*;
- Eames, J.C.E., Eang S., Loveridge, R. and Gray, T.N.E., 2018. Impact of experimental domestic water buffalo *Bubalus bubalis* grazing on waterhole dynamics in north-eastern Cambodia. *Cambodian Journal of Natural History* 2018 (2) 108-119. *See also*;
- Campos-Arceiz, A., 2009. Shit happens (to be useful)! Use of elephant dung as habitat by amphibians. *Biotropica*, 41(4), 406-407.
- ⁶¹ Terakawa, M., Matsui, K., Hamada, T., Noma, N., & Yumoto, T., 2008. Reduced dispersal effectiveness in the largeseeded tree *Myrica rubra* in the absence of the Japanese macaque on Tanegashima Island, Japan. *Japanese Journal of Conservation Ecology*, 13, 161-167.
- ⁶² Brodie, J.F., Helmy, O.E., Brockelman, W.Y. and Maron, J.L., 2009. Bushmeat poaching reduces the seed dispersal and population growth rate of a mammal-dispersed tree. *Ecological Applications*, 19(4), pp.854-863.
- ⁶³ Wright, H.L., Collar, N.J., Lake, I.R., Bou, V. and Dolman, P.M., 2012. Foraging ecology of sympatric White-shouldered Ibis *Pseudibis davisoni* and Giant Ibis *Thaumatibis gigantea* in northern Cambodia. *Forktail*, 28, pp.93-100.
- ⁶⁴ Although tigers are recognized as functionally extinct by conservationists in all three countries, it is important to note that this has not been formally recognized by the governments of those countries.
- ⁶⁵ Rasphone, A., Kéry, M., Kamler, J.F. and Macdonald, D.W., 2019. Documenting the demise of tiger and leopard, and the status of other carnivores and prey, in Lao PDR's most prized protected area: Nam Et-Phou Louey. *Global Ecology and Conservation*, 20, p.e00766.
- ⁶⁶ Risdianto, D., Martyr, D.J., Nugraha, R.T., Harihar, A., Wibisono, H.T., Haidir, I.A., Macdonald, D.W., D'Cruze, N. and Linkie, M., 2016. Examining the shifting patterns of poaching from a long-term law enforcement intervention in Sumatra. *Biological Conservation*, 204, pp.306-312.
- ⁶⁷ Chundawat, D.R., Raju, V.U., Rajora, H. and Matthews, J., 2018. The value of Wildlife Tourism around Ranthambhore Tiger Reserve in Rajasthan for Wildlife Conservation and Local Communities. *TOFTigers*, New Delhi, India.

SECTION 5

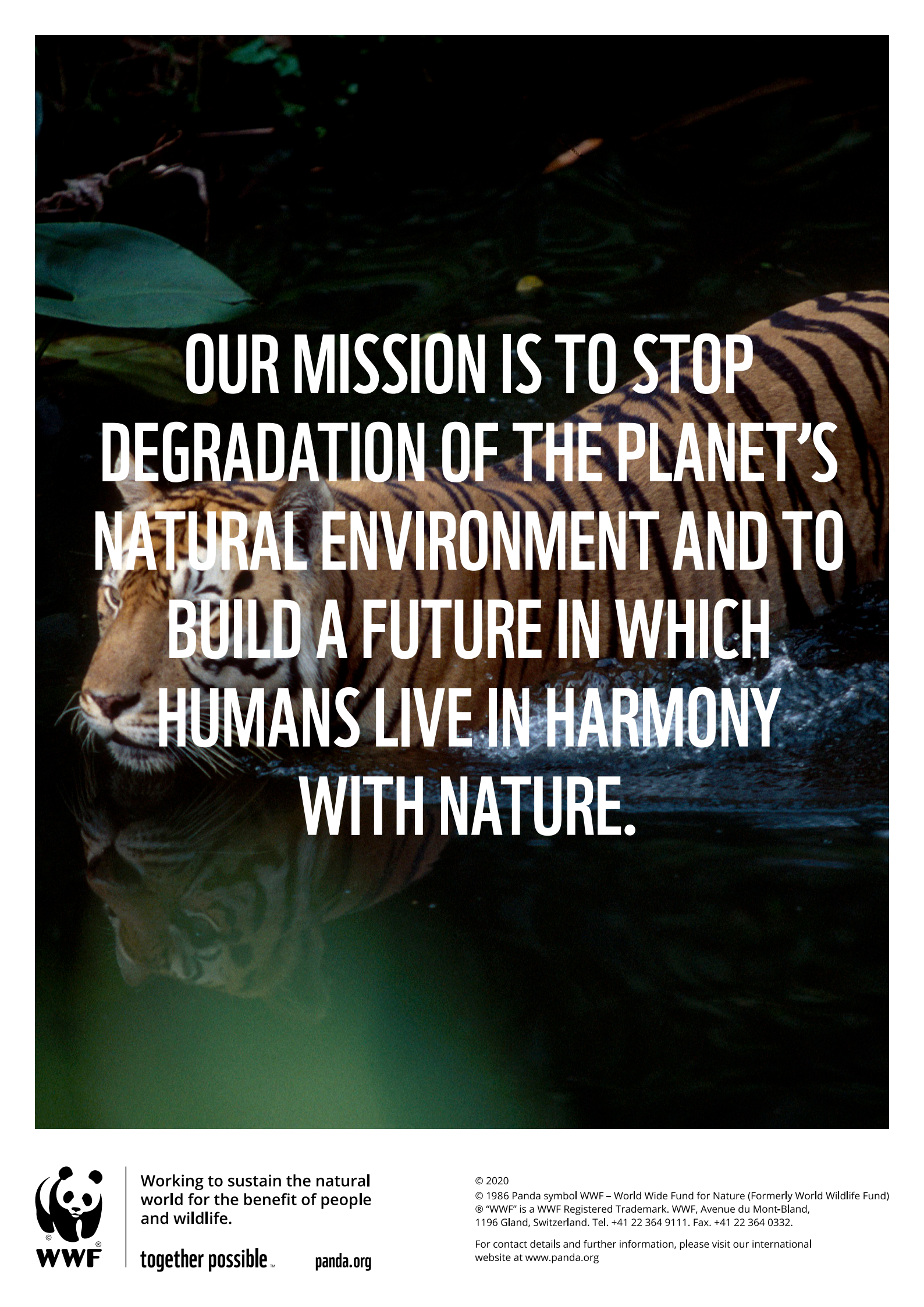
- ⁶⁸ Nielsen, M.R., Pouliot, M., Meilby, H., Smith-Hall, C. and Angelsen, A., 2017. Global patterns and determinants of the economic importance of bushmeat. *Biological Conservation*, 215, pp.277-287.
- ⁶⁹ Coad, L., Lim, S. and Nuon, L., 2019. Wildlife and livelihoods in the Cardamom Mountains, Cambodia. *Frontiers in Ecology and Evolution*, 7, p.296.
- ⁷⁰ MacMillan, D.C. and Nguyen, Q.A., 2014. Factors influencing the illegal harvest of wildlife by trapping and snaring among the Katu ethnic group in Vietnam. *Oryx*, 48(2), pp.304-312.
- ⁷¹ Luskin, M.S., Christina, E.D., Kelley, L.C. and Potts, M.D., 2014. Modern hunting practices and wild meat trade in the oil palm plantation-dominated landscapes of Sumatra, Indonesia. *Human Ecology*, 42(1), pp.35-45.
- ⁷² McEvoy, J.F., Connette, G., Huang, Q., Soe, P., Pyone, K.H.H., Valitutto, M., Htun, Y.L., Lin, A.N., Thant, A.L., Htun, W.Y. and Paing, K.H., 2019. Two sides of the same coin—Wildmeat consumption and illegal wildlife trade at the crossroads of Asia. *Biological Conservation*, 238, p.108197. *See also*;
- Rao, M., Htun, S., Zaw, T. and Myint, T., 2010. Hunting, livelihoods and declining wildlife in the Hponkanrazi Wildlife Sanctuary, North Myanmar. *Environmental Management*, 46(2), pp.143-153.
- ⁷³ Coad, L., Lim, S. and Nuon, L., 2019. Wildlife and livelihoods in the Cardamom Mountains, Cambodia. *Frontiers in Ecology and Evolution*, 7, p.296. *See also*;
- Evans, T.S., Myat, T.W., Aung, P., Oo, Z.M., Maw, M.T., Toe, A.T., Aung, T.H., Hom, N.S., Shein, K.T., Thant, K.Z. and Win, Y.T., 2020. Bushmeat hunting and trade in Myanmar's central teak forests: Threats to biodiversity and human livelihoods. *Global Ecology and Conservation*, 22, p.e00889. *See also*;
- Ibbett, H., Milner-Gulland, E.J., Beale, C.M., Dobson, A., Griffin, O., O'Kelly, H.J. and Keane, A., 2020. Experimentally assessing the effect of search effort on snare detectability. *Biological Conservation*, 247, p.108581. *See also*;
- Loke, V.P., Lim, T. and Campos-Arceiz, A., 2020. Hunting practices of the Jahai indigenous community in northern peninsular Malaysia. *Global Ecology and Conservation*, 21, p.e00815. *See also*;
- ⁷⁴ Coad, L., Lim, S. and Nuon, L., 2019. Wildlife and livelihoods in the Cardamom Mountains, Cambodia. *Frontiers in Ecology and Evolution*, 7, p.296. *See also*;
- MacMillan, D.C. and Nguyen, Q.A., 2014. Factors influencing the illegal harvest of wildlife by trapping and snaring among the Katu ethnic group in Vietnam. *Oryx*, 48(2), pp.304-312
- ⁷⁵ Coad, L., Lim, S. and Nuon, L., 2019. Wildlife and livelihoods in the Cardamom Mountains, Cambodia. *Frontiers in Ecology and Evolution*, 7, p.296. *See also*;
- MacMillan, D.C. and Nguyen, Q.A., 2014. Factors influencing the illegal harvest of wildlife by trapping and snaring among the Katu ethnic group in Vietnam. *Oryx*, 48(2), pp.304-312. *See also*;
- O'Kelly, H.J., Rowcliffe, J.M., Durant, S.M. and Milner-Gulland, E.J., 2018. Robust estimation of snare prevalence within a tropical forest context using N-mixture models. *Biological Conservation*, 217, pp.75-82..
- ⁷⁶ O'Kelly, H.J., Rowcliffe, J.M., Durant, S.M. and Milner-Gulland, E.J., 2018. Robust estimation of snare prevalence within a tropical forest context using N-mixture models. *Biological Conservation*, 217, pp.75-82.
- ⁷⁷ Coad, L., Lim, S. and Nuon, L., 2019. Wildlife and livelihoods in the Cardamom Mountains, Cambodia. *Frontiers in Ecology and Evolution*, 7, p.296. *See also*;
- Ibbett, H., Milner-Gulland, E.J., Beale, C.M., Dobson, A., Griffin, O., O'Kelly, H.J. and Keane, A., 2020. Experimentally assessing the effect of search effort on snare detectability. *Biological Conservation*, 247, p.108581. *See also*;
- Latinne, A., Saputro, S., Kalengkongan, J., Kowel, C.L., Gaghiwu, L., Ransaleleh, T.A., Nangoy, M.J., Wahyuni, I., Kusumaningrum, T., Safari, D. and Feferholtz, Y., 2020. Characterizing and quantifying the wildlife trade network in Sulawesi, Indonesia. *Global Ecology and Conservation*, 21, p.e00887. *See also*;
- MacMillan, D.C. and Nguyen, Q.A., 2014. Factors influencing the illegal harvest of wildlife by trapping and snaring among the Katu ethnic group in Vietnam. *Oryx*, 48(2), pp.304-312. *See also*;
- McEvoy, J.F., Connette, G., Huang, Q., Soe, P., Pyone, K.H.H., Valitutto, M., Htun, Y.L., Lin, A.N., Thant, A.L., Htun, W.Y. and Paing, K.H., 2019. Two sides of the same coin—Wildmeat consumption and illegal wildlife trade at the crossroads of Asia. *Biological Conservation*, 238, p.108197. *See also*;
- McKenney, B., Chea, Y., Tola, P. and Evans, T., 2004. Focusing on Cambodia's high value forests: Livelihoods and management. *Cambodia Development Resource Institute and Wildlife Conservation Society, Phnom Penh*.
- ⁷⁸ O'Kelly, H.J., Rowcliffe, J.M., Durant, S.M. and Milner-Gulland, E.J., 2018. Robust estimation of snare prevalence within a tropical forest context using N-mixture models. *Biological Conservation*, 217, pp.75-82.
- ⁷⁹ MacMillan, D.C. and Nguyen, Q.A., 2014. Factors influencing the illegal harvest of wildlife by trapping and snaring among the Katu ethnic group in Vietnam. *Oryx*, 48(2), pp.304-312.
- ⁸⁰ MacMillan, D.C. and Nguyen, Q.A., 2014. Factors influencing the illegal harvest of wildlife by trapping and snaring among the Katu ethnic group in Vietnam. *Oryx*, 48(2), pp.304-312.
- ⁸¹ Viollaz, J. and Gore, M.L., 2019. Piloting Community-Based Conservation Crime Prevention in the Annamite Mountains. Findings Report drafted for Global Wildlife Conservation, Fauna and Flora International, World Wildlife Fund and Vinh University. Michigan State University, USA.
- ⁸² Coad, L., Lim, S. and Nuon, L., 2019. Wildlife and livelihoods in the Cardamom Mountains, Cambodia. *Frontiers in Ecology and Evolution*, 7, p.296.
- ⁸³ Steinmetz, R., Chutipong, W. and Seaturien, N., 2006. Collaborating to conserve large mammals in Southeast Asia. *Conservation Biology*, 20(5), pp.1391-1401.

Endnotes

- ⁸⁴ Nielsen, M.R., Meilby, H., Smith-Hall, C., Pouliot, M. and Treue, T., 2018. The importance of wild meat in the global south. *Ecological Economics*, 146, pp.696-705.
- ⁸⁵ Golden, C.D., Fernald, L.C., Brashares, J.S., Rasolofoniaina, B.R. and Kremen, C., 2011. Benefits of wildlife consumption to child nutrition in a biodiversity hotspot. *Proceedings of the National Academy of Sciences*, 108(49), pp.19653-19656. See also;
- Nielsen, M.R., Meilby, H., Smith-Hall, C., Pouliot, M. and Treue, T., 2018. The importance of wild meat in the global south. *Ecological Economics*, 146, pp.696-705
- ⁸⁶ Sunderland, T.C., 2011. Food security: why is biodiversity important? *International Forestry Review*, 13(3), pp.265-274. See also;
- Maxwell, D. and Wiebe, K., 1999. Land tenure and food security: Exploring dynamic linkages. *Development and Change*, 30(4), pp.825-849.
- ⁸⁷ Swamy, V. and Pinedo-Vasquez, M., 2014. Bushmeat harvest in tropical forests: Knowledge base, gaps and research priorities (Vol. 114). CIFOR.
- ⁸⁸ Robinson, J.G., Redford, K.H. and Bennett, E.L., 1999. Wildlife harvest in logged tropical forests.
- ⁸⁹ Luskin, M.S., Christina, E.D., Kelley, L.C. and Potts, M.D., 2014. Modern hunting practices and wild meat trade in the oil palm plantation-dominated landscapes of Sumatra, Indonesia. *Human Ecology*, 42(1), pp.35-45.
- ⁹⁰ Four elephants were killed during a two-month period by snares on plantations bordering the Sg Taliwas Forest Reserve and Sapagaya Forest Reserve. See; 2018. More elephants killed by snares – WWF, viewed 12 May 2020, <<https://www.theborneopost.com/2018/08/29/moreelephants-killed-by-snares-wwf/>>
- ⁹¹ Dobson, A.D., Milner-Gulland, E.J., Ingram, D.J. and Keane, A., 2019. A framework for assessing impacts of wild meat hunting practices in the tropics. *Human Ecology*, 47(3), pp.449-464.
- ⁹² Garnett, S.T., Burgess, N.D., Fa, J.E., Fernández-Llamazares, Á., Molnár, Z., Robinson, C.J., Watson, J.E., Zander, K.K., Austin, B., Brondizio, E.S. and Collier, N.F., 2018. A spatial overview of the global importance of Indigenous lands for conservation. *Nature Sustainability*, 1(7), p.369. Data used for calculation was found in the supplementary information (supplementary information 3). Data from this paper, which was obtained from multiple sources, was combined with World Database on Protected Areas data to calculate the figures in the table. By this analysis, out of a total of 574,951 sq.km protected areas in eight largest ASEAN countries, indigenous peoples' lands accounted for 366,105 sq.km, 63.7% coverage overall.
- ⁹³ Belecky, M., Singh R. and Moreto, W., 2019. Life on the Frontline 2019: A Global Survey of the Working Conditions of Rangers. WWF.
- ⁹⁴ Internal report, WWF-Malaysia. See also; Darmaraj, M., 2019. Malaysian Tiger Closer than Ever to Extinction. The Sun Daily. Viewed 23 May 2020, <<https://www.thesundaily.my/opinion/malayan-tiger-closer-than-ever-to-extinction-LY1166629>>
- ⁹⁵ Loke, V.P., Lim, T. and Campos-Arceiz, A., 2020. Hunting practices of the Jahai indigenous community in northern peninsular Malaysia. *Global Ecology and Conservation*, 21, p.e00815.
- ⁹⁶ Evans, T.S., Myat, T.W., Aung, P., Oo, Z.M., Maw, M.T., Toe, A.T., Aung, T.H., Hom, N.S., Shein, K.T., Thant, K.Z. and Win, Y.T., 2020. Bushmeat hunting and trade in Myanmar's central teak forests: Threats to biodiversity and human livelihoods. *Global Ecology and Conservation*, 22, p.e00889. See also;
- ⁹⁷ Pangau-Adam, M., Noske, R. and Muehlenberg, M., 2012. Wildmeat or bushmeat? Subsistence hunting and commercial harvesting in Papua (West New Guinea), Indonesia. *Human Ecology*, 40(4), pp.611-621.
- ⁹⁸ This schedule is limited to ten species.
- ⁹⁹ UNEP/CBD/COP/DEC/XI/25, 2012. <<https://www.cbd.int/doc/decisions/cop-11/cop-11-dec-25-en.pdf>>

SECTION 6

- ¹⁰⁰ The Law Library of Congress, 2016. Laws on Leg-Hold Animal Traps Around the World. <<https://www.loc.gov/law/help/leghold-traps/leg-hold-traps.pdf>> and <<https://www.loc.gov/law/help/leg-hold-traps/supplemental-report.pdf>>
- ¹⁰¹ Snare means any type of trap that— (a) is made of light wire cable looped through a locking device or of small nylon cord tied so that it will tighten as the animal pulls against it; (b) consists of two metal rectangles hinged together midway on the long side to open and close like scissors. One jaw has a trigger that can be baited. The opposite jaw has a catch or dog that holds the trap open; (c) is triggered by a pan-tension device, the weight of an animal stepping between the jaws of the trap causes the jaws to slam and strangulate the victim's leg or other body part in a vicelike grip [Schedule seven, Wildlife Conservation Act, 2010].
- ¹⁰² The Wild Life (Protection) Amendment Bill, 2013, Insertion of new section 9A 'Prohibition on animal traps' <<https://parivesh.nic.in/writereaddata/WildlifeProtectionAmendmentBill2013.pdf>>
- ¹⁰³ It states that 'an "animal trap" means any device designed to restrain or capture an animal and includes a leg hold trap device which usually works by means of jaws which close tightly upon one or more of the animal's limbs, thereby preventing withdrawal of the limb or limbs from the trap'. Furthermore, snares are defined by name as a 'weapon' under the Wildlife Protection Act, 1972.
- ¹⁰⁴ Although it has been argued that the proposed amendment in India would cover such instances. See, Annamaraju, S., *Traps and Snares: Riddled Paths for Indian Wildlife – Wildlife Trust of India*, viewed 12 May 2020 <<https://www.wti.org.in/news/traps-and-snares-riddled-paths-for-indianwildlife/>>
- ¹⁰⁵ MacMillan, D.C. and Nguyen, Q.A., 2014. Factors influencing the illegal harvest of wildlife by trapping and snaring among the Katu ethnic group in Viet Nam. *Oryx*, 48(2), pp.304-312.
- ¹⁰⁶ Lindsey, P.A., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R.W., Eves, H., Henschel, P. and Lewis, D., 2013. The bushmeat trade in African savannas: Impacts, drivers, and possible solutions. *Biological conservation*, 160, pp.80-96.
- ¹⁰⁷ Cawthorn, D.M. and Hoffman, L.C., 2015. The bushmeat and food security nexus: A global account of the contributions, conundrums and ethical collisions. *Food Research International*, 76, pp.906-925.
- ¹⁰⁸ WWF, 2019. *Workshop notes: Increasing Transparency and Effectiveness in Wildlife Crime Prosecutions*, viewed on 12 May 2020, <<http://tigers.panda.org/reports/#show-report/judicial-workshop-report>>
- ¹⁰⁹ UNODC, 2014. Criminal Justice Response to Wildlife and Forest Crime in Lao PDR. <https://www.unodc.org/documents/southeastasiaandpacific/Publications/wildlife/Criminal_Justice_Responses_to_the_Illegal_Trade_in_Timber_in_South_East_Asia_v7.pdf>
- ¹¹⁰ Asian Development Bank, 2014. Symposium on Combating Wildlife Crime: Securing Enforcement, Ensuring Justice, and Upholding the Rule of Law. <<https://www.adb.org/publications/symposium-combating-wildlife-crimeproceedings>>
- ¹²² Denin, M.J.A, 2019. Jejak Penjenayah Rimba. MyMetro. Viewed 11 May 2020, <<https://www.hmetro.com.my/utama/2019/05/452205/jejak-penjenayah-rimba>>
- ¹²³ Edward, J., 2017. Foreign poachers on the rise. Malay Mail. Viewed 11 May 2020, <<https://www.malaymail.com/news/malaysia/2017/09/27/foreign-poachers-on-the-rise/1473951>>
- ¹²⁴ 2019. Perang diisytihar ke atas pemburu haram untuk selamatkan Harimau Malaya. BH Online. Viewed 11 May 2020, <<https://www.bharian.com.my/berita/nasional/2019/03/542157/perang-diisytihar-ke-atas-pemburu-haram-untuk-selamatkan-harimau>> 125 2020. 82 pesalah ditangkap, 460 jerat dimusnah, Berita Harian. Viewed 11 May 2020, <<https://www.pressreader.com/malaysia/berita-harian-malaysia/20200116/281573767644614>>
- ¹²⁶ Ramendram, C., 2019. With a price of up to RM800,000, the ayan Tiger is prime bounty for poachers. The Sun Daily. Viewed 11 May 2020, <<https://www.thesundaily.my/local/with-a-price-of-up-to-rm800-000-the-malayan-tiger-is-prime-bounty-for-poachers-EE1521547>>
- ¹²⁷ 2020. 82 pesalah ditangkap, 460 jerat dimusnah, Berita Harian. Viewed 11 May 2020, <<https://www.pressreader.com/malaysia/berita-harian-malaysia/20200116/281573767644614>>



**OUR MISSION IS TO STOP
DEGRADATION OF THE PLANET'S
NATURAL ENVIRONMENT AND TO
BUILD A FUTURE IN WHICH
HUMANS LIVE IN HARMONY
WITH NATURE.**



Working to sustain the natural world for the benefit of people and wildlife.

together possible™

panda.org

© 2020

© 1986 Panda symbol WWF – World Wide Fund for Nature (Formerly World Wildlife Fund)

® “WWF” is a WWF Registered Trademark. WWF, Avenue du Mont-Bland, 1196 Gland, Switzerland. Tel. +41 22 364 9111. Fax. +41 22 364 0332.

For contact details and further information, please visit our international website at www.panda.org